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Blackbook: Approaches to Medical Presentations

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<table>
<thead>
<tr>
<th>Edition</th>
<th>Year(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Edition</td>
<td>2007 (Reprint 2008)</td>
</tr>
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<td>2010</td>
</tr>
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<td>2011</td>
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<tr>
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<td>2015</td>
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<td>2016</td>
</tr>
<tr>
<td>Tenth Edition</td>
<td>2017</td>
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<td>2019</td>
</tr>
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<td>Thirteenth Edition</td>
<td>2020</td>
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<td>Fourteenth Edition</td>
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</tr>
</tbody>
</table>

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Medical presentation schemes conceived by Henry Mandin.
The Calgary Black Book Project founded by Brett Poulin.

Printed in Calgary, Alberta, Canada.
A Message from the Editors

Welcome to the Blackbook, an ongoing project organizing medical presentations into schemes. The Blackbook is the result of the hard work and dedication of medical students and faculty at the University of Calgary, Cumming School of Medicine. We are proud that healthcare practitioners and trainees around the world find the Blackbook to be a useful tool in their learning.

The Blackbook continues to evolve with each new version. This fifteenth edition features cover artwork hand drawn by a talented medical student in our class, Fajr. You can check out more of her artwork on Instagram @artbyfajr.

As medical students, we are often asked, “What is your approach to X?”. The Blackbook presents information that is organized into scheme-based approaches. The Blackbook website continues to integrate with other University of Calgary resources, the Calgary Guide and Calgary Cards, an online study aid using patient case centered multiple choice questions. These resources aim to facilitate the direct translation of scheme-oriented learning into clinical scenario practice so that students can confidently answer the question, “What is your approach to X?”. 
We continue to strive to make the *Blackbook* a leading study resource. Please email blackbk@ucalgary.ca with any feedback, corrections, or ideas for new schemes.

Thank you and happy learning!

Anya Friesen & Kamiko Bressler
Introduction to Schemes

The material presented in this book is intended to assist learners in organizing their knowledge into information packets, which are more effective for the resolution of the patient problems they will encounter. There are three major factors that influence learning and the retrieval of medical knowledge from memory: meaning, encoding specificity (the context and sequence for learning), and practice on the task of remembering. Of the three, the strongest influence is the degree of meaning that can be imposed on information. To achieve success, experts organize and “chunk” information into meaningful configurations, thereby reducing the memory load.

These meaningful configurations or systematically arranged networks of connected facts are termed schemata. As new information becomes available, it is integrated into schemes already in existence, thus permitting learning to take place. Knowledge organized into schemes (basic science and clinical information integrated into meaningful networks of concepts and facts) is useful for both information storage and retrieval. To become excellent in diagnosis, it is necessary to practice retrieving from memory information necessary for problem resolution, thus facilitating an organized approach to problem solving (scheme-driven problem solving).
The domain of medicine can be broken down to 121 (+/- 5) clinical presentations, which represent a common or important way in which a patient, group of patients, community or population presents to a physician, and expects the physician to recommend a method for managing the situation. For a given clinical presentation, the number of possible diagnoses may be sufficiently large that it is not possible to consider them all at once, or even remember all the possibilities. By classifying diagnoses into schemes, for each clinical presentation, the myriad of possible diagnoses become more manageable ‘groups’ of diagnoses. This thus becomes a very powerful tool for both organization of knowledge memory (its primary role at the undergraduate medical education stage), as well as subsequent medical problem solving.

There is no single right way to approach any given clinical presentation. Each of the schemes provided represents one approach that proved useful and meaningful to one experienced, expert author. A modified, personalized scheme may be better than someone else’s scheme, and certainly better than having no scheme at all. It is important to keep in mind, before creating a scheme, the five fundamentals of scheme creation that were used to develop this book.

If a scheme is to be useful, the answers to the next five questions should be positive:
1. Is it simple and easy to remember? (Does it reduce memory load by “chunking” information into categories and subcategories?)
2. Does it provide an organizational structure that is easy to alter?
3. Does the organizing principle of the scheme enhance the meaning of the information?
4. Does the organizing principle of the scheme mirror encoding specificity (both context and process specificity)?
5. Does the scheme aid in problem solving? (E.g. does it differentiate between large categories initially, and subsequently progressively smaller ones until a single diagnosis is reached?)

By adhering to these principles, the schemes presented in this book, or any modifications to them done by the reader, will enhance knowledge storage and long term retrieval from memory, while making the medical problem-solving task a more accurate and enjoyable endeavour.

Dr. Henry Mandin
Dr. Sylvain Coderre
# Table of Contents

*A Message from the Editors* ................. v

*Introduction to Schemes* ................. vii

## Cardiovascular 1
- Abnormal Rhythm (1) .................................................. 3
- Abnormal Rhythm (2) .................................................... 4
- Chest Discomfort Cardiovascular ......................... 5
- Chest Discomfort Pulmonary / Mediastinal .... 6
- Chest Discomfort Other ................................. 7
- Diastolic Murmur ..................................................... 8
- Hypertension ................................................................. 9
- Hypertension in Pregnancy .................................. 10
- Isolated Right-Sided Heart Failure .................. 11
- Left-Sided Heart Failure ........................................... 12

- Pulse Abnormalities .................................................. 13
- Shock ........................................................................ 14
- Syncope ...................................................................... 15
- Systolic Murmur Benign & Stenotic .................. 16
- Systolic Murmur Valvular & Other .................. 17

## Respiratory 19
- Acid-Base Disorder Pulmonary ........................ 21
- Chest Discomfort Cardiovascular .................. 22
- Chest Discomfort Pulmonary ........................ 23
- Chest Discomfort Other ................................. 24
- Chest Trauma Complications ......................... 25
- Cough Chronic ............................................................... 26
- Cough, Dyspnea & Fever ................................. 27
- Dyspnea Acute ............................................................. 28
Dyspnea Chronic Cardiac ........................................... 29
Dyspnea Chronic Pulmonary / Other .................. 30
Excessive Daytime Sleepiness ............................ 31
Hemoptysis .............................................................. 32
Hypoxemia ............................................................... 33
Lung Nodule ............................................................ 34
Mediastinal Mass .................................................... 35
Pleural Effusion ....................................................... 36
Pulmonary Function Tests Interpretation .... 37
Pulmonary Hypertension ..................................... 38

**Hematologic**  39

Overall Approach to Anemia .................................. 43
Approach to Anemia Mean Corpuscular Volume .............. 44

Anemia with Elevated MCV .................................... 45
Anemia with Normal MCV ...................................... 46
Anemia with Low MCV .......................................... 47
Approach to Bleeding / Bruising Platelets &
Vascular System ................................................. 48
Approach to Bleeding / Bruising Coagulation Protopiens ...... 49
Approach to Splenomegaly ..................................... 50
Fever in the Immunocompromised Host ................ 51
Hemolysis ............................................................... 52
Lymphadenopathy Localized ................................ 53
Lymphadenopathy Diffuse .................................... 54
Approach to Leukocytosis ..................................... 55
Lymphocytosis ........................................................ 56
Neutrophilia ............................................................ 57
Neutropenia Decreased Neutrophils Only...58
Neutropenia Bicytopenia / Pancytopenia....59
Prolonged PT (INR), Normal PTT......................60
Approach to Prolonged PT (INR), ..................61
Prolonged PTT ..................................................61
Prolonged PTT, Normal PT (INR) Bleeding
   Tendency ......................................................62
Prolonged PTT, Normal PT (INR) No Bleeding
   Tendency ......................................................63
Polycythemia ..................................................64
Suspected Deep Vein Thrombosis (DVT).....65
Suspected Pulmonary Embolism (PE).......66
Thrombocytopenia ........................................67
Thrombocytosis ..............................................68

Gastrointestinal 69
Abdominal Distention ....................................73
Abdominal Distention Ascites .........................74
Abdominal Distention Other Causes ...............75
Abdominal Mass ............................................76
Abdominal Pain (Adult) Acute - Diffuse......77
Abdominal Pain (Adult) Acute - Localized....78
Abdominal Pain (Adult) Chronic - Constant.79
Abdominal Pain (Adult) Chronic - Crampy /
   Fleeting......................................................80
Abdominal Pain (Adult) Chronic - Post-
   Prandial......................................................81
Anorectal Pain ..............................................82
Acute Diarrhea ............................................83
Chronic Diarrhea Small Bowel .......................84
Chronic Diarrhea Steatorrhea & Large Bowel
   .....................................................................85
Constipation (Adult) Altered Bowel Function
   & Idiopathic..................................................86
Constipation (Adult) Secondary Causes........87
Constipation (Pediatric)..............................88
Dysphagia.................................................89
Elevated Liver Enzymes.............................90
Upper Gastronintestinal Bleed (Hematemesis
/ Melena)....................................................91
Lower Gastrointestinal Bleed......................92
Hepatomegaly.............................................93
Jaundice.....................................................94
Liver Mass..................................................95
Mouth Disorders (Adult & Elderly)..............96
Nausea & Vomiting Gastrointestinal Disease
........................................................................97
Nausea & Vomiting Other Systemic Disease
........................................................................98
Stool Incontinence.....................................99
Weight Gain...............................................100
Weight Loss...............................................101

Renal.........................................................103
Acute Kidney Injury.................................105
Chronic Kidney Disease............................106
Dysuria.......................................................107
Generalized Edema.....................................108
Hematuria...................................................109
Hyperkalemia Intercellular Shift.................110
Hyperkalemia Reduced Excretion..............111
Hypokalemia..............................................112
Hypernatremia...........................................113
Hyponatremia............................................114
Hypertension............................................115
Increased Urinary Frequency.....................116
Metabolic Alkalosis.................................117
Metabolic Acidosis Normal Anion Gap........118
Metabolic Acidosis Elevated Anion Gap...... 119
Nephrolithiasis ......................................................... 120
Polyuria.................................................................... 121
Proteinuria .................................................................. 122
Renal Mass Solid ...................................................... 123
Renal Mass Cystic ...................................................... 124
Scrotal Mass .............................................................. 125
Suspected Acid-Base Disturbance .................. 126
Urinary Incontinence ............................................... 127
Urinary Tract Obstruction ......................................... 128

Endocrinology .......................................................... 129
Abnormal Lipid Profile Combined &
  Decreased HDL ..................................................... 133
Abnormal Lipid Profile Increased LDL &
  Increased Triglycerides ........................................ 134
Abnormal Serum TSH ............................................... 135
Adrenal Mass Benign ................................................. 136
Adrenal Mass Malignant ............................................ 137
Amenorrhea .............................................................. 138
Breast Discharge ..................................................... 139
Gynecomastia Increased Estrogen &
  Increased HCG ....................................................... 140
Gynecomastia Increased LH & Decreased Testosterone ..................................................... 141
Hirsutism ................................................................. 142
Hirsutism & Virilization Androgen Excess.... 143
Hirsutism & Virilization Hypertrichosis ........... 144
Hypercalcemia Low PTH ........................................ 145
Hypercalcemia Normal / High PTH ............... 146
Hypocalcemia High Phosphate ......................... 147
Hypocalcemia Low Phosphate ......................... 148
Hypocalcemia High / Low PTH ......................... 149
Hyperglycemia ......................................................... 150
Hypoglycemia.................................151
Hyperphosphatemia..........................152
Hypophosphatemia..........................153
Hyperthyroidism............................154
Hypothyroidism..............................155
Hyperuricemia...............................156
Male Sexual Dysfunction..................157
Sellar / Pituitary Mass......................158
Sellar / Pituitary Mass Size...............159
Short Stature................................160
Tall Stature..................................161
Weight Gain / Obesity.....................162

Neurologic 163
Altered Level of Consciousness Approach 167
Altered Level of Consciousness GCS ≤ 7 168
Aphasia Fluent...............................169
Aphasia Non-Fluent..........................170
Back Pain.....................................171
Cognitive Impairment.....................172
Dizziness......................................173
Dysarthria.....................................174
Falls in the Elderly.........................175
Gait Disturbance............................176
Headache Primary.........................177
Headache Secondary, without Red Flag Symptoms.................................178
Hemiplegia....................................179
Mechanisms of Pain.......................180
Movement Disorder Hyperkinetic.......181
Movement Disorder Tremor..............182
Movement Disorder Bradykinetic.......183
Peripheral Weakness......................184
Peripheral Weakness Sensory Changes 185
Spell / Seizure Epileptic Seizure .................. 186
Spell / Seizure Secondary Organic ............. 187
Spell / Seizure Other ........................................ 188
Stroke Intracerebral Hemorrhage ............... 189
Stroke Ischemia .............................................. 190
Stroke Subarachnoid Hemorrhage ............. 191
Syncope ........................................................... 192
Vertigo ............................................................. 193

**Obstetrical & Gynecological**  195
Intrapartum Abnormal Fetal HR Tracing
  Variability & Decelerations .................... 197
Intrapartum Abnormal Fetal HR Tracing
  Baseline ................................................... 198
Abnormal Genital Bleeding ....................... 199
Acute Pelvic Pain ....................................... 200
Chronic Pelvic Pain ..................................... 201
Amenorrhea Primary ................................. 202
Amenorrhea Secondary ......................... 203
Antenatal Care ........................................... 204
Bleeding in Pregnancy < 20 Weeks ............ 205
Bleeding in Pregnancy 2nd & 3rd Trimester
  ........................................................................ 206
Breast Disorder ......................................... 207
Growth Discrepancy Small for Gestational
  Age / Intrauterine Growth Restriction ....... 208
Growth Discrepancy Large for Gestational
  Age ............................................................ 209
Infertility (Female) ..................................... 210
Infertility (Male) ......................................... 211
Intrapartum Factors that May Affect Fetal
  Oxygenation ............................................... 212
Pelvic Mass .................................................. 213
Ovarian Mass ............................................. 214
Pelvic Organ Prolapse ................................................ 215
Post-Partum Fever .................................................... 216
Post-Partum Hemorrhage ........................................... 217
Recurrent Pregnancy Loss .......................................... 218
Vaginal Discharge .................................................... 219

**Dermatologic**  221

Burns ......................................................................... 225

Dermatoses in Pregnancy Physiologic Changes .......... 226

Dermatoses in Pregnancy Specific Skin Conditions .... 227

Disorders of Pigmentations
  Hyperpigmentation .................................................. 228

Disorders of Pigmentations
  Hypopigmentation .................................................. 229

Genital Lesion .......................................................... 230

Hair Loss (Alopecia) Diffuse ..................................... 231
Hair Loss (Alopecia) Localized .................................. 232

Morphology of Skin Lesions Primary Skin Lesions .... 233

Morphology of Skin Lesions Secondary Skin Lesions ... 234

Mucous Membrane Disorder Oral Cavity .................... 235

Nail Disorders Primary Dermatologic Disease .......... 236

Nail Disorders Systemic Disease ............................... 237

Nail Disorders Systemic Disease - Clubbing ............... 238

Pruritus No Primary Skin Lesion ............................... 239

Pruritus Primary Skin Lesion ..................................... 240

Skin Rash Eczematous .............................................. 241

Skin Rash Papulosquamous ...................................... 242

Skin Rash Pustular .................................................... 243
Skin Rash Reactive ................................................................. 244
Skin Rash Vesiculobullous .................................................... 245
Skin Ulcer by Etiology .......................................................... 246
Skin Ulcer by Location Genitals ......................................... 247
Skin Ulcer by Location Head & Neck .................................. 248
Skin Ulcer by Location Lower Legs / Feet ......................... 249
Skin Ulcer by Location Oral Ulcers .................................... 250
Skin Ulcer by Location Trunk / Sacral Region .................... 251
Vascular Lesions ................................................................ 252

Musculoskeletal ................................................................ 253
Acute Joint Pain Vitamin CD .............................................. 255
Back Pain ............................................................................ 256
Bone Lesion .......................................................................... 257
Chronic Joint Pain ............................................................... 258
Deformity / Limp ................................................................. 259
Fracture Healing ................................................................ 260
Guide to Spinal Cord Injury ............................................... 261
Infectious Joint Pain ............................................................. 262
Inflammatory Joint Pain ....................................................... 263
Myotomes Segmental Innervation of Muscles .................... 264
Pathologic Fractures ............................................................. 265
Soft Tissue .......................................................................... 266
Osteoporosis BMD Testing .................................................. 267
Tumour ................................................................................. 268
Vascular Joint Pain ............................................................... 269

Psychiatric ........................................................................ 271
Anxiety Disorders Associated with Panic ............................. 273
Anxiety Disorders Recurrent Anxious Thoughts ................ 274
Mood Disorders Depressed Mood ......................................... 275
Mood Disorders Elevated Mood ........................................ 276
Obsessive-Compulsive & Related Disorders ........................................................... 277
Personality Disorder .......................................................................................... 278
Psychotic Disorders ......................................................................................... 279
Somatoform Disorders ....................................................................................... 280
Trauma & Stressor Related Disorders ................................................................. 281

Otolaryngologic  283
Hearing Loss Conductive ................................................................................... 285
Hearing Loss Sensorineural ............................................................................... 286
Hoarseness Acute ............................................................................................... 287
Hoarseness Non-Acute ....................................................................................... 288
Neck Mass ........................................................................................................ 289
Otaligia ............................................................................................................ 290
Smell Dysfunction ............................................................................................. 291
Tinnitus Objective .............................................................................................. 292
Tinnitus Subjective ............................................................................................. 293

Ophthalmologic  295
Cross Section of the Eye & Acronyms ................................................................. 297
Approach to an Eye Exam .................................................................................. 298
Acute Vision Loss Bilateral ............................................................................... 299
Acute Vision Loss Unilateral ......................................................................... 300
Chronic Vision Loss Anatomic ........................................................................ 301
Amblyopia .......................................................................................................... 302
Diplopia ............................................................................................................... 303
Neuro-Ophthalmology Visual Field Defects ......................................................... 304
Pupillary Abnormalities Isocoria ................................................................. 305
Pupillary Abnormalities Anisocoria ................................................................. 306
Red Eye Atraumatic ......................................................................................... 307
Red Eye Traumatic ............................................................................................ 308
Strabismus Ocular Misalignment ..................................................................... 309
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abdominal Mass</td>
<td>317</td>
</tr>
<tr>
<td>Acute Abdominal Pain</td>
<td>318</td>
</tr>
<tr>
<td>Acute Renal Failure</td>
<td>319</td>
</tr>
<tr>
<td>Altered Level Of Consciousness</td>
<td>320</td>
</tr>
<tr>
<td>Anemia By MCV</td>
<td>321</td>
</tr>
<tr>
<td>Anemia By Mechanism</td>
<td>322</td>
</tr>
<tr>
<td>Bleeding / Bruising</td>
<td>323</td>
</tr>
<tr>
<td>Chronic Abdominal Pain</td>
<td>324</td>
</tr>
<tr>
<td>Chronic Kidney Disease</td>
<td>325</td>
</tr>
<tr>
<td>Congenital Anomalies</td>
<td>326</td>
</tr>
<tr>
<td>Constipation (Pediatric)</td>
<td>327</td>
</tr>
<tr>
<td>Cyanosis in the Newborn</td>
<td>328</td>
</tr>
<tr>
<td>Dehydration</td>
<td>329</td>
</tr>
<tr>
<td>Depressed / Lethargic Newborn</td>
<td>330</td>
</tr>
<tr>
<td>Developmental Delay</td>
<td>331</td>
</tr>
<tr>
<td>Diarrhea (Pediatric)</td>
<td>332</td>
</tr>
<tr>
<td>Dysuria</td>
<td>333</td>
</tr>
<tr>
<td>Edema</td>
<td>334</td>
</tr>
<tr>
<td>Enuresis</td>
<td>335</td>
</tr>
<tr>
<td>Febrile Seizures</td>
<td>336</td>
</tr>
<tr>
<td>Fever (Age &lt;1 Month)</td>
<td>337</td>
</tr>
<tr>
<td>Fever (Age 1-3 Months)</td>
<td>338</td>
</tr>
<tr>
<td>Fever (Age &gt;3 Months)</td>
<td>339</td>
</tr>
<tr>
<td>Global Developmental Delay / Intellectual Disability</td>
<td>340</td>
</tr>
<tr>
<td>Headache</td>
<td>341</td>
</tr>
<tr>
<td>Hematuria</td>
<td>342</td>
</tr>
<tr>
<td>Hypernatremia</td>
<td>343</td>
</tr>
<tr>
<td>Hypoglycemia</td>
<td>344</td>
</tr>
<tr>
<td>Hyponatremia</td>
<td>345</td>
</tr>
<tr>
<td>Hypotonic Infant (Floppy Newborn)</td>
<td>346</td>
</tr>
<tr>
<td>Increased Urinary Frequency</td>
<td>347</td>
</tr>
<tr>
<td>Large for Gestational Age</td>
<td>348</td>
</tr>
</tbody>
</table>
Rash (Papulosquamous).................................378
Rash (Pustular)........................................379
Rash (Reactive)........................................380
Rash (Vesiculobullous).............................381
Respiratory Distress In The Newborn... 382
Respiratory Distress In The Newborn
Tachypnea..................................................383
Salter Harris Physeal Injury Classification
....................................................................................384
School Difficulties......................................385
Scrotal Mass.............................................386
Shock............................................................387
Short Stature.............................................388
Skin Lesion (Primary Skin) .......................389
Skin Lesion (Secondary Skin)......................390
Small for Gestational Age.........................391
Sore Throat / Sore Mouth..........................392
Sudden Paroxysmal Event.........................393
Sudden Unexpected Death In Infancy (SUDI)
...............................................................................................394
Thrombocytopenia......................................395

General Presentations 397
Fatigue........................................................399
Acute Fever..................................................400
Fever of Unknown Origin / Chronic Fever.. 401
Hypothermia...............................................402
Sore Throat / Rhinorrhea............................403

Historical Executive Student Editors...405

Scheme Creators........................................406

Abbreviations ..........................................407
Cardiovascular

Abnormal Rhythm (1) .......................................................... 3
Abnormal Rhythm (2) ......................................................... 4
Chest Discomfort Cardiovascular .................................... 5
Chest Discomfort Pulmonary / Mediastinal .................... 6
Chest Discomfort Other ................................................... 7
Diastolic Murmur ............................................................. 8
Hypertension ................................................................. 9
Hypertension in Pregnancy ........................................... 10
Isolated Right-Sided Heart Failure ................................. 11
Left-Sided Heart Failure ............................................... 12
Pulse Abnormalities ....................................................... 13
Shock ........................................................................... 14
Syncope ........................................................................ 15
Systolic Murmur Benign & Stenotic ............................... 16
Systolic Murmur Valvular & Other .............................. 17
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Abnormal Rhythm

Types of Arrhythmia

Bradyarrhythmia (<60 bpm)
- Sinus Bradycardia
- Sick Sinus Syndrome
- SA Block
- AV Block (1\textsuperscript{st}/2\textsuperscript{nd}/3\textsuperscript{rd} degree)
- Junctional Escape Rhythm
- Ventricular Escape Rhythm

Abnormal Beats
- Premature atrial contraction
- Premature ventricular contraction

Tachyarrhythmia (>100 bpm)

Narrow QRS (<120 msec)
- SVT

Wide QRS (>120 msec)
- VT or SVT with aberrancy

Regular Rhythm SVT (constant R-R Interval)
- Sinus Tachycardia
- Monofocal Ectopic Atrial Tachycardia
- AFlutter
- AVNRT
- AVRT (ie. WPW)

Irregular Rhythm SVT (variable R-R interval)
- AFib
- AFlutter with Variable AV Conduction
- Multifocal Atrial Tachycardia

Regular Rhythm (constant R-R Interval)
- Monomorphic VT
- Regular rhythm SVT with conduction aberrancy

Irregular Rhythm (variable R-R interval)
- Polymorphic VT (including Torsades de Pointes if in a setting of long QT)
- Irregular rhythm SVT with conduction aberrancy

Abnormal Rhythm (1)
Abnormal Rhythm (2)

Causes of Arrhythmia

May present as: palpitations, dizziness, syncope, chest discomfort

Cardiac

- Structural
  - Valve disease
  - Cardiomyopathy

- Electrical Conduction Abnormalities
  - Ectopic foci
  - Accessory pathway
  - Scar tissue (previous MI)

Non-Cardiac

- High Output State
  - Anemia
  - Fever/infection
  - Pregnancy

- Metabolic
  - Hypoglycemia
  - Thyrotoxicosis
  - Pheochromocytoma

- Drugs
  - Alcohol
  - Caffeine
  - Sympathomimetics
    - Anticholinergics
    - Cocaine

- Psychiatric
  - Panic Attack
  - Generalized Anxiety Disorder
Chest Discomfort

Cardiovascular

- Outflow Obstruction
  - Aortic Stenosis

- Pulmonary/Mediastinal
  - Ischemic
    - Myocardial Infarction*
    - Stable/Unstable Angina*

- Non-Ischemic
  - Aortic Dissection*
  - Dilating Aneurysm*
  - Pericarditis
  - Myocarditis

* Denotes acutely life-threatening causes
Chest Discomfort

Pulmonary / Mediastinal

- Cardiovascular
  - Vascular
    - Pulmonary Embolism*
      (chest pain often not present)
    - Pulmonary Hypertension
  - Pleural Processes
    - Pneumothorax (Tension*)
    - Pleuritis/Serositis
    - Pleural Effusion
    - Malignant Mesothelioma
- Other
  - Parenchymal
    - Pneumonia with pleurisy*
    - Tuberculosis*
    - Neoplasm*
    - Sarcoidosis

* Denotes acutely life-threatening causes
Chest Discomfort

Other

Chest Discomfort

Cardiovascular

Pulmonary/Mediastinal

Other

Gastrointestinal

• Gastro-Esophageal Reflux Disease
• Biliary Disease
• Peptic Ulcer Disease
• Pancreatitis*
• Esophageal Spasm
• Esophageal Perforation*

Musculoskeletal

• Costochondritis
• Muscular Injury
• Trauma

Neurologic/Psychiatric

• Anxiety/Panic
• Herpes Simplex Virus/Post-Herpetic Neuralgia
• Somatoform Disorder
• Spinal Radiculopathy

* Denotes acutely life-threatening causes
Diastolic Murmur

- Early Diastolic
  - Aortic Regurgitation*
  - Pulmonary Regurgitation (Graham-Steell Murmur)*

- Mid-Diastolic
  - Mitral Stenosis*
  - Tricuspid Stenosis*
  - Severe Aortic Regurgitation (Austin Flint Murmur)
  - Atrial Myxoma Prolapse

- Late Diastolic
  - Mitral Stenosis*
  - Tricuspid Stenosis*
  - Myxoma

* Mitral Stenosis/Tricuspid Stenosis (OS – opening snap)
**Hypertension**

**Primary (Essential) (95%)**
Onset between age 20 and 50.
Positive family history.
No features of secondary hypertension.

- Long-standing
- Uncontrolled
- Drug Withdrawal

**Secondary (5%)**
Onset age < 20 or > 50 years.
No family history. Hypertensive urgency.
Resistant hypertension.

**Exogenous**
- Corticosteroids
- Oral Contraceptive Pills
- Cocaine
- Black licorice
- Medications

**Renal**
- Renal parenchymal disease
  - CKD
  - AKI
  - Glomerulonephritis
- Renovascular disease
  (unilateral and bilateral renal artery stenosis)

**Mechanical**
- Aortic coarctation
- Obstructive Sleep Apnea

**Endocrine**
- Glucocorticoid excess (Cushing syndrome or disease)
- Catecholamine excess (pheochromocytoma)
- Mineralocorticoid excess (primary aldosteronism)
- Hyperthyroidism (mainly systolic hypertension)
- Hypothyroidism (mainly diastolic hypertension)
- Hyperparathyroidism
- Pregnancy (Gestational hypertension)

**Mislabelled**
Repeatedly normal blood pressure when taken at home, work or when using an ambulatory monitor.

- White-coat Hypertension
- Masked Hypertension

**Definition of hypertension:**
Systolic BP ≥ 140mmHg or Diastolic BP ≥ 90mmHg
Isolated systolic hypertension in the elderly: ≥ 160mmHg
Diabetes mellitus ≥ 130/80mmHg
Note: In children, the definition of hypertension is different (either systolic or diastolic BP >95thile), but the approach is the same.

Hypertensive Urgency: BP usually >180/110mmHg or asymptomatic Diastolic BP >130mmHg with target organ damage usually present but not acutely changing
Hypertensive Emergency: BP usually >220/140mmHg with evolving target organ damage
Hypertension in Pregnancy

DBP ≥ 90mmHg, based on two measurements

Pre-existing Hypertension
Before Pregnancy OR <20 weeks gestational age

- No Proteinuria
- Proteinuria (≥0.3g/24hr urine) OR one or more Adverse Conditions*

  - Chronic Hypertension
  - Pre-existing Hypertension with Pre-Eclampsia

Gestational Hypertension
Previously normotensive, >20 weeks gestational age

- No Proteinuria
- Proteinuria (≥0.3g/24hr urine) OR one or more Adverse Conditions*

  - Gestational Hypertension with Pre-Eclampsia

Pre-Eclampsia + Seizures/Coma

- Eclampsia

*Adverse Conditions:
(SOGC, 2008)

Maternal

- Persistent or new/unusual headache
- Visual disturbances
- Persistent abdominal/RUQ pain
- Severe nausea or vomiting
- Chest pain/dyspnea
- Severe hypertension
- Pulmonary Edema
- Suspected placental abruption
- Elevated serum creatinine/AST/ALT/LDH
- Platelet <100x10^9/L
- Serum albumin <20g/L

Fetal

- Oligohydramnios
- Intrauterine growth restriction
- Absent/reversed end-diastolic flow in the umbilical artery
- Intrauterine fetal death

Clinical Pearl: BP should always be measured in a sitting position for a pregnant patient.
Isolated Right-Sided Heart Failure

Note: all left-sided heart failure can also lead to right-sided heart failure
(the most common cause of right heart failure is left heart failure)

Cardiac

- Myocardium
  - Right Ventricle Infarction
  - Restrictive Cardiomyopathy
- Valves
  - Pulmonary Stenosis
  - Tricuspid Regurgitation
- Pericardium
  - Constrictive Pericarditis
  - Pericardial Tamponade

Pulmonary

- Parenchyma
  - Chronic Obstructive Pulmonary Disease
  - Diffuse Lung Disease
  - Acute Respiratory Distress Syndrome
  - Chronic Lung Infection
- Vasculature
  - Pulmonary Embolism
  - Primary Pulmonary Arterial Hypertension
  - Pulmonary Veno-Occlusive Disease

⚠️ Potentially acutely life-threatening presentation
Left-Sided Heart Failure

Valvular Disease (Preserved Diastolic/Systolic Function)
- Mitral Stenosis
- Mitral Regurgitation
- Aortic Stenosis
- Aortic Regurgitation

Systolic Dysfunction (Reduced Ejection Fraction)

Impaired Contractility
- Uncontrolled Severe Hypertension
- Aortic Stenosis (Severe)

Increased Afterload

Coronary Artery Disease
- Myocardial Infarction
- Transient Myocardial Ischemia

Chronic Volume Overload
- Mitral Regurgitation
- Aortic Regurgitation

Dilated Cardiomyopathies
- Infiltrative
- Infectious
- Toxic (alcohol, cocaine)
- Genetic

Myocardial

Diastolic Dysfunction (Preserved Ejection Fraction)

Impaired Diastolic Filling
- Transient Myocardial Ischemia
- Left Ventricular Hypertrophy
- Restrictive Cardiomyopathy
- Pericardial Constriction

SV = Stroke Volume
EDV = End-Diastolic Volume
ESV = End-Systolic Volume

Ejection Fraction = \( \frac{SV}{EDV} = \frac{EDV - ESV}{EDV} \)

Heart Failure

Potential acutely life-threatening presentation
Pulse Abnormalities

Unequal/Delayed
- Obstructive arterial disease (ie. Atherosclerosis)
- Aortic dissection*
- Aortic aneurysm*
- Aortic coarctation
- Takayasu disease
- Normal variant

Pulsus Alternans
Variation in pulse amplitude with alternate beats
- Left heart failure*

Pulsus Paradoxus
Exaggerated inspiratory drop in arterial pressure >10mmHg
- Cardiac tamponade*
- AECOPD/ Acute Exacerbation of Asthma*
- Hypovolemic shock*
- Constrictive Pericarditis
- Restrictive Cardiomyopathy

Aortic Stenosis
- Anacrotic
- Pulsus parvus (small amplitude)
- Pulsus tardus (delayed/slow upstroke)

Water Hammer Pulse
Rapid upstroke followed by rapid collapse
- Aortic regurgitation
- High output states (ie. Anemia, hypoglycemia, thyrotoxicosis, )

* Denotes acutely life-threatening causes
Shock

Warm Extremities

Distributive Shock
Low JVP
- Sepsis
- Anaphylaxis
- Burns
- Neurogenic

Cardiogenic Shock
Bibasilar Lung Crackles
- Myocardial Ischemia or Infarction
- Left-sided Valvular Disease
- Arrhythmia
- Cardiomyopathy (ie. HOCM)

Obstructive Shock
Normal/Decreased Breath Sounds
- Pulmonary Embolism
- Tension Pneumothorax
- Cardiac Tamponade

Cold Extremities

High JVP

Low JVP

Hypovolemic Shock
(Rule out Decompensated Distributive Shock)
- Hemorrhage
- Dehydration
- Vomiting
- Diarrhea
- Interstitial Fluid Redistribution

⚠️ Potentially acutely life-threatening presentation
Cardiovascular

Syncope

- Neurocardiogenic
  - Vasovagal
  - Orthostatic Hypotension
  - Autonomic Neuropathy
  - Situational (micturition, coughing, defecation)

- Cardiac
  - CO = SV x HR

- Respiratory
  - Pulmonary Embolism
  - Hypoxia
  - Hypercapnia

- Other
  - Hypoglycemia
  - Anemia
  - Medications (CCB, BB, Nitrates, Diuretics)
    - TIA
    - Psychiatric
    - Intoxication
    - Migraine

Rule out Seizure

Stroke Volume

- Contractility
  - MI
  - DCM

- Afterload
  - Mitral/Aortic Stenosis
  - HCM (LVOT)

- Preload
  - Blood Loss/Hypotension
  - Mitral Stenosis
  - Cardiac Tamponade
  - Constrictive Pericarditis

Heart Rate/Rhythm

- Tachyarrhythmia
  - VT/VFib
  - AFib/AF flutter
  - AVNRT/AVRT

- Bradyarrhythmia
  - Sick Sinus Syndrome (SA Node)
  - 2nd/3rd degree AV Block
  - Pacemaker Malfunction
  - Tachy-Brady Syndrome

Situational (micturition, coughing, defecation)

Rule out Seizure
Systolic Murmur

Benign & Stenotic

Systolic Murmur

Benign/Flow/Hyperdynamic
- Pregnancy
- Fever
- Anemia

Supravalvular
- Aortic Coarctation
- Supravalvular Aortic Stenosis (rings, webs)

Stenosis
- Hypertrophic Obstructive Cardiomyopathy
- Subvalvular Aortic Stenosis (rings, webs)

Incompetent Valve

Valvular
- Aortic Stenosis*
- Pulmonary Stenosis*
- Uni-/Bicuspid
- Degenerative (Tricuspid)
- Rheumatic Heart Disease

Other

Aortic Stenosis/
Pulmonary Stenosis

S₁ S₂
Systolic Murmur
Valvular & Other

- Benign/Flow/Hyperdynamic
- Stenotic
- Incompetent Valve
- Other
  - Ventricular Septal Defect

- Mitral Regurgitation*
  - Leaflet/Annulus
    - Prolapse*
    - Dilated cardiomyopathy
    - Endocarditis
    - Hypertrophic Cardiomyopathy
    - Rheumatic Fever
    - Marfan’s Disease
  - Chordae Tendinae
    - Rupture
    - Endocarditis
    - Rheumatic Fever
    - Trauma
  - Papillary Muscle Dysfunction
    - Ischemia
    - Infarct
    - Rupture

- Tricuspid Regurgitation*
  - Dilation of Right Ventricle/Annulus
    - Dilated cardiomyopathy
    - MI
    - Pulmonary Hypertension
  - Leaflet
    - Prolapse*
    - Endocarditis
    - Rheumatic Fever
    - Ebstein’s Anomaly
    - Carcinoid

- S1 S2
  - Mitral Regurgitation/

* Mitral Valve Prolapse (OS – OS)
Respiratory

Acid-Base Disorder Pulmonary .......................... 21
Chest Discomfort Cardiovascular ....................... 22
Chest Discomfort Pulmonary ............................. 23
Chest Discomfort Other ................................... 24
Chest Trauma Complications ............................... 25
Cough Chronic .................................................. 26
Cough, Dyspnea & Fever ...................................... 27
Dyspnea Acute ................................................... 28
Dyspnea Chronic Cardiac ..................................... 29
Dyspnea Chronic Pulmonary / Other .................... 30
Excessive Daytime Sleepiness .............................. 31
Hemoptysis ....................................................... 32
Hypoxemia ....................................................... 33
Lung Nodule ..................................................... 34

Mediastinal Mass ................................................ 35
Pleural Effusion .................................................. 36
Pulmonary Function Tests Interpretation .......... 37
Pulmonary Hypertension ................................... 38
Acid-Base Disorder

Pulmonary

Acid-Base Disorder

- pH < 7.35 (Acidemia)
  - Metabolic Acidosis
    - Elevated Anion Gap
      - See “Metabolic Acidosis Elevated Anion Gap” on page 119
    - Normal Anion Gap
      - See “Metabolic Acidosis Normal Anion Gap” on page 118
  - Respiratory Acidosis
    - Hypoventilation present for hours to days
- pH 7.35-7.45 (Normal pH)
  - Mixed Acid-Base Disorder
  - Metabolic Alkalosis
    - Chronic
      - Hyperventilation present for hours to days
    - Acute
      - Hyperventilation present for minutes to hours
  - Respiratory Alkalosis
    - Chronic
      - Hyperventilation present for hours to days
    - Acute
      - Hyperventilation present for minutes to hours

Appropriate Compensation: Ratio (CO₂:HCO₃⁻)
- Metabolic Acidosis: 12:10
- Metabolic Alkalosis: 7:10
- Acute Respiratory Acidosis: 10:1
- Chronic Respiratory Acidosis: 10:3
- Acute Respiratory Alkalosis: 10:2
- Chronic Respiratory Alkalosis: 10:4

See “Metabolic Acidosis Elevated Anion Gap” on page 119
See “Metabolic Acidosis Normal Anion Gap” on page 118
See “Metabolic Alkalosis” on page 117
Chest Discomfort

Cardiovascular

- Outflow Obstruction
  - Aortic Stenosis

- Ischemic
  - Myocardial Infarction*
  - Stable/Unstable Angina*

- Non-Ischemic
  - Aortic Dissection*
  - Dilating Aneurysm*
  - Pericarditis
  - Myocarditis

* Denotes acutely life-threatening causes
Chest Discomfort

Pulmonary

- Pneumothorax (Tension*)
- Pleuritis/Serositis
- Pleural Effusion
- Malignant Mesothelioma

- Pneumonia*
- Pulmonary Embolism*
- Malignancy
- Sarcoidosis
- Acute Chest Syndrome

* Potentially acutely life-threatening
Chest Discomfort

- Cardiovascular
  - Gastrointestinal
    - GERD
    - Biliary Disease
    - Peptic Ulcer Disease
    - Pancreatitis*
    - Esophageal Spasm
    - Esophageal Perforation*
  - Musculoskeletal
    - Costochondritis
    - Muscular Injury
    - Trauma

- Pulmonary/Mediastinal

- Other
  - Neurologic/Psychiatric
    - Anxiety/Panic
    - Herpes Simplex Virus/Post-Herpetic Neuralgia
    - Somatoform Disorder
    - Spinal Radiculopathy
Chest Trauma Complications

- Cardiac
  - Cardiac Tamponade*
  - Pericarditis
  - Myocardial Contusion
  - Acute Aortic Rupture*

- Chest Wall
  - Rib Fractures
  - Flail Chest*
  - Diaphragm Injury

- Lung
  - Pulmonary Contusion
  - Pneumothorax (Tension*)
  - Hemothorax

* Potentially acutely life-threatening
Cough

Chronic Cough ( > 3 wks )

Normal Chest X-Ray

Normal Spirometry

Obstructive Disease (FEV1/FVC <75%) • Asthma • COPD

Upper Airway • Post-Nasal Drip / Rhinosinusitis • Neuromusclar Swallowing Disorder • Thyroiditis • Mediastinal Mass • Elongated Uvula

Lower Airway • Asthma • GERD • Post-Infectious • Smoker’s Cough • Non-Asthmatic Eosinophilic Bronchitis • Foreign Body

Other • ACE Inhibitor

Cough & Dyspnea & Fever

Abnormal Chest X-Ray

• COPD • Chronic Infection (Eg. Fungal, Tuberculosis) • Neoplasm • CHF • Interstitial Disease • Foreign Body

Cough

Respiratory
Cough, Dyspnea & Fever

* Potentially acutely life-threatening

Cough

Chronic Cough (> 3 wks)

Cough & Dyspnea & Fever

Normal CXR

- Acute Bronchitis
- AECOPD

Non-Infectious

- Pulmonary Embolism*
- Cryptogenic Organizing Pneumonia
- Wegener’s Granulomatosis

Pneumonia in the Immunocompetent Host

Pneumonia in the Immunocompromised Host

Abnormal CXR

- Bacterial (often non-pathogenic with immune competence)
- Fungal (e.g. *Pneumocystis jirovecii*)
- Viral

New/Changed Murmur

Hospital-Acquired

- Aerobic Gram-Negative Bacilli
- Gram-Positive Cocci

Community-Acquired

- *S. pneumoniae*
- *H. influenzae*
- Viral (Eg. Influenza)
- *M. pneumoniae*
- *C. pneumoniae*

Tuberculosis

Peripheral Stigmata of Subacute Endocarditis

- Left-Sided Endocarditis

Intravenous Drug User

- Right-Sided Endocarditis with Septic Emboli
Dyspnea

Acute

Dyspnea

Acute
Presents in minutes to hours

Cardiovascular

• Myocardial Infarction*
• Cardiac Tamponade*
• CHF

• Pleural
  • Pneumothorax (Tension*)

• Parenchymal
  • Pneumonia

• Vascular
  • Pulmonary Embolism*

• Lower Airway (Wheeze)
  • Asthma*
  • AECOPD
  • CHF

• Upper Airway (Stridor)
  • Aspiration*
  • Anaphylaxis*

Chronic

Respiratory

Potential acutely life-threatening presentation

* Denotes acutely life-threatening causes
Dyspnea Chronic

Cardiac

Dyspnea

Acute
Preseets in minutes to hours

Cardiac

Pulmonary

Other

Pericardial
• Effusion
• Cardiac Tamponade*
• Constriction

Myocardial
• Systolic Dysfunction
• Diastolic Dysfunction
• Restrictive Cardiomyopathy

Valvular
• Stenosis
• Regurgitation
• Sub-Valvular Disease

Coronary Artery Disease
• Stable Angina
• Acute Coronary Syndrome*

Arrhythmia
• Atrial Fibrillation
• Bradyarrhythmia
• Tachyarrhythmia

* Denotes acutely life-threatening causes
**Dyspnea Chronic**

_Pulmonary / Other_

---

**Dyspnea**

- **Acute**
  - Presents in minutes to hours

- **Chronic**

---

**Cardiac**

---

**Pulmonary**

---

**Other**

- Anemia
- Anxiety
- Deconditioning
- Hyperthyroidism
- Metabolic Acidosis

---

**Airways**

- Asthma
- COPD
- Bronchiectasis

---

**Parenchyma**

- (abnormal chest X-ray)

---

**Interstitium**

- Interstitial Pulmonary Fibrosis
- Hypersensitivity Pneumonitis
- CHF
- Sarcoidosis

---

**Vessels**

- Pulmonary Embolism*
- Pulmonary Hypertension

* Denotes acutely life-threatening causes
Excessive Daytime Sleepiness

Differentiate Fatigue from Sleepiness

Insufficient Sleep
- Poor Sleep Hygiene
- Insomnia
- Behavioral Sleep Deprivation (Eg. Shift Work)

Sleep Disorders
- Obstructive/Central Sleep Apnea
- Restless Legs Syndrome
- Periodic Limb Movement Disorder
- Narcolepsy
- Obesity Hypoventilation Syndrome

Medical/Psychiatric Disorders
- Neurologic Disorders (Eg. Parkinson’s, MS)
- Head Trauma
- Depression
- Anxiety

Other
- Medications (Eg. Benzodiazepines, Antihistamines, Opioid Analgesics, Antipsychotics)
- Drug Abuse (Eg. Alcohol, Opioids)
Hemoptysis

Massive Hemoptysis
(>100 mL in 24 hours)
- Malignancy
- Bronchiectasis
- Abscess/Mycetoma
- Arteriovenous Malformation

Non-Massive Hemoptysis
- CXR +/- CT

Normal
- Hematemesis
- Epistaxis
- Bronchitis

Focal Abnormality
- CHF
- Bronchiectasis
- Pulmonary Vasculitis

Diffuse Abnormality

Infection
- Bacterial
- Viral
- Tuberculosis
- Fungal

Malignancy

Pulmonary Vasculitis
- Lupus Erythematosus
- Goodpasture’s Syndrome
- Granulomatosis with polyangiitis/microscopic polyangiitis

Vascular
- Pulmonary Embolism
- Arteriovenous Malformation
Hypoxemia

Alveolar-Arterial Gradient = $P_AO_2 - P_AO_2$

$P_AO_2 = FIO_2 (P_B+PH_2O)-(P_{CO_2}/0.8)$

*In Calgary, $P_B = 660$mmHg, Sea level $P_B = 760$mmHg

---

Hypoxemia

**Severe Pneumonia**

**Atelectasis**

*Potentially acutely life-threatening.*

**VSDs will be a Right-to-left shunt in infancy, become a Left-to-Right shunt in childhood to adulthood, and revert back to a right-to-left shunt when the left ventricle fails in severe disease, contributing to Eisenmenger’s Syndrome.*
Lung Nodule

Single Round Lesion < 3cm In Diameter

New Nodule

Multiple Nodules

Nodule on CXR > 2 Years Without a Change in Size

- Scar
- Granuloma
- Arteriovenous Malformation

Solitary Nodule

- Malignant Neoplasm
- Benign Neoplasm (e.g. Hamartoma, Lipoma, Fibroma)
- Granuloma
- Abscess
- Arteriovenous Malformation
- Bronchogenic Cyst
- Rounded Atelectasis

Malignancy

- Primary lung cancer
- Metastases (“cannonball lesions”; e.g. Melanoma, Head & Neck, Sarcoma, Colon, Kidney, Breast, Testicle)

Infection

- Fungal
- Tuberculosis
- Septic Embolism
- Parasitic

Inflammation

- Rheumatoid Arthritis
- Granulomatosis with polyangiitis (GPA)/microscopic polyangiitis (MPA)
- Sarcoidosis
- Pneumoconiosis

Vascular

- Arteriovenous Malformation

* Potentially acutely life-threatening
Mediastinal Mass

Mediastinal Mass

Anterior
- Thyroid
- Thymoma
- Teratoma
- “Terrible” Lymphoma

Middle
- Aneurysm
- Lymphadenopathy
- Cystic (Bronchial, Pericardial, Esophageal)

Posterior
- Neurogenic Tumour
- Esophageal Lesion
- Diaphragmatic Hernia
Pleural Effusion

Thoracic Ultrasound should be used to perform Diagnostic Thoracentesis

Exudate
Use Light’s Criteria

Pulmonary
- Infectious
- Neoplastic
- Inflammatory (RA, SLE)
- Pulmonary Embolus*
- Chylothorax
- Hemothorax

Gastrointestinal
- Ruptured Esophagus*
- Pancreatitis

Transudate
Use Light’s Criteria

Increased Hydrostatic Pressure
- Congestive Heart Failure
- Renal Failure with Hypervolemia
- (Early) Pulmonary Embolus

Decreased Oncotic Pressure
- Cirrhosis
- Nephrotic Syndrome

Light’s Criteria
- Pleural Fluid Protein/Serum Protein > 0.5
- Pleural Fluid Lactate Dehydrogenase (LDH)/Serum LDH > 0.6
- Pleural Fluid LDH > 2/3 Serum LDH Upper Limit of Normal

* Potentially acutely life-threatening
Pulmonary Function Tests

Interpretation

**Pulmonary Function Tests Interpretation**

\[ \text{FEV}_1 / \text{FVC} \geq \text{LLN} \]

**FVC \geq \text{LLN}**

- YES: TLC \leq \text{LLN} → **Restriction**
- NO: TLC \geq \text{LLN} → **Obstruction**

**FVC \geq \text{LLN}**

- YES: DL_{CO} \geq \text{LLN} → **Normal**
- NO: DL_{CO} \leq \text{LLN} → **Mixed Defect**

**LLN**: Lower limit of Normal

Pulmonary Hypertension

- Pulmonary Arterial Hypertension
  - Idiopathic
  - Connective Tissue Disease
  - Portal Hypertension
  - Congenital Heart Disease

- Left-Sided Heart Dysfunction
  - Systolic
  - Diastolic
  - Valvular

- Lung Disease and/or Hypoxemia
  - COPD
  - Interstitial Lung Disease
  - Sleep Apnea

- Chronic Thromboembolic Disease
Hematologic

Overall Approach to Anemia ........................................... 43
Approach to Anemia Mean Corpuscular Volume ..................... 44
Anemia with Elevated MCV ............................................. 45
Anemia with Normal MCV .............................................. 46
Anemia with Low MCV .................................................. 47
Approach to Bleeding / Bruising Platelets & Vascular System ................................. 48
Approach to Bleeding / Bruising Coagulation Proteins ..................... 49
Approach to Splenomegaly .............................................. 50
Fever in the Immunocompromised Host .................................. 51
Hemolysis ....................................................................... 52
Lymphadenopathy Localized ............................................ 53
Lymphadenopathy Diffuse .............................................. 54
Approach to Leukocytosis ................................................ 55
Lymphocytosis ............................................................... 56
Neutrophilia ................................................................. 57
Neutropenia Decreased Neutrophils Only ............................... 58
Neutropenia Bicytopenia / Pancytopenia ............................... 59
Prolonged PT (INR), Normal PTT .................................... 60
Approach to Prolonged PT (INR) ....................................... 61
Prolonged PTT .............................................................. 61
Prolonged PTT, Normal PT (INR) Bleeding Tendency ............. 62
Prolonged PTT, Normal PT (INR) No Bleeding Tendency ......... 63
Polycythemia .................................................................. 64
Suspected Deep Vein Thrombosis (DVT) ............................... 65
Suspected Pulmonary Embolism (PE) ................................. 66
Thrombocytopenia.................................67
Thrombocytosis......................................68
Overall Approach to Anemia

Anemia

Blood Loss
- Normocytic/Normochromic RBCs on Smear
  - Acute Bleed
  - Chronic Bleed

Decreased RBC Production
- Normal/Decreased Reticulocytes
  - Iron Deficiency
  - B12/Folate Deficiency
  - Aplastic Anemia
  - Anemia of Chronic Disease
  - Marrow Infiltration

Increased RBC Destruction
- Increased Reticulocytes, Increased Unconjugated Bilirubin, Spherocytes on Smear

Congenital
- Hemoglobinopathy
- Thalassemia
- RBC Membrane Disorder
- RBC Metabolism Disorder

Acquired
- Immune
- Non-Immune
Hematologic

Approach to Anemia

Mean Corpuscular Volume

Anemia

Low Mean Corpuscular Volume (<80 fL)
- Iron Deficiency
- Thalassemia
- Lead Poisoning
- Anemia of Chronic Disease

Normal Mean Corpuscular Volume (80-100 fL)
- Bleeding
- Hemolysis
- Marrow Failure
- Anemia of Chronic Disease (e.g. Renal Disease, Liver Disease, Endocrinopathy, Chronic Inflammation, Chronic Infection)

High Mean Corpuscular Volume (>100 fL)
- B12 Deficiency
- Folate Deficiency
- Drugs
- Reticulocytosis
- Liver Disease
- Hypothyroidism
- Myelodysplasia
Anemia with Elevated MCV

Rule out Reticulocytosis

- Normal Blood Smear
  - Drugs
- Oval Macrocytes Hypersegmented Neutrophils
- RBCs in Rouleaux Formation
  - Multiple Myeloma
- Dysplastic
  - Myelodysplastic Syndromes
- Macrocytosis Target Cells Normal WBCs

Low RBC Folate
- Dietary Deficiency
- Malabsorption
- Increased Requirement (e.g. Pregnancy)

Low Serum B12 Antibody Testing

Anti-IF Antibodies Present
- Pernicious Anemia

Anti-IF Antibodies Not Present
- Small Bowel Disorder
- Pancreatic Disease
- Parasites
- Pernicious Anemia

Normal Liver Function Tests
- Rule out B12 and Folate Deficiency

Abnormal Liver Function Tests
- Liver Disease
Anemia with Normal MCV

Anemia with normal Mean Corpuscular Volume

- Decreased WBCs
  - Decreased/Normal Reticulocytosis
    - Marrow Aplasia
    - Marrow Infiltration
  - Increased Reticulocytosis
    - Primary Hypersplenism
    - Secondary (e.g. RA, SLE, PRV, Chronic)

- Normal/Increased WBCs
  - Increased Reticulocytosis
    - Renal Failure
    - Inflammation
    - Cancer
    - Hypothyroid
    - Pregnancy
    - Early Iron Deficiency

- Polychromatic Macrocytes, Normal RBCs
  - Acute Bleed
  - Hemolysis

- Polychromatic Macrocytes, RBC Spherocytes, RBC Fragments
  - Microangiopathic Hemolytic Anemias (MAHA)

- Abnormal RBCs
  - Sickle Cells, Target Cells
  - Hemoglobinopathy
Anemia with Low MCV

Anemia with Low Mean Corpuscular Volume

Decreased Heme Synthesis or Decreased Globin Synthesis

- Ferritin decreased, serum iron decreased, TIBC increased
  - Fe/TIBC <18%
  - MCV/RBC >13
  - Iron Deficiency (Eg. Causes: DChronic Blood Loss, Occult DBleed, Malabsorption, Dietary DDeficiency)

- Ferritin normal/increased, serum iron decreased, TIBC normal/decreased
  - Fe/TIBC >18%
  - Anemia Secondary to NInflammation

- Ferritin normal/increased, Serum iron normal, TIBC Normal
  - MCV/RBC <13, +/- basophilic stippling, +/- increased reticulocytes

- Increased HgbA2
  - Normal HgbA
  - β-Thalassemia Minor

- Increased HgbA2
  - Increased HgbF
  - No HgbA
  - β-Thalassemia Major

- Increased HgbH, HgbH inclusions in RBC
  - α-Thalassemia 2-3 digene deletion

- Other
  - e.g. HgbE, HgbC, etc.
Approach to Bleeding / Bruising
Platelets & Vascular System

Bleeding/Brusing

Platelets
- Thrombocytopenia
  - Quantitative Defect
  - Decreased Production
  - Increased Destruction
  - Abnormal Sequestration
  - (See thrombocytopenia scheme)
- Disordered Platelet Function
  - Qualitative Defect
- Congenital
  - Rare

Vascular System
- congenital
- Acquired

Coagulation Proteins
- Acquired
  - Steroids
  - Vasculitis
- Connective Tissue Disorders
- Hereditary Telangiectasia

Platelets & Vascular System

Hematologic
Approach to Bleeding / Bruising

**Coagulation Proteins**

- **Bleeding/Brusing**
  - Platelets
  - Vascular System
  - Coagulation Proteins

**Coagulation Proteins**

- **Congenital**
  - Factor VIII Deficiency
  - Factor IX Deficiency
  - Von Willebrand’s Disease
  - Other deficiencies

- **Acquired**
  - Anticoagulation (Iatrogenic)
  - Liver Disease
  - Vitamin K Deficiency
  - Disseminated Intravascular Coagulation
Approach to Splenomegaly

- **Splenomegaly**
  - Evidence of portal hypertension or coagulopathy?
    - Congestive
      - Cirrhosis
      - Thrombus (e.g. Hepatic, Portal, Splenic)
    - Infectious
      - Bacterial
      - Viral (EBV)
      - Parasitic
      - Fungal
    - Infiltrative
      - Systemic Lupus Erythematosus
      - Sarcoidosis
      - Felty’s Disease
      - Serum Sickness
    - Inflammatory
      - Hemolytic Disease
        - Sickle Cell Disease (children)
        - Thalassemia
        - Congenital Spherocytosis
        - Acquired causes
  - Blood smear abnormalities?
    - Non-Malignant
      - Amyloidosis
      - Gaucher’s Disease
      - Glycogen Storage Disease
    - Malignant
      - Lymphoma
      - Leukemia
      - Myeloproliferative disorders (e.g. polycythemia vera, essential thrombocytosis, myelofibrosis)
Fever in the Immunocompromised Host

**Cellular Defect**
- Cell Mediated Immunity
  - T-Cells Affected
    - Pneumonia
    - *Aspergillus*
    - *Candida*
    - *Pneumocystis jirovecii*
    - CNS Infection

**Structural Defect**
- Asplenia/Hyposplenism
  - Bacteremia/Septic Shock
  - Encapsulated Bacteria

**Protein Defect**
- Complement Deficiency
  - Encapsulated Bacteriemia
    - *Streptococcus pneumoniae*
    - *Haemophilus influenzae*
    - *Neisseria spp.*

- Hypogammaglobulinemia
  - Recurrent Sinusitis
  - Pneumonia
  - Bronchitis
  - Chronic Diarrhea
    - *Giardia Infection*
Lymphadenopathy

Localized

Localized Lymphadenopathy

Reactive

Inflammatory
- Allergy
- Acne
- Insect bites

Infectious
- Bacterial (e.g., Pharyngitis, Cellulitis, Lymphadenitis)

Neoplastic

Stage I-II Lymphoma
- Non-Hodgkin’s Lymphoma
- Hodgkin’s Lymphoma

Metastatic Carcinoma
- Nasopharyngeal
- Head/Neck
- Thyroid
- Breast
- GI Tract
- Melanoma

<table>
<thead>
<tr>
<th>Cervical</th>
<th>Supraclavicular</th>
<th>Axillary</th>
<th>Epitrochlear (Always pathologic)</th>
<th>Inguinal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior</td>
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- Anterior
- Infection (e.g., Mononucleosis, Toxoplasmosis)
- Posterior
- TB
- Lymphoma
- Kikuchi Disease
- Head/Neck
- Malignancy

- Anterior
- Infection (Arm, Thoracic Wall, Breast)
- Cancer (in absence of infection in upper extremity)
- Infection (Forearm/Hand)
- Lymphoma
- Sarcoidosis
- Tularemia
- Secondary Syphilis

- Anterior
- Infection (Leg)
- Sexually Transmitted Infection
- Cancer
Lymphadenopathy

Diffuse

Diffuse Lymphadenopathy

- Reactive
  - Systemic Inflammatory
    - Systemic Lupus Erythematosus
    - Sarcoidosis
    - Rheumatoid Arthritis
    - Pseudotumor
  - Infectious
    - EBV
    - CMV
    - HIV
    - Tuberculosis
    - Hepatitis
  - Other
    - Acne
    - Allergy
    - Insect Bites
    - Young age
- Neoplastic
  - Leukemia
    - History of Bleeding, Infection, Fatigue
      - Acute Lymphoblastic Leukemia (Pancytopenia, WBC differential includes Blasts)
    - Asymptomatic, Age > 50
      - Chronic Lymphocytic Leukemia (CBC with Lymphocytes)
  - Monoclonal Lymphocytes on Biopsy
  - Reed-Sternberg Cells on Biopsy
    - Non-Hodgkin’s Lymphoma
    - Hodgkin’s Lymphoma

Systemic Inflammatory

Infectious

Other

Leukemia

Monoclonal Lymphocytes on Biopsy

Reed-Sternberg Cells on Biopsy

History of Bleeding, Infection, Fatigue

Asymptomatic, Age > 50

Acute Lymphoblastic Leukemia (Pancytopenia, WBC differential includes Blasts)

Chronic Lymphocytic Leukemia (CBC with Lymphocytes)
Approach to Leukocytosis

Increased Leukocytes

Granulocytosis

Lymphocytosis (See Lymphocytosis scheme)

Acute Leukemia (Blast Cells, Anemia, Thrombocytopenia)

Neutrophilia (most common—See Neutrophilia scheme)

- Infection
- Allergies
- Chronic inflammation
- Chronic myelogenous leukemia

- Parasitic Infection
- Allergies
- Autoimmune disorders (ex. EGPA, IBD, RA, Sarcoidosis)
- Chronic myelogenous leukemia
- Hypereosinophilic syndromes
- DRESS*

- Acute lymphoblastic leukemia
- Acute myeloblastic leukemia (May see Auer Rods on PBS)

Reactive

Neoplastic

Reactive

Neoplastic

*Denotes acutely life-threatening condition
Lymphocytosis

Increased Lymphocytes

Reactive
Polyclonal proliferation

Infectious
Atypical polyclonal T-Lymphocytes
- Viral (EBV, CMV, Rubella, Mumps, Hepatitis)
- *Bordetella pertussis*

Other
- Hypersensitivity reactions (drugs, stress)
- Asplenia
- Autoimmune (Rheumatoid Arthritis)

Neoplastic
Monoclonal proliferation of mature lymphocytes
- Chronic lymphoblastic leukemia
- Non-Hodgkin’s Lymphoma

Hematologic
Neutrophilia

Increased Neutrophils

Reactive (Orderly WBC differential) (Most Common)

Infection (Most Common) (Döhle Bodies and Toxic Granulation seen on PBS)
- Bacterial
- Abscess
- Viral

Medications
- Corticosteroids
- Lithium
- Epinephrine

Cancer
- Solid Tumour (eg. Lung, Bladder, Colon)

Other
- Inflammation
- Tissue necrosis
- Physical stimuli
- Emotional stimuli
- Metabolic disorders
- Asplenia
- Smoking

Neoplastic (Disorderly WBC differential)

Myeloproliferative Disorder
- Chronic myelogenous leukemia
- Polycythemia vera
Neutropenia
Decreased Neutrophils Only

Isolated Neutrophil Decrease
- Congenital
- Decreased Marrow Production
  - Idiopathic
    - Chronic
  - Idiopathic
    - Chronic
    - Increased Consumption
      - Septicemia
        - Gram Positive Bacteria
        - Gram Negative Bacteria
      - Increased Destruction
        - Systemic Lupus Erythematous
        - Rheumatoid Arthritis

Bicytopenia/Pancytopenia (Neutrophils and Other Cell Lines Decreased)
- Medications
  - Anticonvulsants
  - Antibiotics
  - Antithyroid
  - Antihypertensive
  - Antirheumatic
  - Antistroke
  - Antipsychotic
  - Antineoplastic
- Viral Infection
  - Epstein-Barr Virus
  - Cytomegalovirus
  - Childhood viruses
  - HIV
  - Influenza
  - COVID-19
Neutropenia

Bicytopenia / Pancytopenia

Neutropenia

Isolated Neutrophil Decrease

Bicytopenia/Pancytopenia (Neutrophils and Other Cell Lines Decreased)

Decreased Production

Sequestration

• Splenomegaly

Marrow Infiltration

• Infection
• Primary Myelofibrosis
• Acute myeloid leukemia
• Acute lymphoid leukemia
• Non-hematological malignancies

Stem cell damage or suppression

• Chemotherapy
• Radiation
• Drugs
• Toxins
• Aplastic Anemia
• Myelodysplasia

Nutritional deficiency

• B12/folate/combined deficiencies
Prolonged PT (INR), Normal PTT

Normal PTT/Long PT

- Sufficient Vitamin K
  - Congenital Clotting Factor Deficiency – Extrinsic Factor (Factor VII Deficiency)

- Insufficient Vitamin K
  - Vitamin K Deficiency
  - Vitamin K Antagonist
    - Coumadin (Warfarin) use

  - Child/Adult
    - Antibiotics and Poor Nutrition
    - Fat Malabsorption

  - Newborn
    - Hemorrhagic Disease of the Newborn
Approach to Prolonged PT (INR), Prolonged PTT

Long PT (INR), Long PTT

Factor Deficiency
- Congenital
  - Factor X
  - Factor V
  - Factor II
  - Fibrinogen
- Disseminated Intravascular Coagulation
- Vit K Deficiency
  (decreases levels of Factors II, VII, IX, X, and Protein C+S)

Acquired
- Vitamin K Problem
- Liver Disease

Inhibitor
- Drugs
  - Heparin
- Autoantibodies to a Clotting Factor in the Common Pathway
  (Rare)

Notes:
- PT more sensitive to Vitamin K deficiency; therefore PT used for monitoring Coumadin therapy (PTT only affected in very severe cases)
- PTT more sensitive to heparin; therefore PTT used for monitoring heparin therapy (PT only affected in very severe cases)
Prolonged PTT, Normal PT (INR)

Bleeding Tendency

Long PTT/Normal PT

Bleeding Tendency
- Congenital
  - X-Linked Disorder
    * Factor VIII Deficiency (Hemophilia A)
    * Factor IX Deficiency (Hemophilia B)
  - Autosomal Recessive Disorder
    * Factor XI Deficiency (Hemophilia C)
  - Autosomal Dominant Disorder
    * von Willebrand’s Disease with a low Factor VIII

No Bleeding Tendency
- Acquired
  - Autoantibodies
    * Factor VIII Inhibitor
    * Other Factors (rare)
  - Drugs
    * Heparin
Prolonged PTT, Normal PT (INR)

No Bleeding Tendency

Long PTT/Normal PT

Bleeding Tendency

Congenital
(Intrinsic Pathway Factor Deficiency)

- Factor XII
- Prekallikrein (Fletcher Factor)
- High Molecular Weight Kininogen (Fitzgerald Factor)

No Bleeding Tendency

Acquired

- Antiphospholipid Antibodies (APLA)
Polycythemia

(Erythrocytosis)

Relative
Normal RBC Mass/
Decreased Plasma Volume
• Burns
• Diarrhea
• Dehydration
• Idiopathic

True
Elevated RBC Mass
JAK-2 Negative
Elevated Erythropoietin
Reactive (Most Common)
Rule out exogenous cause of high EPO

JAK-2 Positive
Low/Normal Erythropoietin,
O₂ Saturation ≥ 90%,
Splenomegaly, increased PMNs
• Polycythemia Vera

High Affinity Hemoglobin
O₂ Saturation ≥ 90%
Increased carboxyhemoglobin
Abnormal P450 determination
Smoking, positive Family History, early onset
• Congenital Hemoglobinopathy
• Familial Polycythemia
• Carboxyhemoglobin

Hypoxia
O₂ saturation ≤ 90%
(Most Common)

Erythropoietin Secreting Tumor
O₂ Saturation ≥ 90%
Abnormal Abdominal Ultrasound

Exogenous agents
O₂ Saturation ≥ 90%
• Androgen/anabolic steroid use
• Recombinant EPO administration

Heart Murmur,
Cyanosis without Pulmonary Disease
• Cyanotic Heart Disease

Abnormal Chest X-Ray
Shortness of Breath, Cough,
Smoking, Snoring
Chronic Chest Symptoms
• Sleep Apnea
• Chronic Pulmonary Disease
Suspected Deep Vein Thrombosis (DVT)

Well's Criteria for DVT

- Active Cancer (1)
- Paralysis, paresis, recent immobilization of lower extremity (1)
- Recently bedridden for >3 days, or major surgery in last 4 weeks (1)
- Localized tenderness along distribution of the deep venous system (1)
- Entire leg swollen (1)
- Calf swelling by >3 cm compared to asymptomatic leg (1)
- Pitting edema (greater in symptomatic leg) (1)
- Collateral, nonvaricose superficial veins (1)
- Alternative diagnosis as or more likely than DVT (-2)

Suspected Pulmonary Embolism (PE)

Suspected PE

Calculate Clinical Probability Score

Low: ≤ 4 Points
- Negative D-Dimer
  - STOP
- Positive D-Dimer
  - STOP

High: > 4 Points
- CT-PA or Compression U/S
  - Negative CT-PE
    - Low Clinical Suspicion
      - STOP
  - Non-Diagnostic
  - Positive CT-PA
    - Positive
      - TREAT
    - Negative
      - Repeat U/S in 1 Week

Well’s Criteria for PE
- Clinical Signs and Symptoms of DVT (leg swelling and pain with palpation of the deep veins) (3.0)
- Alternative diagnosis less likely than PE (3.0)
- Heart rate >100bpm (1.5)
- Immobilization or surgery in last 4 weeks (1.5)
- Previous DVT or PE (1.5)
- Hemoptysis (1.0)
- Malignancy (ongoing or previous 6 months) (1.0)

Thrombocytopenia

Low Platelet Count

- Decreased Production
  - Decreased Megakaryopoiesis
    - Aplastic Anemia
    - Toxic Damage (e.g. Chemotherapy)
    - Displacement (e.g. Leukemia, Tumour)
  - Ineffective Megakaryopoiesis
    - B12 Deficiency
    - Folate Deficiency
    - Folate Antagonist (methotrexate)
    - Drugs

- Increased Sequestration
  - Splenomegaly

- Increased Destruction
  - HELLP Syndrome
  - TTP/HUS
  - DIC
  - Vasculitis
  - Infection
  - Foreign Surface (e.g. Prosthetic Heart Valve)

- Immune
  - Autoimmune
    - ITP
    - SLE
    - CLL
    - APLA
  - Alloimmune
    - anti-HLA antibodies

- Non-Immune
  - Drugs
    - Quinidine
    - HIT
    - Others
Thrombocytosis

- **Reactive** (Most common)
  - Infectious
    - Acute or Chronic
  - Inflammatory
    - IBD
    - Rheumatic disorders
    - Celiac disease
  - Tissue Damage
    - Post-op surgery
    - Trauma
    - Burns
- **Spurious**
  - Artifact (redo CBC)
- **Autonomous**
  - Essential thrombocytosis
  - Polycythemia Vera
  - Chronic Myelogenous Leukemia
  - Primary Myelofibrosis
- **Non-malignant hematologic conditions**
  - Rebound effect following treatment of ITP
  - Rebound effect following ETOH induced thrombocytopenia
- **Other**
  - Post-splenectomy or hypersplenic states (Howell-Jolly bodies on PBS)
  - Non-hematologic malignancy
  - Iron deficiency anemia (most common)
Gastrointestinal

Abdominal Distention ................................................................. 73
Abdominal Distention Ascites .................................................. 74
Abdominal Distention Other Causes ........................................ 75
Abdominal Mass .................................................................. 76
Abdominal Pain (Adult) Acute - Diffuse .............................. 77
Abdominal Pain (Adult) Acute - Localized .............................. 78
Abdominal Pain (Adult) Chronic - Constant ......................... 79
Abdominal Pain (Adult) Chronic - Crampy / Fleeting ......... 80
Abdominal Pain (Adult) Chronic - Post-Prandial .................. 81
Anorectal Pain .................................................................... 82
Acute Diarrhea .................................................................... 83
Chronic Diarrhea Small Bowel .......................................... 84
Chronic Diarrhea Steatorrhea & Large Bowel .................... 85
Constipation (Adult) Altered Bowel Function & Idiopathic .... 86
Constipation (Adult) Secondary Causes ............................... 87
Constipation (Pediatric) ........................................................ 88
Dysphagia .......................................................................... 89
Elevated Liver Enzymes ......................................................... 90
Upper Gastrointestinal Bleed (Hematemesis / Melena) .... 91
Lower Gastrointestinal Bleed .................................................. 92
Hepatomegaly ................................................................... 93
Jaundice ............................................................................. 94
Liver Mass .......................................................................... 95
Mouth Disorders (Adult & Elderly) ..........96
Nausea & Vomiting Gastrointestinal
  Disease..........................................................97
Nausea & Vomiting Other Systemic
  Disease..........................................................98
Stool Incontinence.................................99
Weight Gain..............................................100
Weight Loss..............................................101
**Historical Editors**
Dr. Chris Andrews
Khaled Ahmed
Jennifer Amyotte
Stacy Cormack
Beata Komierowski
James Lee
Shaina Lee
Matt Linton
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Dr. Kelly Burak
Abdominal Distention

- Ascites
- Bowel Dilatation
- Other Causes

**Mechanical obstruction**
- Adhesions 60%
- Volvulus 3%
- Malignancy 20%
- Herniation 10%

- Acute Colonic

- Paralytic Ileus
  - Peritonitis
  - Post-surgical
  - Hypothyroidism

- Chronic Intestinal

- Ogilvie's Syndrome
  - Trauma/Surgery
  - Medical Conditions (e.g. Myocardial Infarction, Congestive Heart Failure)
  - Drugs
  - Retroperitoneal Hemorrhage/Malignancy

- Toxic Megacolon
  - Inflammatory
  - Infectious
  - Ischemic

- Myopathic
  - Scleroderma
  - Familial Myopathy

- Neuropathic
  - Enteric (e.g. Amyloidosis, Paraneoplastic, Narcotics)
  - Extrinsic (e.g. Multiple Sclerosis, Spinal Injury, Stroke)
Abdominal Distention

Ascites

High Albumin Gradient (SAAG)*
>11 g/L serum-fluid albumin

• Portal Hypertension
  • Cirrhosis
  • Alcoholic Hepatitis
  • Portal vein thrombus
  • Budd-Chiari Syndrome

• Cardiac
  • Congestive Heart Failure
  • Constrictive Pericarditis

Low Albumin Gradient (SAAG)*
<11 g/L serum-albumin gradient

• Peritoneal
  • Carcinomatosis
  • Infection (Neutrophils > 250/cc)

• Other Causes
  • Pancreatitis
  • Serositis
  • Nephrotic Syndrome

Clinical pearl: “rule of 97”: SAAG 97% accurate. If high SAAG, 97% of time it is cirrhosis/portal hypertension. If low SAAG, 97% time carcinomatosis (and cytology 97% sensitive)

*Serum Ascites Albumin Gradient (SAAG) = [Serum albumin] – [Peritoneal fluid albumin]
Abdominal Distention

Other Causes

Abdominal Distention

- Ascites
  - Pelvic Mass
    - Pregnancy
    - Fibroids
    - Ovarian Mass
    - Bladder Mass
    - Malignancy
    - Obesity

- Bowel Dilatation
  - Feces/Flatus
    - Constipation
    - Irritable Bowel Syndrome
    - Carbohydrate Malabsorption
    - Diet (Lactose Intolerance)
    - Chronic Obstruction

- Other Causes
  - Organomegaly
    - Hepatomegaly
    - Splenomegaly
    - Hydronephrosis
    - Renal Cysts
    - Aortic Aneurysm*

6 Fs of Abdominal Distention
- Fluid
- Feces
- Flatus
- Fetus
- Fibroids and benign masses
- Fatal tumour

*Denotes acutely life-threatening conditions
Abdominal Mass

Exclude pregnancy/hernia/abdominal wall mass

Organomegaly
- Liver
- Spleen
- Kidneys (eg. Cysts, Cystic Renal Cell Carcinoma, Hydronephrosis)

Neoplasic
- Gastrointestinal Tumours (eg. Colonic, Gastric, Pancreatic)
- Gynecologic Tumors (eg. Ovarian, Uterine)
- Lymphoma/Sarcoma

Other Causes

Feces

Pulsatile
- Vascular (Abdominal Aortic Aneurysm)*

Pseudoneoplastic
- Pancreatic Pseudocyst

*Denotes acutely life-threatening conditions
Abdominal Pain (Adult)

Acute - Diffuse

Acute Abdominal Pain (<72 hours)

Look For Surgical Abdomen
Upper Quadrant: R/O Cardiac, Pulmonary, Renal, Musculoskeletal Causes
Lower Quadrant: R/O Genitourinary Causes

Diffuse

Peritonitic*
- Pancreatitis
- Bowel Obstruction
- Viscus Perforation
- Intraperitoneal Hemorrhage (ruptured AAA)

Non-Peritonitic
- Gastroenteritis
- Irritable Bowel Syndrome
- Constipation
- Metabolic Disease (eg. Diabetic Ketoacidosis)*
- Mesenteric Ischemia*
- Mesenteric Thrombus
- Sickle Cell Anemia
- Musculoskeletal
- Trauma
- Peptic Ulcer Disease

*Denotes acutely life-threatening conditions
Abdominal Pain (Adult)
Acute - Localized

Acute Abdominal Pain
(<72 hours)

Look For Surgical Abdomen
Upper Quadrant: R/O Cardiac, Pulmonary, Renal, Musculoskeletal Causes
Lower Quadrant: R/O Genitourinary Causes

Diffuse

Upper Quadrant

Non-Peritoneal

Right Upper Quadrant
• Biliary Colic
• Hepatitis
• Hepatic Abscess
• Bowel Obstruction*
• Pyelonephritis

Epigastric
• Peptic Ulcer Disease
• Gastritis
• Esophageal Rupture*
• Biliary Colic

Left Upper Quadrant
• Splenic Infarct
• Splenic Abscess
• Splenic Rupture*

Peritoneal*

Bowel*
• Appendicitis
• Diverticulitis
• Incarcerated Hernia

Non-Peritoneal

Lower Quadrant

Peritoneal

Pelvic/Adrenal
• Ectopic Pregnancy*
• Ovarian Torsion
• Pelvic Inflammatory Disease
• Salpingitis

*Denotes acutely life-threatening conditions
Abdominal Pain (Adult)

Chronic - Constant

Chronic Abdominal Pain

Recurrent abdominal pain? Consider tumor
Upper Quadrant/Epigastric? Consider cardiac causes
Lower quadrant? Consider genitourinary causes

Constant

Cramping/Fleeting

Post-Prandial

Upper Quadrant
- Gastroesophageal Reflux Disease
- Peptic Ulcer Disease
- Chronic Pancreatitis
- Pancreatic Tumor
- Gastric Cancer
- Liver Distention (e.g. Hepatomegaly, Tumor, Fat)
- Splenic (e.g. Abscess, Splenomegaly) – very rare

Lower Quadrant
- Crohn’s Disease
- Gynecologic (e.g. Tumor, Endometriosis)

Any Location/Diffuse
- Ascites
- Muscle Wall
- Neuropathic pain
- Somatization
Abdominal Pain (Adult)
Chronic - Crampy / Fleeting

Chronic Abdominal Pain

Recurrent abdominal pain? Consider tumor
Upper Quadrant/Epigastric? Consider cardiac causes
Lower quadrant? Consider genitourinary causes

Constant

Cramping/Fleeting

Post-Prandial

Upper Quadrant
- Biliary Colic/Cholelithiasis
- Choledocholithiasis
- Sphincter of Oddi Dysfunction
- Renal Colic

Lower Quadrant
- Bloating (e.g. Celiac Disease, Lactose Intolerance)
- Renal colic
- Irritable Bowel Syndrome
- Endometriosis

Any Location/Diffuse
- Bowel Obstruction (e.g. Adhesions, Crohn’s, Volvulus, Neoplasm, Hernia)
- Irritable Bowel Syndrome
Abdominal Pain (Adult)

Chronic - Post-Prandial

Chronic Abdominal Pain

Recurrent abdominal pain? Consider tumor
Upper Quadrant/Epigastria? Consider cardiac causes
Lower quadrant? Consider genitourinary causes

Constant

Cramping/Fleeting

Post-Prandial

Upper Quadrant
- Biliary Colic/Cholelithiasis
- Gastroesophageal Reflux Disease
- Peptic Ulcer Disease/Dyspepsia
- Gastric Cancer
- Chronic Pancreatitis
- Obstructing Colon Cancer

Lower Quadrant
- Obstructing Colon Cancer
- Lactose Intolerance

Any Location/Diffuse
- Bowel Obstruction (e.g. Adhesions, Crohn’s, Volvulus, Neoplasm, Hernia)
- Mesenteric Angina
Anorectal Pain

Exclude: Poor Hygiene, Dietary, Anal Trauma

Internal Lesion
- Proctitis
  - Inflammation
  - Infection (Including Sexually Transmitted)

Diagnosis of Exclusion
- Proctalgia
- Other
  - Malignancy
  - Solitary Rectal Ulcer

External Lesion

Dermatologic
- Dermatitis
- Psoriasis

Anorectal Disease
- Fissure
- Fistula/Abscess (Crohn's)
- Hemorrhoid
**Acute Diarrhea**

> 2-3 loose stools/day, >175-235 g/day; > 48 hours, <14 days

### Infectious

- Diarrhea Predominant
  - Watery/Large Volume (Small Bowel)
    - Viral
    - Bacterial (e.g. *C. perfringens, V. cholerae, E. coli, Salmonella, Yersinia*)
    - Parasitic (e.g. *Giardia*)
    - Drugs (Antibiotics, Laxatives, Antacids)
    - Toxins

- Bloody/Pain/Small Volume/Urgency (Large Bowel)
  - Bacterial (e.g. *E. coli, C. difficile, Salmonella, Campylobacter, Shigella*)
  - Parasitic (e.g. *E. histolytica*)

### Ischemic

- Nausea/Vomiting Predominant
  - **Bacillus cereus**
  - **Staphylococcus aureus**

### Inflammatory

- Non-Bloody
  - Crohn’s Ileitis
  - Crohn’s Colitis

- Bloody
  - Ulcerative Colitis
  - Crohn’s Colitis

---

**C. difficile** is under “large bowel” but presents with non-bloody diarrhea usually.

Ischemic colitis is a self-limiting illness in most (due to vascular network from SMA, IMA, iliacs) whereas small bowel ischemia is an abdominal catastrophe (only one supply, SMA).
Chronic Diarrhea

Small Bowel

Steatorrhea
Oily/Foul/Hard to Flush

Large Bowel
Small Volume/Bloody/Painful/
Tenesmus/Urgency

Small Bowel
Large Volume/Watery

Secretory

Disordered Motility
• Irritable Bowel Syndrome (diagnosis of exclusion)
• Diabetic Neuropathy
• Hyperthyroidism

Osmotic
• Magnesium, Phosphate, Sulfate
• Carbohydrate Malabsorption
• Lactose Intolerance

Mucosal
• Crohn’s Disease (screen with CBC, albumin, ESR, endoscopy)
• Celiac Disease (screen with TTG)
• Chronic Inflammation
• Whipple’s Disease

Tumors

Mucosal
• Gastrinoma
• Carcinoid Syndrome
• Mastocystosis

Neoplastic
• Adenocarcinoma
• Lymphoma
Chronic Diarrhea

Steatorrhea & Large Bowel

Chronic Diarrhea

>3 Loose Stools/Day, > 14 days
Exclude Chronic Inflammation

Steatorrhea
Oily/Foul/Hard to Flush

Malabsorptive
• Pancreatic Insufficiency

Malabsorptive
• Celiac Disease
• Mucosal Disease
• Ileal Crohn’s Disease

Primary Malabsorption

Irritable Bowel Syndrome
• Hyperthyroid

Secondary Malabsorption
• Bacterial Overgrowth
• Liver Cholestasis
• Mesenteric Ischemia
• Short Bowel/ Resection

Motility

Inflammatory
• Irritable Bowel Syndrome
• Hyperthyroid

Inflammatory Bowel Disease
• Radiation Colitis
• Ischemic Colitis

Small Bowel
Large Volume/Watery

Secretory
• Villous Adenoma
• Colon Cancer
• Microscopic Colitis

Large Bowel
Small Volume/Bloody/Painful/
Tenesmus/Urgency
Constipation (Adult)
Altered Bowel Function & Idiopathic

Constipation

Infrequency (< 3 bowel movements/week)?
Sensation of Blockage or incomplete evacuation? Straining?

Altered Bowel Function

Diet/Lifestyle
- Fibre
- Calories
- Fluid
- Exercise
- Psychosocial

Medications
- Neurally Active Medications (e.g. Opiates, Anti-Hypertensives)
- Cation Related (e.g. Iron, Aluminum, Calcium, Potassium)
- Anticholinergic (e.g. Antispasmodics, Antidepressants, Antipsychotics)

Severe Idiopathic

Colonic Inertia

Outlet Delay
- Pelvic Floor Dyssynergia

Secondary Causes

Irritable Bowel
Constipation (Adult)

Secondary Causes

- Infrequency (< 3 bowel movements/week)?
- Sensation of Blockage or incomplete evacuation? Straining?

Altered Bowel Function
- Severe Idiopathic
- Secondary Causes

Neurogenic
- Peripheral
  - Hirschsprung’s Disease
  - Autonomic Neuropathy
  - Pseudo-obstruction
- Central
  - Multiple Sclerosis
  - Parkinson’s Disease
  - Spinal Cord/Sacral/Cauda Equina Injury

Non-Neurogenic
- Metabolic
  - Hypothyroidism
  - Hypokalemia
  - Hypercalcemia
- Colorectal Disease
  - Colon Cancer
  - Colonic Stricture
    (Inflammatory Bowel Disease and Diverticular Disease)
Constipation (Pediatric)

Constipation

Infrequent Bowel Movements? Hard, Small stools? Painful evacuation? Encopresis?

Neonate/Infant

Dietary/Functional
- Insufficient Volume/Bulk
- Hirschsprung’s Disease
- Imperforate Anus
- Anal Atresia
- Intestinal Stenosis
- Intestinal Atresia

Neurologic
- Spinal Cord Lesions
- Myotonia Congenita
- Guillain-Barré Syndrome

Dietary/Functional
- Insufficient Bulk/Fluid
- Withholding
- Painful (e.g. Fissures)

Anatomic
- Bowel Obstruction
- Pseudo-obstruction

Older Child

Neurologic
- Hirschsprung’s Disease
- Myotonia Congenita
- Guillain-Barré Syndrome
Dysphagia

If heartburn present: Consider GERD

Oropharyngeal Dysphagia
Immediate Difficulty
Difficulty initiating swallowing? Choking? Nasal Regurgitation?

Structural
• Tumors
• Zenker’s Diverticulum
• Foreign Body

Neuromuscular/Toxic/Metabolic
• Myasthenia Gravis
• CNS Tumors
• Cerebrovascular Accident
• Multiple Sclerosis
• Amyotrophic Lateral Sclerosis
• Polymyositis

Motor Disorder
Solids and/or Liquids

Intermittent Symptoms
• Esophageal Spasm

Progressive Symptoms
• Scleroderma
• Achalasia
• Diabetic Neuropathy

Esophageal Dysphagia
Delayed Difficulty
Food sticks seconds later/ Further down?

Mechanical Obstruction
Solids only

Intermittent Symptoms
• Schatzki Ring
• Esophageal Web
• Eosinophilic Esophagitis

Progressive Symptoms
• Reflux Stricture
• Esophageal Cancer
Elevated Liver Enzymes

**Hepatocellular**
ALT or AST > ALP

- Severe
  - ALT > 15x ULN
  - Viral
  - Drugs/Toxins
  - Ischemia
  - Autoimmune
  - Wilson’s
  - Pregnancy
    - AFLP
    - HELLP

- Moderate
  - ALT 5–15x ULN
  - Viral
  - Drugs
  - AIH
  - Wilson’s
  - Hemochromatosis
  - NAFLD
  - Others

- Mild
  - ALT < 5x ULN
  - NAFLD
  - Alcohol
  - Viral
  - Hemochromatosis
  - Drugs
  - AIH
  - A1AT deficiency
  - Wilson’s
  - Others
  - Cholestatic disease

**Cholestatic (does not always cause Jaundice)**
ALP > ALT or AST

- US – Normal Bile Ducts
  - PBC
  - PSC
  - Alcoholic hepatitis
  - Drugs
  - TPN
  - Sepsis
  - Infiltrative
    - Sarcoïd
    - Amyloid
    - Malignancy
    - Infection
    - Cirrhosis (any)
  - Congenital
    - Biliary Atresia
    - Alagille Syndrome
    - Progressive Familial Intracholestasis

- US – Dilated Bile Ducts
  - Common Bile Duct Stone
  - Biliary stricture
  - PSC
  - Worms/flukes
  - Cholangiocarcinoma
  - Pancreatic cancer
  - Others

**Dx ALF if**
↑INR and hepatic encephalopathy

**ETOH hepatitis**
usually cholestatic, and usually
ALT < 300

**NAFLD**
10% population

**Dx by biopsy**
± MRI/MRCP

**ERCP for dx and therapy**

**Gastrointestinal**
Upper Gastrointestinal Bleed
(Hematemesis / Melena)

Acute Hematemesis/Melena

Blood in vomitus?/black, tarry stools

If Melena, 5-10% colorectal/small bowel. Exclude bleeding disorder.

Peptic Ulcer Disease (55%)

Portal Hypertension (15%)

Other

* Gastro-esophageal varices*

Gastric Acid Hypersecretion

Non-Steroidal Anti-Inflammatory Drugs

Stress (ICU Setting)

Helicobacter Pylori

Retching?

Aorto-Enteric Fistula*

Mallory Weiss Tear

Tumors

Esophagitis/Gastritis

*Denotes acutely life-threatening conditions
Lower Gastrointestinal Bleed

Occult Bleeding
(or iron-deficiency anemia)
- Colorectal cancer
- Angiodysplasia (colon or small bowel)
- Occult UGIB (ulcer, esophagitis, gastritis, cancer)
- Small bowel tumors
- Asymptomatic IBD

Overt Bleeding

In Patient
Lots of bleeding
Rule out brisk UGIB

Out Patient
- Perianal disease most common (hemorrhoids, fissures, abscess)
- Inflammatory Bowel Disease
- Colorectal Cancer

Large Bowel - Painful
- Acute colitis (ischemia, infectious, inflammatory)

Large Bowel - Painless
- Diverticular bleed
- Angiodysplasia

Small Bowel
- Meckel’s Diverticulum
- Tumors
Hepatomegaly

**Rule out concurrent splenomegaly and jaundice**

- **Infiltrative**
  - Right Heart Failure
  - Budd-Chiari Syndrome
  - Constrictive Pericarditis

- **Congestive**
  - Hepatitis A, B, C
  - Mononucleosis
  - Tuberculosis
  - Bacterial Cholangitis
  - Abscess
  - Schistosomiasis

- **Infectious**
  - Alcoholic Hepatitis
  - Autoimmune Hepatitis
  - Drug Induced Hepatitis
  - Sarcoidosis
  - Histiocytosis X
  - Primary Sclerosing Cholangitis
  - Primary Biliary Cirrhosis

- **Inflammatory**
  - Fatty Liver
  - Cysts
  - Hemochromatosis
  - Wilson’s Disease
  - Amyloidosis
  - Myelofibrosis

- **Malignant**
  - Primary Carcinoma
  - Metastases
  - Lymphoma
  - Leukemia
  - Polycythemia
  - Multiple Myeloma

- **Non-Malignant**
  - Fatty Liver
  - Cysts
  - Hemochromatosis
  - Wilson’s Disease
  - Amyloidosis
  - Myelofibrosis
Jaundice

Pre-Hepatic
Unconjugated Hyperbilirubinemia

Hepatic
Conjugated Hyperbilirubinemia
- Hepatocellular
- Cholestatic
- Dubin Johnson

See Elevated Liver Enzymes scheme

Post-Hepatic
Conjugated Hyperbilirubinemia. Usually has Duct Dilatation on Ultrasound.

Increased Production
- Hemolysis
- Ineffective Erythropoiesis
- Hematoma

Decreased Hepatic Uptake
- Sepsis
- Drugs (eg. Rifampin)

Decreased Conjugation
- Gilbert’s Syndrome
- Crigler-Najjar Syndromes (I and II)

Biliary Duct Compression
- Malignancy
- Metastases
- Pancreatitis

Intraductal Obstruction
- Gallstones
- Biliary Stricture
- Cholangiocarcinoma
- Primary Sclerosing Cholangitis
Liver Mass

Cystic
- Benign
  - Simple
    - Cyst
    - Polycystic Liver Disease
    - Caroli’s
  - Complex
    - Cystadenoma
    - Hydatid Cyst
- Malignant
  - Proliferative
    - Hemangioma
    - Focal Nodular Hyperplasia
    - Adenoma
  - Infectious
    - Abscess

Solid
- Benign
- Malignant
  - Primary Malignancy
    - Hepatocellular Carcinoma
    - Cholangiocarcinoma
  - Secondary Malignancy
    - Metastases (e.g. Lung, Colon, Breast)
Mouth Disorders (Adult & Elderly)

Consider oral manifestations of systemic disease

Teeth
- GERD (Dissolves enamel)
- Sjögren’s Syndrome (Dental Caries)

Mucous Membrane

Ulcerating

Non-Ulcerating

Gastrointestinal
- Crohn’s Disease
- Ulcerative Colitis
- NSAIDs

Other
- Canker Sore
- Cold Sore
- Anemia
- Langerhan’s Cell Histiocytosis
- Wegener’s Disease
- Sarcoidosis
- Drug Induced
- Sexually Transmitted Infection

Lighter (White)
- Gingivitis
- Kawasaki Disease (Strawberry Tongue)
- Other Gum Disease
- Mucocele
- Allergic Reaction

Darker (Red)

No Colour Change
- Chronic Liver Disease
- Sjögren’s Syndrome
- Acromegaly
- Amyloidosis
- Psoriasis
- Gingival Hyperplasia
- Dry Mouth

Non-Neoplastic
- Candidiasis
- Lichen Planus
- Anemia

Neoplastic
- Leukoplakia
- Squamous Cell Carcinoma
Nausea & Vomiting
Gastrointestinal Disease

Nausea and Vomiting

Gastrointestinal Disease

Upper Gastrointestinal
- Acute
  - Infectious Gastroenteritis
  - Gastric/Duodenal Obstruction*
  - Gastric Volvulus*
- Chronic
  - Gastroesophageal Reflux Disease
  - Peptic Ulcer Disease
  - Gastroparesis

Hepatobiliary
- Acute
  - Acute Hepatitis
  - Acute Cholecystitis*
  - Cholelithiasis
  - Choledocholithiasis/cholangitis
  - Acute Pancreatitis*
- Chronic

Lower Gastrointestinal
- Acute
  - Infectious Gastroenteritis
  - Small/Large Bowel Obstruction*
  - Acute Appendicitis*
  - Mesenteric Ischemia*
  - Acute Diverticulitis
- Chronic
  - Inflammatory Bowel Disease
  - Colonic Neoplasm

*Denotes acutely life-threatening conditions
Nausea & Vomiting
Other Systemic Disease

Nausea and Vomiting

Gastrointestinal Disease
- Endocrine/Metabolic
  - Pregnancy
  - Diabetes/ DKA*
  - Uremia
  - Hypercalcemia
  - Addison’s Disease
  - Thyroid Disease
- Other
  - Sepsis (eg. Pyelonephritis, Pneumonia)*
  - Radiation Sickness
  - Acute Myocardial Infarction*
- Drugs/Toxins
  - Chemotherapy
  - Antibiotics
  - Ethanol
  - Carbon Monoxide
  - Heavy Metal
  - Nicotine
- Central Nervous System
  - High Intracranial Pressure
    - Hemorrhage*
    - Meningitis
    - Infarction*
    - Malignancy
    - Head Trauma
  - Vestibular (Inner Ear)
    - Ear Infection
    - Motion Sickness
    - Vestibular Migraine
    - Ménière’s Disease
  - Psychiatric
    - Self-Induced (Bulimia)
    - Cyclic Vomiting
    - Psychogenic

*Denotes acutely life-threatening conditions
Stool Incontinence

Intact Pelvic Floor

Trauma/Surgery
- Surgery: Anorectal, Prostate, Bowl
- Pelvic Fracture
- Pelvic Inflammation

Nerve/Sphincter Damage
- Vaginal Delivery
- Rectal Prolapse
- Severe Hemorrhoid

Congenital Anorectal Malformation

Affected Pelvic Floor

Chronic Constipation
- Stool Impaction with overflow
- Encopresis

Neurological Conditions
- Age-Related (e.g. Dementia, Strokes)
- Neuropathy (e.g. Diabetes, Congenital Megacolon, Hirschsprung’s Disease)
- Multiple Sclerosis
- Tumors/Trauma (e.g. Brain, Spinal Cord, Cauda Equina)

Diarrheal Conditions
- Inflammatory Bowel Disease
- Irritable Bowel Syndrome
- Chronic Laxative Use

Stress and Emotional Problems
Weight Gain

Increased Intake
- Dietary
- Social/Behavioural
- Iatrogenic

Decreased Expenditure
- Sedentary Lifestyle
- Smoking Cessation

Neurogenic/Genetic
- Depression
  - Dementia

Hypothalamic/Pituitary
- Hypothalamic Syndrome
  - Growth Hormone Deficiency

Gonadic
- Polycystic Ovarian Syndrome
  - Hypogonadism

Other Causes
- Cushing’s Disease
  - Hypothyroidism
Weight Loss

- Decreased Intake
  - GI illness (upper and lower)
  - Psychiatric (Depression, eating disorders)
  - Poverty
  - Abuse
  - Dementia
  - Anorexia as an Adverse Drug Effect

- Malabsorption
  - Small Bowel Disease (e.g. Crohn’s Disease, Celiac Disease)
  - Pancreatic Insufficiency
  - Cholestatic Liver Disease
  - Protein-losing Enteropathy (e.g. Inflammatory Bowel Disease)

- Increased Expenditure
  - Increased Protein/Energy Requirements (e.g. Post-Surgical, Infections, Trauma, Burns)
  - Cancer
  - Hyperthyroidism
  - Chronic Cardiac/Respiratory distress (e.g. COPD)
  - Chronic Renal Failure
  - Adrenal Insufficiency
  - Poorly Controlled Diabetes Mellitus
  - HIV
Renal

Acute Kidney Injury.......................................................... 105
Chronic Kidney Disease ............................................. 106
Dysuria........................................................................ 107
Generalized Edema..................................................... 108
Hematuria.................................................................... 109
Hyperkalemia Intercellular Shift................................. 110
Hyperkalemia Reduced Excretion................................. 111
Hypokalemia................................................................ 112
Hypernatremia............................................................... 113
Hyponatremia................................................................. 114
Hypertension................................................................. 115
Increased Urinary Frequency ....................................... 116
Metabolic Alkalosis ...................................................... 117
Metabolic Acidosis Normal Anion Gap....................... 118
Metabolic Acidosis Elevated Anion Gap...................... 119
Nephrolithiasis............................................................... 120
Polyuria........................................................................ 121
Proteinuria................................................................. 122
Renal Mass Solid.......................................................... 123
Renal Mass Cystic........................................................ 124
Scrotal Mass................................................................. 125
Suspected Acid-Base Disturbance............................... 126
Urinary Incontinence.................................................... 127
Urinary Tract Obstruction............................................. 128
Historical Editors
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Acute Kidney Injury

Acute increase in creatinine by at least 50%

Pre-Renal
(FeNa < 1%, bland urine sediment)

Renal Hypoperfusion

Systemic Hypotension

• Hepatorenal syndromes
• Drugs
• Emboli

\[\text{Shock}\]

Tubular
(Thrombocytopenia and schistocytosis on CBC)

Uranalysis and CBC

Vascular

Glomerular
(RBC casts, dysmorphic RBCs)

Post-Renal
(Obstruction/hydronephrosis on U/S)

• Benign Prostatic Hyperplasia
• Constipation
• Prostate Cancer
• Urolithiasis

TTP/HUS
(Rapidly Progressive Glomerulonephritis)

Acute Interstitial Nephritis

Rapidly Progressive Glomerulonephritis

• Anti-GBM antibodies
• Immune-complex deposition (IgA, post-strep, lupus)
• Pauci-immune (Wegener’s)

Acute Interstitial Nephritis

• Drugs (NSAIDs, Abx, allopurinol, PPI)
• Infections (CMV, strep, legionella)
• Immune (lupus, sarcoid, Sjögren)

Renal Hypoperfusion

Systemic Hypotension

Tubular

Cast nephropathy (multiple myeloma)
Urate crystals
Calcium Oxalate (Ethylene glycol)

Tubular Obstruction

Tubular Necrosis
(Epithelial cell casts)

• Ischemia (severe hypotension)
• Toxins (contrast, aminoglycosides, chemotherapy)
• Pigments

Glomerular

• Anti-GBM antibodies
• Immune-complex deposition (IgA, post-strep, lupus)
• Pauci-immune (Wegener’s)

TTP/HUS

• Shiga-like toxin (E. coli)
• Drugs
• HIV
• Malignancy

Hepatorenal syndromes
• Drugs
• Emboli

Drugs

Emboli

Shock

Acute Tubular Necrosis
(Epithelial cell casts)

Renal

Tubular Obstruction

Interstitial
(Sterile pyuria, eosinophiluria)
Chronic Kidney Disease

Decreased kidney function (eGFR < 60ml/min/1.73m²) persistent over at least 3 months

Pre-Renal (Evidence of Renovascular disease)
- Ateroemboli
- Renal artery stenosis
- Drugs
- Chronic hypoperfusion

Renal (Abnormal urinalysis: proteinuria/pyuria)
- Tubular (Family history, ultrasound)
  - Polycystic kidney disease
  - Medullary cystic disease
  - Nephronophthsis

- Vascular (Other small vessel disease)
  - Atherosclerosis
- Glomerular (Proteinuria)
  - Diabetes
  - Hypertension

Post-Renal (Obstruction/hydronephrosis on U/S)
- Interstitial (Sterile pyuria, WBC casts, eosinophilia)
  - Drugs (NSAIDs, analgesics)
  - Infections (chronic pyelonephritis)
  - Immune (sarcoïd, Sjögren)
  - Multiple myeloma
  - Hyperoxaluria
  - Hypercalcemia
  - Hyperphosphatemia
Dysuria

Pyuria
Leukocytes on Dipstick/Microscopy

Bacteriuria & Hematuria
Dipstick positive for nitrites (if infected with enterobacteria).

• Gonococcal
• Non-Gonococcal (e.g. Chlamydia, Trichomonas)

No Bacteriuria & No Hematuria
Dipstick negative for nitrites.

• Candida
• Herpes Simplex Virus

Upper Urinary Tract Infection/Pyelonephritis
WBC Casts

Lower Urinary Tract Infection/Cystitis
WBC Clumps

No Pyuria
No Leukocytes on Dipstick/Microscopy

Urethritis

• Candida
• Gardnerella
• Neoplasm

Vaginitis

• Candida

Non-Pathogenic

• Estrogen deficiency
• Interstitial cystitis
• Radiation cystitis

Dipstick negative for nitrites.
Generalized Edema

Overfill
(Increased renal sodium retention, Urine Na > 40meq/L)
- NSAIDs
- AKI/CKD
- Nephrotic Syndrome

Underfill
(Urine Na < 20meq/L)

Altered Startling Forces
(Absolute decrease in EABV)

Congestive Heart Failure
“forward failure”
(Relative decrease in EABV)

Increased Interstitial Oncotic Pressure
- Myxedema (Hypothyroid)

Increased Capillary Hydrostatic Pressure
- Right heart failure
- Constrictive pericarditis
- Portal hypertension
- Pregnancy

Decreased Capillary Oncotic Pressure
- Nephrotic syndrome
- Cirrhosis

Increased Capillary Permeability
- Inflammation
- Sepsis
- Acute Respiratory Distress Syndrome
- Allergies
- Burns/Trauma
Hematuria

Red blood cells on urine microscopy. Must exclude false positives from myoglobinuria, beet, drugs (pyridium, phenytoin, rifampin, nitrofurantoin), or menstruation

Extraglomerular (Isomorphic RBCs with no casts)

Glomerular (Dysmorphic RBCs and/or RBC casts)

Urinary Tract Infection?
(Pyuria +/- nitrites with bacteria on microscopy)

Isolated extraglomerular hematuria is presumed to be secondary to malignancy until proven otherwise

Upper Tract (above bladder)

- Vascular
- Tubulointerstitial
- Calculi (see scheme for renal colic)
- Trauma
- Neoplasm/ Cyst (see schemes for renal mass)

Lower Tract (bladder & below)

- Trauma
- Neoplasm
- BPH
- Calculi

Isolated Hematuria with benign sediment
(injury to epithelial side of glomerular capillary wall)

- IgA nephropathy
- Thin GBM disease
- Hereditary nephritis (Alport’s)

Isolated Hematuria with active sediment
(injury to the endothelial side of glomerular capillary wall)

- Anti-GBM antibodies
- Immune-complex deposition (IgA, post-strep, lupus)
- Pauci-immune disease (Granulomatosis with polyangiitis/microscopic polyangiitis)

Hematuria with active sediment and >3.5g/day (nephrotic range) Proteinuria
(injury to both endothelial and epithelial capillary wall)

- Membranoproliferative glomerulonephritis
- Lupus glomerulonephritis
- Post-Infectious glomerulonephritis
**Hyperkalemia**

**Intercellular Shift**

- **Hyperkalemia**
  - Serum Potassium > 5.5 mmol/L

- **Reduced Excretion**
  - Increased Release
    - Increased Serum Osmoles, Increased Urate, Phosphate, Creatinine Kinase
    - Non-Anion Gap Metabolic Acidosis
    - Hyperosmolarity
    - Cell Lysis (e.g. Tumor Lysis Syndrome, rhabdomyolysis)

- **Increased Intake**
  - Increased Intake (IV potassium with reduced excretion)

- **Transcellular Shift**
  - Appropriate renal excretion
    - (GFR, TTKG, distal flow adequate)

- **Decreased Entry**
  - Decreased Na⁺-H⁺ Exchanger
  - Decreased Na⁺-K⁺-ATPase
  - Insulin Deficiency/Resistance
  - β₂ antagonism
  - α₁ agonism
  - Digoxin

**Exclude pseudohyperkalemia**
- Leukocytosis, thrombocytosis, hemolysis

TTKG = \( \frac{K_{\text{Urine}} \times \text{Osm}_{\text{Serum}}}{K_{\text{Serum}} \times \text{Osm}_{\text{Urine}}} \)
Hyperkalemia
Reduced Excretion

**Hyperkalemia**
Serum potassium > 5.5 mmol/L

**Exclude pseudohyperkalemia**
Leukocytosis, thrombocytosis, hemolysis

**Reduced Excretion**

**Increased Intake**
(IV potassium with reduced excretion)

**Transcellular Shift**

**Principal Cell Problem**
TTKG < 7

**Reduced flow through distal nephron**
TTKG > 7, Urine Na < 20meq/L
- Low EABV (e.g., CHF, cirrhosis, hypotension)

**High Renin High Aldosterone**
- ENaC blockers
- AIN/CIN
- Obstruction

**High Renin Low Aldosterone**
- ACEi/ARB
- Adrenal insufficiency
- Heparin

**Low Renin Low Aldosterone**
- Diabetic nephropathy
- β₂ antagonism
- NSAIDs

TTKG = (K_{Urine} \times Osm_{Serum})/(K_{Serum} \times Osm_{Urine})

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111
Hypokalemia

Serum Potassium < 3.5 mmol/L

Increased Loss

Renal Loss
Urine loss > 20 mmol/d

High distal [K]
TTKG > 4

EABV contracted

Volume Status Assessment

Normal or expanded EABV

High renin
High aldosterone

Low renin
High aldosterone

Low renin
Low aldosterone

• Loop diuretics/
  Bartter’s syndrome
• Thiazide diuretics/
  Gittelman’s syndrome
• Magnesium depletion

Decreased intake
(rare cause in isolation)

GI loss
Urine loss < 20 mmol/d

High distal flow
TTKG < 4

• Polyuria

• Diarrhea
• Vomiting
• NG suction
• Laxatives

Transcellular shift

• Insulin
• β2 agonists
• alkalemia
• Refeeding syndrome
• Rapid hematopoiesis
• Hypothermia
• Thyrotoxic periodic paralysis/familial hypokalemic periodic paralysis

Low renin
Low aldosterone

• Licorice intake
• Liddle’s syndrome

• High renin
  High aldosterone

• Renal artery stenosis
• Hyperaldosteronism

• Low renin
  Low aldosterone
Hypernatremia

Excess free water loss

Serum Sodium >145 mmol/L

High Urine Volume
>3L/24 hours
Renal water loss

High Urine Osmolality
> 300 mmol/kg
- Hypertonic saline administration
- Osmotic diuresis (see Polyuria scheme)
  e.g., mannitol, glucosuria

Low Urine Osmolality
< 300 mmol/kg
- Diabetes Insipidus

Low Urine Volume
<3L/24 hours

Non-renal losses

Non-renal losses
- Decreased intake of water
- Decreased level of consciousness
- No access to water

GI loss
- Watery Diarrhea

Insensible loss
- Burns
- ICU patients
- Fever
- Inadequate intake for exercise-related loss
- Hyperventilation
Hyponatremia

Serum Sodium <135 mmol/L

Hypo-osmolar plasma
Posm < 280 mmol/kg

Impaired H20 Excretion
- Reduced GFR
- Diuretics

Hypo-osmolar urine
Uosm < 100 mmol/kg
ADH expression

Syndrome of Inappropriate ADH
Euvolemic; no physiologic stimulus to ADH
- Pain/Post-op
- Neurologic trauma
- Drugs
- Pulmonary pathology
- Malignancy

Reduced EABV
Urine [Na+] < 20mmol/L

True hypovolemia
- Bleeding
- GI losses
- Renal losses
  (especially thiazide diuretics)

With edema
- Congestive heart failure
- Cirrhosis
- Nephrotic syndrome
- Reduced GFR
  AKI/CRF

Hormonal changes
- Hypothyroidism
- Adrenal insufficiency
- Pregnancy

*serum sodium correction in hyperglycemia:
[Na+]_corrected = [Na+] + (0.3 * ([glucose] − 5))
Hypertension

- **Primary (Essential) (95%)**
  - Onset between age 20 and 50.
  - Positive family history.
  - No features of secondary hypertension.
  - Long-standing
  - Uncontrolled
  - Drug Withdrawal

- **Secondary (5%)**
  - Onset age < 20 or > 50 years.
  - No family history.
  - Hypertensive urgency.
  - Resistant hypertension.

- **Exogenous**
  - Corticosteroids
  - Oral Contraceptive Pills
  - Cocaine
  - Black licorice
  - Medications

- **Renal**
  - Renal parenchymal disease
    - CKD
    - AKI
    - Glomerulonephritis
  - Renovascular disease
    - (unilateral and bilateral renal artery stenosis)

- **Mechanical**
  - Aortic coarctation
  - Obstructive Sleep Apnea

- **Endocrine**
  - Glucocorticoid excess *(Cushing syndrome or disease)*
  - Catecholamine excess *(pheochromocytoma)*
  - Mineralocorticoid excess *(primary aldosteronism)*
  - Hyperthyroidism (mainly systolic hypertension)
  - Hypothyroidism (mainly diastolic hypertension)
  - Hyperparathyroidism
  - Pregnancy *(Gestational hypertension)*

**Definition of hypertension:**
Systolic BP ≥ 140mmHg or Diastolic BP ≥ 90mmHg
Isolated systolic hypertension in the elderly: ≥ 160mmHg
Diabetes mellitus ≥ 130/80mmHg
Note: In children, the definition of hypertension is different (either systolic or diastolic BP >95th percentile), but the approach is the same.

**Hypertensive Urgency:** BP usually >180/110mmHg or asymptomatic Diastolic BP >130mmHg with target organ damage usually present but not acutely changing

**Hypertensive Emergency:** BP usually >220/140mmHg with evolving target organ damage

**Note:** In children, the definition of hypertension is different (either systolic or diastolic BP >95th percentile), but the approach is the same.
Increased Urinary Frequency

Non-increased urine volume (<2mL/min)
Rule out polyuria

Intrinsic to Urinary Tract

Extrinsic to Urinary Tract

- Vulvovaginitis
- Bladder compression/Pregnancy

Urinary Tract Infection
(See Dysuria scheme)

Urinary Obstruction
- Benign prostatic hyperplasia
- Prostatitis
- Prostate cancer
- Nephrolithiasis

Small volume bladder

Detrusor Hyperactivity
- Overactive Bladder
- Diabetes
- MS
- Irritant drugs: Diuretics, caffeine, alcohol
Metabolic Alkalosis

Sustained Metabolic Alkalosis

Volume Status Assessment

Expanded Effective Arterial Blood Volume
No signs of volume depletion

Contracted Effective Arterial Blood Volume
Signs of volume depletion

Gastrointestinal Loss
Low U Cl

Gastric
• Vomiting
• NG suction

Lower Bowel
• Villous adenoma
• Laxative abuse
• Chloridorrhea

Renal Loss
High U Cl

Non-reabsorbed anions
• Penicillins

Impaired tubular transport
• Diuretics (loop/thiazide)
• Hypomagnesemia
• Bartter’s/Gitelman’s

High Renin
High Aldosterone

• Malignant Hypertension
• Renovascular Hypertension
• Renin-Secreting Tumor

Low Renin
High Aldosterone

• Aldosterone-secreting mass
• Adrenal hyperplasia
• Glucocorticoid remediable aldosteronism

Low Renin
Low Aldosterone

• Licorice
• Liddle’s Syndrome
• Enzyme deficiency

Renal Failure with Ingestion

• Milk-Alkali syndrome
• Bicarbonate ingestion

Rule Out

• IV Bicarbonate
• Acute correction of hypercapnia
**Metabolic Acidosis**

**Normal Anion Gap**

- Elevated Anion Gap (>14) (Acid Gain)
  - GI Tract Loss (Negative urine net charge)
    - History of diarrhea?
      - • Diarrhea
      - • Fistula

- Normal Anion Gap (≤14) (Loss of Bicarbonate)
  - Renal Loss
    - Direct Loss
      - Negative U net charge
      - High FE\(_{\text{HCO}_3}\)
        - • RTA Type II
        - • Carbonic anhydrase inhibitor
    - Indirect Loss
      - Positive U net charge

**TTKG** = \( \frac{K_{\text{Urine}} \times \text{Osm}_{\text{Serum}}}{K_{\text{Serum}} \times \text{Osm}_{\text{Urine}}} \)

Urine net charge = \( U_{Na} + U_{K} - U_{Cl} \)

Need to correct anion gap for albumin: For every drop of 10 for albumin (from 40) add 2.5 to the anion gap

- **Principal Cell Problem**
  - Low TTKG
  - • RTA Type IV

- **α-Intercalated Cell Problem**
  - High TTKG
  - • RTA Type I
Metabolic Acidosis

Elevated Anion Gap

Metabolic Acidosis

Need to correct anion gap for albumin: For every drop of 10 for albumin (from 40) add 2.5 to the anion gap

Elevated Anion Gap (>12) (Gain of H+)

- Elevated serum creatinine
- Excess acid addition
- Decreased NH₄ production and anion secretion
  - AKI/CKD

Normal Anion Gap (≤12) (loss of HCO₃⁻)

- Elevated serum lactate
- Positive serum ketones
- Elevated osmolar gap
- Positive serum salicylate level

Excess acid addition

- Salicylate poisoning
  - Shock
  - Drugs
  - Inborn errors

Lactic acidosis

- Lactic acidosis
  - Diabetic ketoacidosis
  - Starvation/alcoholic ketosis

Ketosis

- Ketosis
  - Ethylene/Propylene glycol
  - Methanol

Toxic alcohol ingestion

- Toxic alcohol ingestion
  - Paraldehyde, Iron, Isoniazid, Toluene, Cyanide

Other ingestion

Diagnosis of Mixed Metabolic Disorders in Patients with Metabolic Acidosis:

- Anion Gap Not Increased: Non-Anion Gap Acidosis Alone
- ΔAnion Gap = ΔHCO₃⁻: Anion Gap Acidosis Alone
- ΔAnion Gap < ΔHCO₃⁻: Mixed Anion Gap Acidosis + Non-Anion Gap Acidosis
- ΔAnion Gap > ΔHCO₃⁻: Mixed Anion Gap Acidosis + Metabolic Alkalosis

Anion Gap = Na⁺ - (Cl⁻ + HCO₃⁻) (normal AG ~12)

Elevated Anion Gap

- Elevated serum lactate
- Positive serum ketones
- Elevated osmolar gap
- Positive serum salicylate level

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- ΔAnion Gap > ΔHCO₃⁻: Mixed Anion Gap Acidosis + Metabolic Alkalosis

Anion Gap = Na⁺ - (Cl⁻ + HCO₃⁻) (normal AG ~12)
Nephrolithiasis

Radio-opaque
Calcium-containing
90% of stones

Hard Stones
Calcium oxalate/phosphate
80% of stones

• Hypercalciuria
  • Increased PTH
  • High salt intake
  • High protein intake

Soft Stones
Struvite Stones
10% of stones

• Hyperoxaluria
  • Enteric overproduction
  • Low calcium intake
  • Dietary
  • Ethylene glycol ingestion

• Stones with decreased solubility
  • Low urine volume
  • Hypocitraturia
  • RTA type I
  • High protein intake

Uric Acid Stones

• Anatomical problem
  • Medullary sponge kidney

Radiolucent
Non-calcium
10% of stones

Cysteine Stones
Non Calcium containing, but opaque

• Cystinuria
  • Hyperuricosuria
  • High protein intake

• Urinary tract infection

Anatomical problem

• Increased PTH
• High salt intake
• High protein intake

• Enteric overproduction
• Low calcium intake
• Dietary
• Ethylene glycol ingestion

• Low urine volume
• Hypocitraturia
• RTA type I
• High protein intake

• Medullary sponge kidney
Polyuria

Urine Output > 3L/day
Increased Urine Volume (>2ml/min)

Osmotic Diuresis
Urine Osmolality > Serum Osmolality

- Hyperglycemia (uncontrolled Diabetes Mellitus)
- Mannitol administration
- Increased urea concentration (e.g. Recovery from Acute Renal Failure, increased protein feeds, Hypercatabolism [Burns, Steroids], GI Bleed)
- NaCl administration

Water Diuresis
Urine Osmolality < Serum Osmolality

Hypotonic Urine Following Water Deprivation Test
Excessive Loss
Give DDAVP

- Uosm Increased by >50%
  Proper kidney response
  - Central Diabetes Insipidus

Hypertonic Urine Following Water Deprivation Test

- Primary polydipsia
  • Uosm unchanged or increased by <50%
    Unresponsive Kidney
  • Nephrogenic Diabetes Insipidus
Proteinuria

Persistent Proteinuria

>150mg/d protein present on repeat testing including overnight testing

Tubular Proteinuria
(Negative urine dip = no albuminuria)

 Urine Protein Electrophoresis
  
  Monoclonal protein
  
  Negative

Overflow
- Multiple Myeloma
- MGUS

Poor reabsorption
- RTA
- Fanconi's syndrome
- Drugs

Glomerular Proteinuria
(Positive urine dip = albuminuria)

 Urine Microscopy

Active urine sediment
WBC/RBC casts
- IgA nephropathy
- Membranoproliferative GN
- Mesangial proliferative
- Anti-GBM antibodies
- Granulomatosis with polyangiitis (GPA)/microscopic polyangiitis (MPA)
- SLE
- HSP
- Post-infectious GN

Bland urine sediment
- FSGS
- Minimal change disease
- Membranous nephropathy
- HTN
- Diabetes
- Protein deposition (eg. Amyloidosis)

Orthostatic Proteinuria

- Tall adolescents

Transient Proteinuria

- Exercise
- Fever
- UTI

Excluded on history/ with repeat testing
Renal Mass

Solid

Renal Mass

Solid

Benign
- <3 cm in size
- Presence of fat on CT
  - Angiomyolipoma (hamartoma)
  - Oncocytoma
  - Tuberous Sclerosis

Cystic

Suspicious
- >3 cm in size
  - Renal Cell Carcinoma
  - Wilm’s tumor (nephroblastoma)
  - Metastatic spread to kidneys
Renal Mass

Solid

Benign
- Anechoic on ultrasound
- Well-demarcated on ultrasound/CT
- Non-enhancing with CT contrast

Simple Cysts
- No family history of ADPKD
- Normal sized kidneys
- No cysts in other organs

Polycystic
- Multiple bilateral cysts
- Positive family history
- Enlarged kidneys
- Cysts in other organs

- Polycystic Kidney Disease
- Tuberous Sclerosis
- Von Hippel-Lindau Syndrome

Cystic

Suspicious
- Septated/Loculated on ultrasound
- Irregular border on ultrasound/CT
- Enhancing with CT contrast

Carcinoma
- No signs of infection

- Renal Cell Carcinoma

Abscess
- Fever and leukocytosis
- Positive Gallium scan

- Polycystic Kidney Disease
- Tuberous Sclerosis
- Von Hippel-Lindau Syndrome

Renal Mass

Cystic
Scrotal Mass

Sudden Onset
- Testicular Torsion
- Torsion of the Testicular Appendix
- Trauma
- Incarcerated Hernia

Gradual Onset
- If with Dysuria see Dysuria scheme

Painful
- Acute Epididymitis
- Epididymo-orchitis

Painless
- Trans-illuminates

Trans-illuminates
- Tumor
  - Solid = Tumor until proven otherwise
  - Germ cell
    - Seminoma, Teratoma, Mixed
  - Non-germ cell

Does Not Trans-illuminate
- Varicocele
  - Soft/“Bag of Worms”

Epididymal
- Epididymal Cyst
- Spermatocele

Spermatic Cord
- Communicating hydrocele
- Indirect hernia

Hydrocele
- Communicating/non-communicating
- Traumatic/Reactive
Suspected Acid-Base Disturbance

Suspected Acid-Base Disorder

Acidemia (pH < 7.35)

Metabolic Acidosis
\( HCO_3^- < 24 \text{mmol/L} \)
\( \frac{CO_2}{HCO_3} = 12:10 \)

- Methanol
- Uremia
- Diabetic Ketoacidosis
- Propylene Glycol
- Isoniazid
- Lactic Acidosis
- Ethylene Glycol
- Acetylsalicylic Acid

Non-Anion Gap
- Renal
- Gastrointestinal (diarrhea)

Normal pH

Respiratory Acidosis
\( pCO_2 > 40 \text{mmHg} \)

Acute
\( \frac{CO_2}{HCO_3} = 10:1 \)

Chronic
\( \frac{CO_2}{HCO_3} = 10:3 \)

Alkalemia (pH > 7.45)

Metabolic Alkalosis
\( HCO_3^- > 28 \text{mmol/L} \)
\( \frac{CO_2}{HCO_3} = 7:10 \)

- Mixed Acid-Base Disorder

Appropriate Compensation:
- Ratio \( \frac{CO_2}{HCO_3} \)
- Metabolic Acidosis: 12:10
- Metabolic Alkalosis: 7:10
- Acute Respiratory Acidosis: 10:1
- Chronic Respiratory Acidosis: 10:3
- Acute Respiratory Alkalosis: 10:2
- Chronic Respiratory Alkalosis: 10:4

Anion Gap = Na - (Cl + HCO_3^-) (normal AG ~12)

Diagnosis of Mixed Metabolic Disorders in Patients with Metabolic Acidosis:
- Anion Gap Not Increased: Non-Anion Gap Acidosis Alone
- \( \Delta \text{Anion Gap} = \Delta HCO_3^- \): Anion Gap Acidosis Alone
- \( \Delta \text{Anion Gap} < \Delta HCO_3^- \): Mixed Anion Gap Acidosis + Non-Anion Gap Acidosis
- \( \Delta \text{Anion Gap} > \Delta HCO_3^- \): Mixed Anion Gap Acidosis + Metabolic Alkalosis

Alkalosis (pH > 7.45)

Respiratory Alkalosis
\( pCO_2 < 35 \text{mmHg} \)

Acute
\( \frac{CO_2}{HCO_3} = 10:2 \)

Chronic
\( \frac{CO_2}{HCO_3} = 10:4 \)
Urinary Incontinence

Transient
Easily reversible cause
- Delirium/confusional states
- Infection (UTI)
- Atrophic urethritis/vaginitis
- Pharmaceuticals
- Psychological/psychiatric
- Excessive urine output
- Restricted mobility
- Stool impaction

Established
Not easily reversible cause

Stress Incontinence
Failure of urethral sphincter to remain closed
Small Volume
Precipitated by stress maneuvers
More common in multiparous women

Overflow Incontinence
Distended bladder with high post-void residual volume
Continuous small volume leakage
+/- Precipitated by stress maneuvers

Urge Incontinence
Detrusor overactivity
Abrupt urgency
Moderate to large leakage of urine
Precipitated by cold temperature & running water

Impaired Detrusor Contraction
Signs of autonomic neuropathy or spinal cord disease, cauda equina syndrome, anticholinergic medications

Bladder Outlet Obstruction
Renal

Urinary Tract Obstruction

Upper Tract
Bladder NOT distended on ultrasound
Hematuria, flank pain, +/- N/V

CT KUB

Intraluminal
• Retroperitoneal Fibrosis
• Cancer

Mass
• Urothelial cell carcinoma
• Squamous cell carcinoma

Extraluminal
• Ureteropelvic junction obstruction

Stone
• Calcium oxalate
• Calcium phosphate
• Uric acid [radiolucent on x-ray]
• Struvite
• Cysteine

Intramural

Lower Tract
Distended bladder on ultrasound
Urgency, frequency, hesitancy, nocturia

Bladder
• Carcinoma (until proven otherwise)
• Bladder stone
• Thrombus (frank hematuria)

Outflow Tract
• BPH
• Prostate cancer
• Urethral stricture
• Posterior Urethral valves
<table>
<thead>
<tr>
<th>Condition</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal Lipid Profile Combined &amp; Decreased HDL</td>
<td>133</td>
</tr>
<tr>
<td>Abnormal Lipid Profile Increased LDL &amp; Increased Triglycerides</td>
<td>134</td>
</tr>
<tr>
<td>Abnormal Serum TSH</td>
<td>135</td>
</tr>
<tr>
<td>Adrenal Mass Benign</td>
<td>136</td>
</tr>
<tr>
<td>Adrenal Mass Malignant</td>
<td>137</td>
</tr>
<tr>
<td>Amenorrhea</td>
<td>138</td>
</tr>
<tr>
<td>Breast Discharge</td>
<td>139</td>
</tr>
<tr>
<td>Gynecomastia Increased Estrogen &amp; Increased HCG</td>
<td>140</td>
</tr>
<tr>
<td>Gynecomastia Increased LH &amp; Decreased Testosterone</td>
<td>141</td>
</tr>
<tr>
<td>Hirsutism</td>
<td>142</td>
</tr>
<tr>
<td>Hirsutism &amp; Virilization Androgen Excess</td>
<td>143</td>
</tr>
<tr>
<td>Hirsutism &amp; Virilization Hypertrichosis</td>
<td>144</td>
</tr>
<tr>
<td>Hypercalcemia Low PTH</td>
<td>145</td>
</tr>
<tr>
<td>Hypercalcemia Normal / High PTH</td>
<td>146</td>
</tr>
<tr>
<td>Hypocalcemia High Phosphate</td>
<td>147</td>
</tr>
<tr>
<td>Hypocalcemia Low Phosphate</td>
<td>148</td>
</tr>
<tr>
<td>Hypocalcemia High / Low PTH</td>
<td>149</td>
</tr>
<tr>
<td>Hyperglycemia</td>
<td>150</td>
</tr>
<tr>
<td>Hypoglycemia</td>
<td>151</td>
</tr>
<tr>
<td>Hyperphosphatemia</td>
<td>152</td>
</tr>
<tr>
<td>Hypophosphatemia</td>
<td>153</td>
</tr>
<tr>
<td>Hyperthyroidism</td>
<td>154</td>
</tr>
<tr>
<td>Hypothyroidism</td>
<td>155</td>
</tr>
<tr>
<td>Hyperuricemia</td>
<td>156</td>
</tr>
</tbody>
</table>
Male Sexual Dysfunction ....................157
Sellar / Pituitary Mass .......................158
Sellar / Pituitary Mass Size ...............159
Short Stature ..................................160
Tall Stature ....................................161
Weight Gain / Obesity ......................162
### Historical Editors
- Dr. Andrew Wade
- Dr. Sophia Chou
- Dave Campbell
- Derrick Chan
- Marc Chretien
- Mollie Ferris
- Kody Johnson
- Becky Kennedy
- Vera Krejcik
- Keith Lawson
- Vanessa Millar
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- Maria Wu

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- Patricia Wong *(Co-editor)*
- Soreya Dhanji

### Faculty Editor
- Dr. Kevin McLaughlin
Abnormal Lipid Profile

Combined & Decreased HDL

Abnormal Serum Lipid Profile

- Increased LDL
  - Genetic Causes
    - Familial Combined Hyperlipidemia
    - Familial Dysbetalipoproteinemia
  - Secondary Causes
    - Nephrotic Syndrome
    - Drugs
    - Diabetes
    - Hypothyroidism

- Increased Triglycerides
  - Secondary Causes
    - Hypertriglyceridemia
    - Drugs
    - Diabetes
    - Hypothyroidism

- Increased Cholesterol and Triglycerides
  - Genetic Causes
    - Apo-A1 Deficiency/Variant
    - Tangier Disease
    - LCAT Deficiency
    - Primary Hypoalphalipoproteinemia
  - Secondary Causes
    - Sedentary Lifestyle
    - Smoking
    - Androgens

Physical signs:
- Hypertriglyceridemia: eruptive xanthoma, lipemia retinalis
- Increased IDL: palmar crease xanthoma, tuberous xanthoma
- Increased LDL: tendon xanthomata on Achilles tendon, knuckles
Abnormal Lipid Profile
Increased LDL & Increased Triglycerides

Abnormal Serum Lipid Profile

- Increased LDL
  - Genetic Causes:
    - Polygenic
    - Hypercholesterolemia
  - Secondary Causes:
    - Familial Hypercholesterolemia
    - Familial Defective ApoB-100
    - LDLr deficiency

- Increased Triglycerides
  - Genetic Causes:
    - Familial Hypertriglyceridemia
  - Secondary Causes:
    - Familial LPL Deficiency
    - Apo-CII Deficiency

- Increased Cholesterol and Triglycerides
  - Genetic Causes:
    - Familial Hypertriglyceridemia
  - Secondary Causes:
    - Diabetes
    - Alcohol
    - Increased Estrogen (e.g. Pregnancy, Hormone Replacement Therapy, Oral Contraceptive)

Physical signs:
- Hypertriglyceridemia: eruptive xanthoma, lipemia retinalis
- Increased IDL: palmar crease xanthoma, tuberous xanthoma
- Increased LDL: tendon xanthomata on Achilles tendon, knuckles
Abnormal Serum TSH

- Decreased TSH
  - Decreased Free T4: Hypopituitarism
  - Normal Free T4
    - Decreased Free T3: Non-Thyroid Illness
    - Normal Free T3: Sub-Clinical Thyrotoxicosis
    - Increased Free T3: T3 Toxicosis
  - Increased Free T4: Thyrotoxicosis
- Increased TSH
  - Decreased Free T4: Hypothyroidism*
  - Normal Free T4: Sub-clinical Hypothyroidism**
  - Recovery from Non-Thyroid Illness

*Refer to Hyperthyroidism (1) on page 154
**Refer to Hyperthyroidism (2) on page 155
**Adrenal Mass**

**Benign**

**Benign Adrenal Mass**

- Most common neoplasm is Benign Non-Functioning Adenoma

**Signs of Hormone Excess**

- Hyperplasia
  - Often Bilateral
  - Androgen Excess
    - Virilization/ Hirsutism
  - Estrogen Excess
    - Feminization, Early Puberty, Heavy Menses
  - Glucocorticoid Excess
    - Cushingoid Features
  - Aldosterone Excess
    - Hypertension +/- Hypokalemia/Alkalosis
  - Positive 24-Hour Metanephrines +/− Nor-Metanephrines
  - Silent/Non-Functioning Mass

**No Signs of Hormone Excess**

- Normal DHEAS
  - Non-Functioning Adenoma
  - Lipoma
  - Myelolipoma
  - Ganglieneuroma
  - Other
    - Cyst
    - Pseudocyst
    - Hematoma
    - Infection (TB, Fungal)
    - Amyloidosis

**Rule of 10’s For Pheochromocytoma:**

- 10% are Malignant
- 10% are Bilateral
- 10% are Extra-Adrenal
- 10% are Familial
- 10% are not Associated with Hypertension

**High DHEAS**

- Androgen Releasing Adenoma

**Normal DHEAS**

- Other Source (e.g. Polycystic Ovarian Syndrome, Congenital Adrenal Hyperplasia)
Adrenal Mass
Malignant

Malignant Adrenal Mass

Suggestive of Malignancy: Inhomogenous Density, Delay in CT Contrast Washout (<50% in 10 minutes), Irregular Shape, Diameter >4cm, Calcification, >20 Hounsfield Units on CT, Vascularity of Mass, Hypointense to Liver on T1 Weighted MRI – DO NOT Biopsy

Signs of Hormone Excess

- Androgen Excess
  - Virilization/ Hirsutism
  - High DHEAS
    - •Androgen Releasing Carcinoma (e.g. Adrenocortical Carcinoma)
  - Normal DHEAS
    - •Other Source (e.g. Polycystic Ovarian Syndrome, Congenital Adrenal Hyperplasia)

- Estrogen Excess
  - Feminization, Early Puberty, Heavy Menses
  - •Estrogen Releasing Carcinoma (High Plasma E₂ + Clinical Picture)

- Glucocorticoid Excess
  - Cushingoid Features
    - •Glucocorticoid Releasing Carcinoma (Positive Dexamethasone Suppression Test)

- Aldosterone Excess
  - Hypertension +/- Hypokalemia/Alkalosis
    - •Aldosterone Releasing Carcinoma (High Aldosterone: Renin Ratio)

No Signs of Hormone Excess

- Positive 24-Hour Metanephrines + Nor-Metanephrines
- Silent/Non-Functioning Mass
  - •Lymphoma Metastases (Often Bilateral) Adrenal Carcinoma

Rule of 10’s For Pheochromocytoma:

- 10% are Malignant
- 10% are Bilateral
- 10% are Extra-Adrenal
- 10% are Familial
- 10% are not Associated with Hypertension
Amenorrhea

Rule Out Pregnancy

Low/Normal FSH

Bleed With Progestin Challenge
  • Polycystic Ovarian Syndrome

Hypothalamic-Pituitary Axis

No Bleed With Progestin Challenge
  • Hypothyroidism
  • Hyperprolactinemia
  • Diabetes Mellitus
  • Exogenous Androgen Use
  • Congenital Structural Abnormalities

High Prolactin
  • Hyperprolactinemia

Organic Cause
  • Congenital GnRH Deficiency
  • Infiltrative or Inflammatory Lesion
  • Tumors
  • Infarction
  • Empty Sella Syndrome
  • Apoplexy

Failed Progestin Challenge
  • Functional
  • Hypothalamic
  • Amenorrhea (e.g. Weight Loss, Eating Disorders, Exercise, Stress, Prolonged Illness)

Elevated FSH

• Premature Ovarian Failure
• Menopause
• Spontaneous

If bleed with progestin challenge = estrogenized
If no bleed with progestin challenge = non-estrogenized
Breast Discharge

- **True Galactorrhea** (on microscopy)
  - Abnormal TSH/ Prolactin
    - High Prolactin + Normal TSH
      - Microprolactinoma
      - Steroid Hormone Intake
      - Chronic Renal Failure
      - Stress (e.g. Pregnancy, Breast Stimulation, Trauma/Surgery)
    - High Prolactin + Normal/ Low TSH
      - Pituitary Macroadenoma
      - Dopamine Inhibition
      - Pituitary Stalk Compression/Lesion
  - Normal TSH/ Prolactin
    - Idiopathic
  - Autonomous Production
    - Renal Cancer or Failure
    - Lactotroph Adenoma
    - Bronchogenic Tumor
    - Contraceptive Pill/Patch/Ring

- **Other Breast Discharge**
  - Neoplasm (usually blood)
  - Other Internal Breast Discharge

- **Primary Hypothyroidism**
Gynecomastia

Increased Estrogen & Increased HCG

Gynecomastia

True Gynecomastia

Pseudogynecomastia
  Fat Deposition Only

Physiologic
  • Newborns
  • Pubescent/Adolescent
  • Elderly

Normal Blood Work
  • Idiopathic

Increased Estrogen

Increased HCG

Increased LH

Decreased Testosterone & Normal/Low LH

No Testicular Mass on Ultrasound
  • Adrenal Neoplasm
  • Increased Extraglomerular Aromatase Activity
  • Liver Disease

Testicular Mass on Ultrasound
  • Leydig Cell Tumor
  • Sertoli Cell Tumor

No Testicular Mass on Ultrasound
  • Extragonadal Germ Cell Tumor
  • HCG Secreting Non-Trophoblastic Neoplasm

Testicular Mass on Ultrasound
  • Testicular Germ Cell Tumor
Gynecomastia

Increased LH & Decreased Testosterone

- True Gynecomastia
- Pseudogynecomastia: Fat Deposition Only
- Physiologic:
  - Newborns
  - Pubescent Adolescent
  - Elderly

Normal Blood Work
- Increased Estrogen
- Increased HCG
- Increased LH
- Decreased Testosterone & Normal/Low LH

- Increased Testosterone:
  - Testicular Germ Cell Tumor
  - Hypogonadism
  - Klinefelter’s Syndrome
  - Kallman’s Syndrome
  - Testicular Torsion
  - Testicular Trauma
  - Congenital Anorchia
  - Viral Orchitis

- Decreased Testosterone:
  - Increased Prolactin
    - Prolactin Secreting Tumor
  - Normal Prolactin
    - Non-Tumor Secondary Hypogonadism

- Increased T4, Decreased TSH:
  - Hyperthyroidism

- Normal T4 and TSH:
  - Androgen Resistance
Hirsutism

Rule Out Virilization

Rapid Onset

Medications
- Steroids
- Danazol
- Progestin Containing Contraceptives

Increased Serum Testosterone
- Ovarian Neoplasm
- Hypertrichosis

Increased Serum DHEAS
- Adrenal Neoplasm

Slow Onset

Regular Menstrual Cycles
- Familial
- Idiopathic
- Ethnic Background

Irregular Menstrual Cycles
- Polycystic Ovarian Syndrome
- Cushing’s Syndrome
- 21-OH Congenital Adrenal Hyperplasia
Hirsutism & Virilization

Androgen Excess

- Ovarian
  - Polycystic
  - Ovarian Syndrome
  - Hyperthecosis
  - Tumor

- Adrenal
  - Congenital Adrenal
  - Hyperplasia
  - Cushing’s Syndrome
  - Tumor

- Low Serum Hormone Binding Globulin
  - Obesity
  - Liver Disease
  - Insulin Resistance Syndrome

- Medications
  - Testosterone
  - DHEA
  - Danazol

Hypertrichosis

- Non-Androgen Distribution

Idiopathic Hirsutism

- Normal Cycles and Androgen Levels
Hirsutism & Virilization

Androgen Excess
Normally With Menstrual Irregularity

Hypertrichosis
Non-Androgen Distribution

Medications
- Phenytoin
- Cyclosporine
- Minoxidil
- Penicillamine
- Diazoxide

Medical/Other
- Hypothyroidism
- Anorexia Nervosa
- Malnutrition
- Porphyria
- Dermatomyositis
- Paraneoplastic Syndrome
- Familial
- Idiopathic
Hypercalcemia

Low PTH

Hypercalcemia
Total Calcium > 2.55 mmol/L; Ionized Calcium > 1.30 mmol/L

Measure In Fasting State

Normal/High PTH

Drug Side Effects
- Thiazide Diuretics
- Lithium
- Vitamin A/Isotretinoin

Low PTH
- Excess Calcium Intake
  (e.g. Milk Alkali)
- Immobilization
- Adrenal Insufficiency
- Thyrotoxicosis
- Paget’s Disease

Vitamin D Related
- Excess Vitamin D/Calcitriol Intake
- Unregulated Conversion of 25-OH D3 to 1,25-(OH)2D3 (e.g. Granulomatous Disease, Lymphoma)

Malignancy
- PTH-Related Peptide (e.g. Breast, Kidney, Lung)
- Cytokine-Mediated Bone Resorption (e.g. Multiple Myeloma, Lymphomas)
- Metastatic Bone Disease

Other
- Excess Calcium Intake
  (e.g. Milk Alkali)
- Immobilization
- Adrenal Insufficiency
- Thyrotoxicosis
- Paget’s Disease

Corrected total serum calcium concentration (mmol/L) = measured total serum calcium concentration (mmol/L) + 0.02[40 g/L – albumin(g/L)]
Hypercalcemia

Total > 2.55 mmol/L; Ionized Calcium > 1.30 mmol/L

Measure In Fasting State

Normal/High PTH

Drug Side Effects
- Thiazide Diuretics
- Lithium
- Vitamin A/Isotretinoin

Low PTH

Primary Hyperparathyroidism
- Adenoma
- Hyperplasia
- MEN 1 and 2A

Tertiary Hyperparathyroidism
- Hypercalcemia (in the setting of long-standing secondary hyperparathyroidism) (e.g. Renal Failure, Post-Renal Transplant)

Familial Hypocalciuria Hypercalcemia
- Autosomal Dominant Calcium Receptor Mutation (CaSR)
- Other Familial Hypercalcemias (e.g. MEN)

Corrected total serum calcium concentration (mmol/L) = measured total serum calcium concentration (mmol/L) + 0.02[40 g/L – albumin(g/L)]
Hypocalcemia

High Phosphate

**Hypocalcemia**
Total Corrected Serum Calcium < 2.10 mmol/L

<table>
<thead>
<tr>
<th>Low Phosphate</th>
<th>High Phosphate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Normal Creatinine</strong></td>
<td><strong>High Creatinine</strong></td>
</tr>
<tr>
<td>Low/Normal PTH</td>
<td>High PTH</td>
</tr>
<tr>
<td><em>Hypoparathyroidism (e.g. Acquired, Autoimmune, Idiopathic, Congenital, Infiltrative)</em></td>
<td><em>PTH Resistance (Pseudo-hypoparathyroidism)</em></td>
</tr>
<tr>
<td><em>Activating Mutation in Calcium Sensing Receptor (CaSR)</em></td>
<td><em>Calcium Complexing</em></td>
</tr>
<tr>
<td><em>Hypomagnesemia</em></td>
<td><em>(Citrate Infusion, Pancreatitis)</em></td>
</tr>
<tr>
<td></td>
<td><em>Low PTH</em></td>
</tr>
<tr>
<td><em>Hypoparathyroidism with Chronic Kidney Disease</em></td>
<td><em>High PTH</em></td>
</tr>
<tr>
<td><em>Secondary Hyperparathyroidism</em></td>
<td><em>Rhabdomyolysis</em></td>
</tr>
<tr>
<td><em>Phosphate Poisoning</em></td>
<td></td>
</tr>
</tbody>
</table>

Corrected total serum calcium concentration (mmol/L) = measured total serum calcium concentration (mmol/L) + 0.02[40 g/L – albumin(g/L)]
Hypocalcemia

Total Corrected Serum Calcium < 2.10 mmol/L

Low Phosphate

- Severe Malnutrition with Hypomagnesemia

Low/Normal PTH

High Phosphate

- Vitamin D Deficiency (e.g. Diet, Malabsorption, Phenytoin, Nephrotic Syndrome, Hepatobiliary Disease)
- Hereditary Vitamin D Resistance
- 1-α-Hydroxylase Deficiency

Corrected total serum calcium concentration (mmol/L) = measured total serum calcium concentration (mmol/L) + 0.02[40 g/L – albumin(g/L)]
Hypocalcemia
High / Low PTH

Hypocalcemia
Total Corrected Serum Calcium < 2.10 mmol/L

Low PTH
Hypoparathyroidism

- Congenital (Pediatric)
  - Ca-S-R
  - DiGeorge

- Acquired
  - Post-operative neck
  - Radiation
  - Infiltrative disease
  - Autoimmune polyendocrinopathy
  - Hypomagnesemia

High PTH

- 25-OH D very low
  - Malabsorption
  - Short gut
  - Gastric bypass
  - Liver disease
  - Increased Vit-D degradation (e.g. anti-convulsants)

- 25-OH D not very low
  - Chronic Renal Failure
  - Severe hyperphosphatemia (e.g. Tumor lysis syndrome, rhabdomyolysis, oral phosphate abuse/laxatives)

Corrected total serum calcium concentration (mmol/L) = measured total serum calcium concentration (mmol/L) + 0.02[40 g/L – albumin(g/L)]
Hyperglycemia

(> 6 mmol/L)

Diabetes Mellitus
- Impaired Glucose Tolerance
- Type 1 Diabetes
- Type 2 Diabetes
- Gestational Diabetes

Endocrinopathy
- Cushing’s Syndrome
- Acromegaly

Medications
- Corticosteroids
- Thiazide diuretics
- β agonists
- Others

Critical Illness/Physiologic Stress
- Stress Hyperglycemia (e.g. Trauma, Surgery, Burns, Sepsis)
- Shock
- Acute Pancreatitis
- Post-Stroke
- Post Myocardial Infarction

Signs/Symptoms of Hyperglycemia:
- Polyphagia, polydipsia, polyuria, blurred vision, fatigue and weight loss
Hypoglycemia

Hypoglycemia
(<4 mmol/L)

Fasting Hypoglycemia

- Excess Insulin
- Medications (e.g. Insulin, Secretagogues, β-Adrenergic Antagonists, Quinine, Salicylates, Pentamidine)
- Alcohol

Post-Prandial
(Reactive)

- Alimentary (e.g. in the setting of Gastric Surgery)
- Congenital Enzyme Deficiencies
- Idiopathic

Other Causes

- Critical Illness (e.g. Hepatic Failure, Renal Failure, Cardiac Failure)
- Sepsis
- Hypopituitarism
- Adrenal Insufficiency
- Hyperinsulinemic States (e.g. Glucagon, Catecholamine Deficiency, Insulinoma)
- Malnutrition/Anorexia Nervosa

Signs/Symptoms of Hypoglycemia:
- Neurogenic: irritability, tremor, anxiety, palpitations, tachycardia, sweating, pallor, paresthesias
- Neuroglycopenia: confusion, lethargy, abnormal behaviour, amnesia, weakness, blurred vision, seizures

⚠️ Potentially acutely life-threatening presentation

Endocrinology
Hyperphosphatemia

Hypermagnesemia

> 1.46 mmol/L

- Transcellular Shift
  - Rhabdomyolysis
  - Tumor Lysis
  - Metabolic or Respiratory Acidosis
  - Insulin Deficiency
- Decreased Excretion
  - FE$_{PO4}$ < 20%
- Increased Intake/Absorption
  - Hypervitaminosis D
  - Phosphate Supplementation
- Pseudo-hyperphosphatemia
  - Multiple Myeloma
  - Hyperbilirubinemia
  - Hemolysis
  - Hyperlipidemia
  - Tumor Lysis

Normally in Context of Impaired Renal Function
Hypophosphatemia

Hypophosphatemia (< 0.8 mmol/L)

Transcellular Shift

• Recovery From DKA
• Refeeding Syndrome
• Acute Respiratory Alkalosis
• Hypokalemia
• Hypomagnesemia
• Burns

Increased Excretion

• GI
  • Small bowel diarrhea
  • Enteric Fistula

• Renal
  • FePO₄ > 5%
  • Hyperparathyroidism
  • Vitamin D Deficiency/Resistance
  • Hypophosphatemic Rickets
  • Oncogenic Osteomalacia
  • Fanconi Syndrome
  • Osmotic Diuresis
  • Acute Volume Expansion
  • Acetazolamide and Thiazide Diuretics

Decreased Intake

• Dietary deficiency
  • Anorexia
  • Chronic Alcoholism

• Malabsorption
  • Aluminum/Magnesium Containing Antacids
  • Inflammatory Bowel Disease
  • Steatorrhea
  • Chronic Diarrhea

GI

Renal

FePO₄ > 5%
Hyperthyroidism

High/Normal Radioiodine Uptake

- Autoimmune Thyroid Disease
  - Grave’s Disease
  - Positive anti-TSH Receptor Antibody

- Autonomous Thyroid Tissue
  - Toxic Adenoma
  - Toxic Multinodular Goiter

- TSH/HCG Excess
  - TSH-Secreting Pituitary Adenoma
  - Gestational Trophoblastic Neoplasm

Low Radioiodine Uptake

- Subacute Thyroiditis
  - Granulomatous
  - Lymphocytic
  - Postpartum
  - Amiodarone
  - Radiation

- Exogenous/Ectopic Hormone
  - Excessive Thyroid Drug
  - Struma Ovarii
Hypothyroidism

Central Hypothyroidism

• Isolated TSH Deficiency
• Panhypopituitarism

Primary Hypothyroidism

Chronic

• Subacute Lymphocytic/Granulomatous
• Thyroiditis
• Post-Partum Thyroiditis
• Subtotal Thyroidectomy

Transient

Infiltrative Disease

• Fibrous Thyroiditis
• Hemosiderosis

Congenital Thyroid Agenesis/ Degensis

• Severe Iodine Deficiency

Medications

• Thionamides
• Lithium
• Amiodarone
• Interferon

Central Hypothyroidism

• Hashimoto’s Thyroiditis
Hyperuricemia

Primary

Over-production
- Increased turnover of nucleotides

Lymphoproliferative Disorders
- Acute lymphoblastic leukemia (ALL)
- Acute myeloid leukemia (AML)
- Chronic myeloid leukemia (CML)

Hemolytic Anemia
- See hemolysis scheme page 52

Others
- Psoriasis
- Chemotherapy
- Drug-induced
- High purine diet

Secondary

Under-excretion
- Lower uric acid clearance
- Starvation

Over-production
- Hyperparathyroidism
- Diabetic acidosis

Endocrine
- Chronic renal failure
- Sarcoidosis
- Hypercalcemia

Renal
- Drug-Induced
- Antiuricosuric drugs
- ACE inhibitors
- Cyclosporine
- Diuretics
- Organic acids
- Ethambutol
- Alcohol

Under-excretion
Male Sexual Dysfunction

Sexual Dysfunction

Establish Dysfunction in Context: Partner Showing Less Desire is not Necessarily Impaired
Global Dysfunction is likely Organic Cause
Situational Impairment Most Likely Psychological

Erectile Dysfunction

Psychological
- Performance Anxiety
- Lack of Sensate
- Focus
- Mood Disorder
- Anxiety Disorder
- Stress
- Guilt
- Interpersonal Issues

Physiological
- Anti-hypertensives
- Anti-depressants
- Diuretics
- Benzodiazepines
- Alcohol
- Sympathomimetic Drugs (e.g. Cocaine, Amphetamines)

Pharmacological
- Hypo-testosteronism
- Prolactinemia
- Hyper-estrogenism
- Hyperthyroidism
- Chronic Pain

Desire
Reduced/Absent

Psychological
- Mood Disorders
- Anxiety Disorders
- Guilt
- Stress
- Interpersonal Issues (e.g. Lack of trust in partner)
- Psychosis/Delusions
- Previous psycho-social trauma
- (e.g. Abuse)

Pharmacological
- Anti-depressants
- Narcotics
- Anti-psychotics
- Anti-androgens
- Alcohol
- Benzodiazepines
- Hallucinogens

Physiological
- Hypo-testosteronism
- Prolactinemia
- Hyper-estrogenism
- Hyperthyroidism
- Chronic Pain

Neurological
- Stroke
- Spinal Cord Injury
- Multiple Sclerosis
- Dementia
- Polyneuropathy

Physiological
- Hypo-testosteronism
- Prolactinemia
- Hypothyroidism
- Hyperthyroidism

Chronic Disease
- Diabetes
- Cardiovascular Disease
- Peyronie’s
- Connective Tissue Disease

Pelvis
- Trauma
- Pelvic Surgery
- Prostate Surgery
- Priapism
- Infection
- Bicycling

Other
- Hypertension
- Dyspareunia
- Dialysis

Endocrinology
Sellar / Pituitary Mass

Adenoma
Primarily Anterior Pituitary

Hyperplasia
•Physiological (e.g. Pregnancy)
•Compensation (e.g. Hypothyroidism)
•Stimulatory (e.g. Ectopic GNRH, CRH)

Non-Adenomatous

Inflammatory
•Infectious
•Autoimmune
•Giant Cell Granuloma
•Langerhan’s Cell
•Histiocytosis
•Sarcoidosis

Secreting
•Prolactin
•GH
•ACTH
•TSH
•LH/FSH
•Mixed

Non-Functioning
•Oncocytoma
•Null Cell Adenoma

Vascular
•Aneurysm
•Infarction

Hamartoma

Neoplasm
•Craniopharyngioma
•Meningioma
•Cyst
•Glioma
•Ependymoma

Metastatic
Sellar / Pituitary Mass

Size

- Small (<1cm) - Hypersecretion
- Large (>1cm) - Hypersecretion, Hyposcretion
- Other
Short Stature

<3rd Percentile
Detailed History, Physical Exam, and Mid-Parental Target Height

Pathological/Abnormal

Disproportionate
- Skeletal Dysplasias
- (e.g. Achondroplasia)
- Rickets

Proportionate

Normal Puberty Onset (BA=CA)
- Familial Short Stature

Delayed Puberty Onset (BA<CA)
- Constitutional Short Stature (Late Bloomer)

No Dysmorphic Features

Dysmorphic Features
- Trisomy 21
- Noonan Syndrome
- Prader-Willi Syndrome
- Russell-Silver Syndrome
- Turner Syndrome

Deprivation
- Primary Malnutrition
- Psychosocial
- Deprivation

Endocrine
- Cushing’s Disease
- GH Deficiency
- IGF-1 Deficiency (e.g. Laron Dwarfism)
- Hypothyroidism
- Congenital Adrenal Hyperplasia
- Panhypopituitarism

Treatment
- Glucocorticoids
- Radiation
- Chemotherapy
- Bone Marrow Transplant

Chronic Disease
- GI (e.g. Celiac, IBD)
- Renal (e.g. CRF)
- Infection (e.g. Chronic UTI)
- Cardiopulmonary (e.g. Cystic Fibrosis, CHF)
- Inborn Metabolism Error
- Immunologic

Other
- Intrauterine Growth Retardation
- Bulimia Nervosa
- Anorexia Nervosa
- CNS Tumors (e.g. Craniopharyngioma)
Tall Stature

> 97th Percentile
Detailed History, Physical Exam, and Mid-Parental Target Height

No Other Obvious Abnormalities/Stigmata

- Normal Growth (BA=CA)
  - Familial Tall Stature
  - XYY Syndrome

  - Non-Obese BMI
    - Early Puberty Onset
      - GH Excess
      - Hyperthyroidism

  - Precocious Puberty
    - Adrenal Tumor
    - Ovarian Tumor
    - Testotoxicosis
    - Congenital Adrenal Hyperplasia

- Accelerated Growth (BA>CA)
  - Obese BMI
    - Exogenous Obesity

  - Normal Puberty Onset
    - Constitutional
      - Constitutional Tall Stature (Early Bloomer)

Other Obvious Abnormalities/Stigmata

- Disproportionate
  - Klinefelter’s Syndrome (XXY)
  - Soto’s Syndrome/Cerebral Gigantism
  - Marfan’s Syndrome
  - Homocystinuria
  - Sex Steroid Deficiency/Resistance
  - Acromegaly (Rare in Children)

- Proportionate
  - Bechwith-Weidmann Syndrome (Normalizing growth after birth)
  - Weaver Syndrome
  - XYY Syndrome
  - Neurofibromatosis 1
  - Hyperthyroidism (Untreated/Severe)
Weight Gain / Obesity

Energy Related (Primary)

- Increased Intake
  - Sedentary Lifestyle
  - Smoking Cessation

- Decreased Expenditure

Secondary

- Neuroendocrine
  - Polycystic Ovarian Syndrome
  - Hypothyroid
  - Cushing’s Syndrome
  - Hypogonadism
  - GH Deficiency
  - Hypothalamic Obesity

- Genetic
  - Autosomal Dominant
  - Autosomal Recessive
  - X-Linked
  - Chromosomal Abnormality

Dietary
- Progressive
- Polyphagia
- High-Fat Diet

Social/Behavioural
- Socioeconomic
- Ethnicity
- Psychological

Iatrogenic
- Drugs/Hormones
- Tube Feeding
- Hypothalamic Surgery
Neurologic

Altered Level of Consciousness Approach 167
Altered Level of Consciousness GCS ≤ 7 ... 168
Aphasia Fluent ................................................................. 169
Aphasia Non-Fluent ...................................................... 170
Back Pain ................................................................. 171
Cognitive Impairment.............................................................. 172
Dizziness ................................................................. 173
Dysarthria .............................................................. 174
Falls in the Elderly ........................................................... 175
Gait Disturbance ........................................................... 176
Headache Primary ............................................................ 177
Headache Secondary, without Red Flag
  Symptoms ........................................................... 178
Hemiplegia ............................................................... 179
Mechanisms of Pain .......................................................... 180
Movement Disorder Hyperkinetic .......................... 181
Movement Disorder Tremor ........................................ 182
Movement Disorder Bradykinetic ...................................... 183
Peripheral Weakness ............................................................ 184
Peripheral Weakness Sensory Changes .......................... 185
Spell / Seizure Epileptic Seizure ................................. 186
Spell / Seizure Secondary Organic ...................................... 187
Spell / Seizure Other ............................................................ 188
Stroke Intracerebral Hemorrhage .................................... 189
Stroke Ischemia ............................................................. 190
Stroke Subarachnoid Hemorrhage ................................. 191
Syncope ................................................................. 192
Vertigo ................................................................. 193
Historical Editors
Dr. Darren Burback
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Altered Level of Consciousness

Approach

**Glasgow Coma Scale Score:**
- 12-15 = Investigate
- 8-12 = Urgent Investigation
- ≤ 7 = Resuscitate + Investigate
- Rapidly Deteriorating = Resuscitate + Investigate

**Clinical Exam**
- Focal
  - Trauma
  - Stroke
  - Tumor
  - Hemorrhage
  - See Imaging Section
- Non-Focal
  - Refer to Blood Work and Imaging Sections

**Blood Work**
- Metabolic Abnormality
  - Hypoxia
  - Hypercapnea
  - Hyper/HypoNa
  - Hyper/HypoCa
  - Hyper/HypoK
  - Sepsis
- No Metabolic Abnormality
  - Postictal
  - Concussion
  - Meningitis
  - Encephalitis

**Imaging**
- Structural Abnormality
  - Epidural Hemorrhage
  - Subdural Hemorrhage
  - Intracranial Hemorrhage
  - Ischemia
  - Tumor
- Non-Structural
  - Post-Ictal
  - Concussion
  - Encephalitis
Altered Level of Consciousness

GCS ≤ 7

Altered LOC GCS ≤ 7

Coma

Other
- Locked-in Syndrome
- Stupor
- Persistent Vegetative State

Brain Involvement

Focal Lesions
- Hemispheric
  - Hemorrhage
  - Traumatic
  - Ischemia/Infarction
- Neoplastic Abscess
- Skull fracture
- Subdural hematoma
- Intracranial Bleeding

Brain Stem
- Hemorrhage
- Traumatic
- Ischemia/Infarction
- Neoplastic Abscess
- Herniation
- Brain stem Lesion

Diffuse Lesions
- Vascular
  - Hypertensive encephalopathy
  - Vasculitis
  - TTP
  - DIC
  - Hypoxemia
  - Multiple emboli

Infection
- Meningitis
- Encephalitis

Other
- Trauma/Concussion
- Post-ictal

Systemic Involvement

Excesses
- Liver/Renal Failure
- Carbon Dioxide Narcosis
- Metabolic Acidosis
- Hypernatremia
- Hypercalcemia
- Hypermagnesemia
- Hyperthermia
- Thyroid Storm

Deficiencies
- Hypoxemia
- Hypoglycemia
- B12/Thiamine deficiency
- Hyponatremia
- Hypocalcemia
- Hypomagnesemia
- Hypothermia
- Myxedema Coma

Drugs/Toxins
- Alcohols
- Barbituates
- Tranquilizers
- Other

⚠️ Potentially acutely life-threatening presentation

*NB – must be direct or indirect bi-hemispheric involvement
Aphasia

Fluent

Fluent
Grammatically correct, but nonsensical, tangential. Phonemic & semantic paraphasias

Non-Fluent
Agrammatic, hesitant, but substantive communication

Impaired Repetition

Impaired Comprehension
• Wernicke’s Aphasia

Intact Comprehension
• Conduction Aphasia

Intact Repetition

Impaired Comprehension
• Transcortical Sensory Aphasia

Intact Comprehension
• Anomic Aphasia
Neurologic

Aphasia:

- Non-Fluent
  - Fluent
    - Grammatically correct, but nonsensical, tangential.
    - Phonemic & semantic paraphasias
  - Non-Fluent
    - Agrammatic, hesitant, but substantive communication

- Impaired Repetition
  - Impaired Comprehension
    - Global Aphasia
  - Intact Comprehension
    - Broca’s Aphasia

- Intact Repetition
  - Impaired Comprehension
    - Mixed Transcortical Aphasia
  - Intact Comprehension
    - Transcortical Motor Aphasia
Back Pain

Always assess for red flags. If no red flags, assess after 6 weeks

Acute/Subacute + Red Flags < 6 weeks

- Fracture
- Tumor/Infection
- Cauda Equina Syndrome

Chronic/Acute After 6 weeks + No Red Flags > 6 weeks

- Unresolved Radicular Symptoms
- Myelopathic
- Spondyloarthropathies or Osteoarthritis

Red Flags: bowel or bladder dysfunction, saddle paresthesia, constitutional symptoms, parasthesis, age >50, <18, IV drug use, neuromotor deficits, nocturnal pain, high energy trauma, past history of neoplasm
Cognitive Impairment

Dementia

Affecting Multiple Domains
- Depression
- Delirium

Decline in Instrumental Activities of Daily Living
- Amnestic Mild Cognitive Impairment
- Non-Amnestic Mild Cognitive Impairment

Subcortical Dementia

Treatable Cause
- Normal Pressure Hydrocephalus
- Chronic Meningitis
- Chronic Drug Abuse
- Tumor
- Subdural Hematoma
- B12 deficiency
- Hypothyroidism
- Hypoglycemia

Early Extrapyramidal Features
- Parkinson’s Disease with Dementia
- Huntington’s Disease

Rapidly Progressive
- Creutzfeldt-Jakob Disease
- Paraneoplastic disorder

Cortical Dementia

Early Language and Behavioral Dysfunction
- Fronto-temporal Dementia

Abrupt Onset, Stepwise Progression
- Vascular Dementia

Early Impairment of Recent Memory
- Alzheimer’s Dementia

Early Extrapyramidal Features
- Dementia with Lewy Bodies
Dizziness

Vertigo/Dizziness

True Vertigo
  Illusion of Rotary Movement

Dizziness
  Lightheaded, unsteady, disoriented

Organic Disease
  - Presyncope/Vasodepressor Syncope
  - Cardiac Arrhythmia
  - Orthostatic Hypotension
  - Hyperventilation
  - Anemia
  - Peripheral neuropathy
  - Visual Impairment
  - Musculoskeletal Problem
  - Drugs

Psychiatric Disease
  - Depression
  - Anxiety
  - Panic Disorder
  - Phobic Dizziness
  - Somatization
Dysarthria

Lower Motor Neuron
Slow, Low Volume, Breathy Speech
Tongue and Facial Atrophy
Fasciculations

- Motor Neuron Disease
- Lesions of Cranial Nerves VII, IX, X, XII
- Myasthenia Gravis
- Muscular Dystrophy

Upper Motor Neuron
Slow, strangulated, harsh voice
Positive jaw jerk, hyperactive gag reflex. Emotional lability

- Bilateral Lacunar Internal Capsule Strokes
- Multiple Sclerosis
- Amyotrophic Lateral Sclerosis

Ataxic (Cerebellar)
Irregular Rhythm and Pitch

- Spinal-Cerebellar Ataxia
- Multiple Sclerosis
- Alcohol
- Tumour
- Paraneoplastic Disorder

Extra-Pyramidal
Rapid, Low Volume, Monotone Speech

- Parkinson’s Disease
Falls in the Elderly

Fall

Normally is a combination of multiple factors

Intrinsic Factors

Presyncope/Syncope
- Cardiac
- Non-Cardiac

Sensory Impairments
- Vision
- Vestibular
- Neuropathy
- Proprioception

Neurological Psychiatric
- Stroke
- Parkinsonism
- Cognition
- Depression
- Other

Performance Measures
- Weakness
- Decreased Balance
- Gait Abnormalities

Musculoskeletal
- Arthritis

Extrinsic Factors

Drugs
- Polypharmacy – esp. >4 medications
- Psychotropics

Environment
- Rugs
- Stairs
- Lighting
Gait Disturbance

Movement Disorder

- Sensory Ataxia
  - Vestibular
  - Visual
  - Proprioceptive

Hereditary

- Cerebellar Ataxia
  - Progressive/ Degenerative
    - X-Linked/ Mitochondrial
      - Fragile X
    - Dominant
      - Spinocerebellar Ataxia
    - Recessive
      - Friedrich’s Ataxia
      - Telangiectasia

Sporadic

- Catalytic Deficiency (Childhood)
  - Intermittent
    - Hyperammonemia
    - Aminoaciduria
    - Pyruvate/Lactic Acid
  - Chronic Progressive
    - Tay-Sachs Disease
    - Niemann-Pick Disease

See Movement Disorder schemes
Headache

Primary

- Primary Headache
  - Usually episodic

  - No pattern
    - Unilateral
      - Migraine (Throbbing/Pulsating)
    - Bilateral
      - Tension/Stress Headache (Tightening, Band-Like, Dull)

  - Other
    - Autonomic Cephalgias
      - Last for minutes to hours. Separated by hours. Sudden onset.
        - Cluster Headache (Orbital, Sharp, Autonomic Dysfunction)
        - Hemicranial Continua
    - In Clusters
      - Other
        - Trigeminal Neuralgia (Shooting, stabbing)

Secondary
- Usually constant

- Last for seconds, separated by minutes to hours
Headache

Secondary, without Red Flag Symptoms

Primary
Usually episodic

With Red Flag Symptoms
Systemic symptoms, focal neurological signs, sudden onset, old age, progressive signs of increased intracranial pressure

Secondary
Usually constant

No Red Flag Symptoms

Acute
- Sinusitis
- Dental Abscess
- Glaucoma
- Traumatic Brain Injury
- Acute Mountain Sickness

Chronic
Drugs
- Analgesic Induced Headache
- Substance Withdrawal
Hemiplegia

**Upper Motor Neuron Weakness**

- Tone: Spastic with clasp-knife resistance
- Reflexes: Hyperactive +/- Clonus
- Pathological Reflexes: Babinski/Hoffman

**Cerebral Hemisphere**
- (Contralateral motor cortex)
  - Aphasia
  - Apraxia
  - Agnosia
  - Agraphia
  - Acalculia
  - Alexia
  - Anomia
  - Anosognosia
  - Asterognosia
  - Seizures
  - Personality Changes
  - Cognition/Confusion, Dementia
  - +/- Sensory Loss

**Contralateral/Sub-Cortical**
- (Corona radiata, Internal Capsule)
  - May be without sensory loss
  - May be combined with contralateral sensory loss

**Brain Stem**
- Diplopia
- Dysarthria
- Dysphagia
- Ptosis
- Decreased Level of Consciousness
- Cranial Nerve Palsies
- ‘Crossed’ Sensory Findings: ipsilateral facial and contralateral extremity findings

**Unilateral Spinal Cord Lesions Above ~C5**
- Brown-Sequard Syndrome (sensory loss to pain and temperature contralateral to weakness, vibration and proprioception loss ipsilateral to weakness)

**Pathological Reflexes**
- Babinski/Hoffman

**Contralateral/Sub-Cortical Lesions**
- (Corona radiata, Internal Capsule)
  - Ipsilateral facial and contralateral extremity findings

**Brown-Sequard Syndrome**
- Sensory loss to pain and temperature contralateral to weakness, vibration and proprioception loss ipsilateral to weakness
Mechanisms of Pain

Pain

Nociceptive
Tissue Damage

Visceral
(From organ/cavity lining)
Poorly localized, crampy, diffuse, deep sensation

Somatic

Deep
Less well-localized, dull, longer duration

Superficial
Well-localized, sharp, short duration

Central Nervous System
Deafferentation
Loss of sensory input

Peripheral Nervous System

Neuropathic
Burning, shooting, gnawing, aching, lancinating

• Post-Herpetic Neuralgia
• Neuroma
• Neuropathy

• Phantom Limb
• Post-stroke
• Spinal injury

Sympathetic
• Complex regional pain syndrome
Movement Disorder

Hyperkinetic

Hyperkinetic
Examples listed not exhaustive for all causes

Tics
• Tourette’s Syndrome
• Attention Deficit Hyperactivity Disorder
• Obsessive Compulsive Disorder

Dystonia
• Generalized dystonia
• Writer’s cramp
• Blepharospasm
• Cervical Dystonia

Stereotypies

Myoclonus
• Epilepsy
• Toxic/metabolic

Chorea
• Huntington’s Disease

Athetosis

Ballism

Tremor

Bradykinetic

Movement Disorder
Movement Disorder

Hyperkinetic

Action Tremor
Occurs During Voluntary Muscle Movement
- Cerebellar Disease (e.g. spinocerebellar ataxia, Vitamin E deficiency, stroke, multiple sclerosis)

Tremor

Resting Tremor
Occurs at Rest
- Parkinson’s Disease
- Midbrain Tremor
- Wilson’s Disease
- Progressive supranuclear palsy
- Multiple System Atrophy
- Drug-Induced Parkinsonism

Bradykinetic

Postural Tremor
Occurs While Held Motionless Against Gravity
- Enhanced Physiologic Change
- Essential tremor
- Dystonia
- Metabolic Etiology (Thyroid, Liver, Kidney)
- Drugs (Lithium, Amiodarone, Valproate)
Movement Disorder

Bradykinetic

Movement Disorder

- Hyperkinetic
- Tremor
- Bradykinetic

- Parkinson’s Disease (TRAP)
  - Resting Tremor
  - Cogwheel Rigidity
  - Akinesia/Bradykinesia
  - Postural Instability

- Drug-Induced Parkinsonism
  - Neuroleptics
  - Haloperidol
  - Metoclopramide
  - Prochlorperazine
  - Amiodarone
  - Verapamil

- Progressive Supranuclear Palsy
  - Characteristics:
    - Vertical Gaze Palsy
    - Axial rigidity > limb rigidity
    - +/- Tremor
    - Bradykinesia
    - Falling backwards

- Multiple System Atrophy
  - Characteristics:
    - Bradykinesia
    - +/- tremor
    - Cerebellar signs
    - Postural Hypotension
Peripheral Weakness

**Weakness**

**Objective Weakness**
- **Upper Motor Neuron**
  - Increased tone and reflexes
  - Babinski Reflex
- **Lower Motor Neuron**
  - Decreased tone and reflexes
  - No Babinski reflex
- **Upper and Lower Motor Neuron**
  - Amyotrophic Lateral Sclerosis
  - Cervical myeloradiculopathy
  - Syrinx

**No Objective Weakness**
- Cardio-pulmonary disease
- Anemia
- Chronic Infection
- Malignancy
- Depression
- Deconditioning
- Arthritis
- Fibromyalgia
- Endocrine Disease

**Sensory Changes**
- See **Peripheral Weakness: Sensory Changes scheme**

**No Sensory Changes**

**Motor Neuron and Motor Neuropathy**
- Atrophy, Fasciculations, Hyperreflexia
  - Lead toxicity
  - Progressive muscular atrophy
  - Hodgkin’s lymphoma
  - Polio
  - Multifocal Motor Neuropathy
  - Spinal Muscular Atrophy

**Neuromuscular Junction**
- Fatigability, Variability, Oculomotor
  - Myasthenia Gravis
  - Lambert-Eaton Myasthenic Syndrome
  - Botulism
  - Congenital

**Myopathy**
- Proximal muscle involvement, elevated CK
  - Polymyositis
  - Duchenne Muscular Dystrophy
  - Statin Toxicity
  - Dermatomyositis
  - Viral infection
Peripheral Weakness

Sensory Changes

Objective Lower Motor Neuron Weakness

Sensory Changes

No Sensory Changes

Follows Distribution

Does Not Follow Distribution

Radiculopathy
- Disc
- Spondylosis
- Tumor
- Infection

Mononeuropathy

Polyneuropathy (Length Dependent)
- Diabetes
- Nutrition
- Alcohol
- Toxins
- Paraproteinemic
- Inherited
- Inflammation

Compression
- Carpal Tunnel
- Ulnar
- Peroneal
- Radial

Other
- Trauma
- Tumor
- Ischemia

Mononeuritis Multiplex
- Vasculitis
- Diabetes
- Tumor

Plexopathy
- Brachial neuritis
- Diabetes
- Tumor

Poly-Radiculopathy
- Spondylosis
- Chronic
- Inflammatory
- Demyelinating
- Polyneuropathy
- Neoplasm
- Infection
Spell / Seizure

Epileptic Seizure

Unprovoked Recurrence
Epileptic Seizure

Focal Seizure

- Non-Dyscognitive
  Features of
  - Aura
  - Motor
  - Autonomic

Dyscognitive

Evolving to Bilateral Convulsive Seizure

Unclassified

Generalized

Provoked Recurrence
Non-epileptic organic seizure/other

Non-Convulsive
- Absence
- Atonic

Convulsive
- Myoclonic
- Clonic
- Tonic
- Tonic-Clonic

1 Previously named Simple Partial Seizure
2 Previously named Complex Partial Seizure
3 Previously named Secondary Generalized Tonic-Clonic Seizure
4 A focal seizure may evolve so rapidly to a bilateral convulsive seizure that no initial distinguishing features are apparent.

⚠️ Potentially acutely life-threatening presentation
Spell / Seizure
Secondary Organic

Unprovoked Recurrence (Primary)
Epileptic Seizure

Other

Febrile
- Sepsis
- Encephalitis
- Meningitis

Infection
- Hypoglycemia
- Hyperglycemia
- Hypercalcemia
- Hyponatremia
- Uremia
- Alcohol/drug withdrawal
- Drug overdose
- Liver Failure

Metabolic

Vascular
- Intracerebral hemorrhage
- Subarachnoid hemorrhage
- Subdural hemorrhage
- Epidural hemorrhage
- Ischemic stroke
- Vasculitides

Degenerative
- Dementia

Structural
- Congenital abnormality
- Neoplasm
- Arteriovenous malformation

Pregnancy
- Eclampsia

⚠️ Potentially acutely life-threatening presentation
Spell / Seizure

Unprovoked Recurrence (Primary)
Epileptic Seizure

Other

Neurological
- Migraine/Auras
- Movement disorders (Dystonia, Dyskinesia, Chorea)

Cardiovascular
- Syncope

Psychogenic
- Panic Disorder
- Conversion Disorder
- Pseudoseizures

Provoked Recurrence (Secondary)
Non-epileptic organic seizure/other

Other

⚠️ Potentially acutely life-threatening presentation
Stroke
Intracerebral Hemorrhage

- Hypertension
  - Essential Hypertension (Aneurysm)
  - Drugs (Cocaine, Amphetamines)

- Vessel Disease
  - Amyloid Angiopathy
  - Vascular Malformation
  - Aneurysm
  - Vasculitis

- Other
  - Trauma
  - Bleeding diathesis
  - Hemorrhage into tumors
  - Hemorrhage into infarct

⚠️ Potentially acutely life-threatening presentation
Stroke

Ischemia

Intracerebral Hemorrhage

Thrombosis
Atherosclerosis, Arterial Dissection, Fibromuscular Dysplasia

Large Vessel
- Lacunar

Small Vessel

Unknown

Heart
- Left Ventricle
- Left Atrium
- Valvular
- Atrial fibrillation
- Bacterial endocarditis
- Myocardial infarction

Ascending Aorta

Systemic Hypoperfusion

Pump Failure
- Cardiac arrest
- Arrhythmias

Cardiac Output Reduction
- Myocardial infarction
- Pulmonary embolus
- Pericardial effusion
- Shock

Potentially acutely life-threatening presentation

Neurologic
Stroke

Subarachnoid Hemorrhage

Stroke

Intracerebral Hemorrhage

Ischemia

Subarachnoid Hemorrhage

Vessel Disease

- Aneurysm
- Vascular Malformation

Other

- Bleeding Diathesis
- Trauma
- Drug Use

⚠️ Potentially acutely life-threatening presentation
Syncope

Cardiac

Arrhythmia
- Tachyarrhythmia
- Bradyarrhythmia
- Supraventricular Tachycardia
- Sick-Sinus Syndrome
- Second/Third Degree Atrioventricular Block

Outflow Obstruction
- Aortic Stenosis
- Hypertrophic Obstructive Cardiomyopathy
- Pulmonary Embolus
- Other

Non-Cardiac

Vasovagal/Autonomic
- Dehydration
- Hypovolemia
- Medications

Orthostatic

Central
- Emotional

Peripheral/Situational
- Bladder Emptying
- Pain
- Reduced Effective Arterial Blood Volume
- Carotid Sinus Syncope
- Tussive
- Defecation
Vertigo

Vertigo/Dizziness:
- Vertigo
  - Illusion of Rotary Movement
- Dizziness
  - Lightheaded, unsteady, disoriented

Central Vestibular Dysfunction
- Imbalance, neurologic symptoms/signs, bidirectional nystagmus

Peripheral Vestibular Dysfunction
- Nausea and vomiting, auditory symptoms, unidirectional nystagmus

True Vertigo
- Illusion of Rotary Movement

Dizziness
- Lightheaded, unsteady, disoriented

Infection
- Meningitis
- Cerebellar/Brainstem Abscess

Trauma
- Cerebellar Contusion

Space-Ocupying Lesion
- Infratentorial Tumors
- Cerebellopontine Angle Tumors
- Glomus Tumors

Vascular
- Vertebrobasilar Insufficiency
- Basilar Artery Migraine
- Transient Ischemic Attack
- Cerebellar/Brainstem Infarction
- Cerebellar Hemorrhage

Inflammatory
- Multiple sclerosis

Intoxication
- Barbiturates
- Ethanol

- Benign Paroxysmal Positional Vertigo
- Labrynthitis/Vestibular Neuronitis
- Menière’s Disease
- Acoustic Neuroma
- Ototoxicity (usually imbalance and oscillopsia)
- Otitis Media
- Temporal Bone Fracture
Obstetrical & Gynecological

Intrapartum Abnormal Fetal HR Tracing
  Variability & Decelerations............................197
Intrapartum Abnormal Fetal HR Tracing
  Baseline .......................................................... 198
Abnormal Genital Bleeding................................. 199
Acute Pelvic Pain..................................................200
Chronic Pelvic Pain...............................................201
Amenorrhea Primary............................................202
Amenorrhea Secondary........................................203
Antenatal Care....................................................204
Bleeding in Pregnancy < 20 Weeks .................205
Bleeding in Pregnancy 2nd & 3rd Trimester...
  ........................................................................206
Breast Disorder....................................................207
Growth Discrepancy Small for Gestational Age / Intrauterine Growth Restriction....208
Growth Discrepancy Large for Gestational Age..........................209
Infertility (Female).................................................210
Infertility (Male)....................................................211
Intrapartum Factors that May Affect Fetal Oxygenation........212
Pelvic Mass..........................................................213
Ovarian Mass........................................................214
Pelvic Organ Prolapse...........................................215
Post-Partum Fever...............................................216
Post-Partum Hemorrhage..................................217
Recurrent Pregnancy Loss.................................218
Vaginal Discharge................................................219
**Historical Editors**
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Intrapartum Abnormal Fetal HR Tracing

Variability & Decelerations

Abnormal Fetal Heart Rate Tracing

Abnormal Variability

- Minimal/Absent Variability
  - ≤ 5 bpm
  - Fetal sleep
  - Prematurity
  - Medications (analgesia, sedatives)
  - Hypoxic acidemia
  - Congenital anomalies

- Marked Variability
  - ≥ 25 bpm
  - Mild hypoxia

Baseline Abnormality

- Sinusoidal Pattern
  - Severe fetal anemia (Hgb < 70)
  - Tissue hypoxia in fetal brain stem

Decelerations

- Absent Accelerations
  - Hypoxic acidemia
  - Fetal abnormality

Early decelerations

- Fetal head compression (mirror contractions)

Variable decelerations

- Cord compression
- Fetal acidemia if complicated variable decelerations

Late decelerations

- Uteroplacental insufficiency
- Maternal hypotension
- Reduced maternal arterial oxygen saturation
- Hypertonic uterus
- Fetal acidemia

Prolonged deceleration

- Hypertonic uterus
- Unresolving umbilical cord compression
- Maternal hypotension
- Maternal seizure
- Rapid fetal descent
Intrapartum Abnormal Fetal HR Tracing

Abnormal Fetal Heart Rate Tracing

- Abnormal Variability
- Baseline Abnormality
- Decelerations

Bradycardia
- < 110 bpm
  - Maternal
    - Hypotension
    - Drug response
    - Maternal position
    - Connective tissue disease with congenital heart block (e.g. SLE)
  - Fetal
    - Umbilical cord occlusion
    - Fetal hypoxia/acidosis
    - Vagal stimulation (e.g. chronic head compression)
    - Fetal cardiac conduction or structural defect

Tachycardia
- > 160 bpm
  - Maternal
    - Fever
    - Infection
    - Dehydration
    - Hyperthyroidism
    - Endogenous adrenaline or anxiety
    - Drug response
    - Anemia
  - Fetal
    - Infection
    - Prolonged fetal activity or stimulation
    - Chronic hypoxemia
    - Cardiac abnormalities
    - Congenital anomalies
    - Anemia
Abnormal Genital Bleeding

Pregnant

Non Pregnant

Gynecologic

Non-Gynecologic

• Medical (e.g. coagulopathy, liver disease, renal disease)
  • Drugs

Uterus
  • Anovulatory
  • Atrophy
  • Fibroid
  • Polyp
  • Exogenous estrogen
  • Neoplasm
  • Infection
  • Endometrial Hyperplasia

Cervix
  • Polyp
  • Ectropion
  • Dysplasia
  • Neoplasm
  • Infection
  • Trauma

Vagina
  • Atrophy
  • Vulvovaginitis
  • Neoplasm
  • Infection
  • Trauma

Vulva
  • Vulvar dystrophy
  • Vulvar Atrophy
  • Vulvovaginitis
  • Neoplasm
  • Infection
  • Trauma

See Bleeding in Pregnancy Scheme
Acute Pelvic Pain

- **Gynecologic**
  - **Pregnant**
    - Extrauterine
      - Ectopic pregnancy**
    - Intrauterine
      - Placental abruption**
      - Spontaneous abortion
      - Labour
      - Molar pregnancy
  - Uterus
    - Fibroid
    - Endometriosis
    - Adenomyosis
    - Pyometrium
    - Hematometra
    - Congenital Anomaly
    - Dysmenorrhea
  - Ovary
    - Tubo-ovarian abscess**
    - Torsion**
    - Ovarian cyst
    - Endometriosis
    - Ovulation pain
  - Fallopian Tube
    - Tubo-ovarian abscess**
    - Pelvic inflammatory disease
    - Torsion
    - Endometriosis
    - Hydrosalpinx

- **Non-Gynecologic**
  - Genitourinary (Infection, Stone)
  - Gastrointestinal (Appendicitis, Gastroenteritis, Diverticulitis, IBD)
  - Musculoskeletal

**Obstetrical Emergencies**
Chronic Pelvic Pain

- Gynecologic
  - Endometriosis
  - Chronic pelvic inflammatory disease
  - Dysmenorrhea
  - Adenomyosis
  - Ovarian cyst
  - Adhesions

- Non-Gynecologic
  - Interstitial cystitis
  - Urinary retention
  - Neoplasm

- Co-morbidities
  - Somatization
  - Sexual/physical/psychological abuse
  - Depression/anxiety
  - Abdominal wall pain

- Gastrointestinal
  - Irritable bowel syndrome
  - Inflammatory bowel disease
  - Constipation
  - Neoplasm

- Genitourinary
  - Interstitial cystitis
  - Urinary retention
  - Neoplasm

- Musculoskeletal
  - Pelvic floor myalgia
  - Myofascial pain (trigger points)
  - Injury

> 6 months in duration
Amenorrhea

Primary

No onset of menarche by age 16 with secondary sexual characteristics
Or, No onset of menarche by age 14 without secondary sexual characteristics

Secondary

Absence of menses for 3 cycles or 6 months

Ovarian Etiology

High FSH
Low Estrogen

• 46, XX Gonadal Dysgenesis (e.g. Fragile X, Balanced Translocations, Turner’s mosaic)
• 46, XY Gonadal Dysgenesis (e.g. Swyer’s Syndrome)
• 45, XO Turner syndrome
• Savage syndrome (ovarian resistance)
• Premature Ovarian Failure (Autoimmune, Iatrogenic)

Receptor Abnormalities and Enzyme Deficiencies

Androgen insensitivity
5-α Reductase deficiency
17-α Hydroxylase deficiency
Vanishing Testes Syndrome
Absent Testes Determining Factor

Central

Low FSH
Low Estrogen

Hypothalamic

• Functional (e.g. eating disorder, weight loss, stress, excessive exercise, illness)
• Congenital GnRH deficiency (Kallmann syndrome)
• Constitutional delay of puberty

Pituitary

• Surgery
• Irradiation
• Tumor, Infiltration
• Hyperprolactinemia
• Hypothyroidism

Congenital Outflow Tract Anomalies

• Imperforate hymen
• Transverse vaginal septum
• Vaginal agenesis (Mayer-Rokitansky-Küster-Hauser syndrome)
• Cervical stenosis
Amenorrhea

Secondary

- Absence of menses for more than 3 cycles or 6 months in women who were previously menstruating
- Rule out pregnancy (β-hCG)

Primary
- No onset of menarche by age 16

Ovarian
- Normal FSH
  - Polycystic ovarian syndrome (positive progesterone challenge, normal prolactin, chaotic menstruation history)
- High FSH
  - Menopause
  - Premature ovarian failure (<35 years old, e.g. autoimmune, chromosomal, iatrogenic)

Hypothalamic
- Negative progesterone challenge, Low FSH, Low estrogen
- Functional (e.g. eating disorder, weight loss, stress, excessive exercise, illness)
- Infiltrative lesions (e.g. lymphoma, Langerhans cell histiocytosis, sarcoidosis)

Pituitary
- High Prolactin
  - Pituitary Adenoma
  - Prolactinoma
  - Chest wall irritation
  - Hypothalamic-Pituitary Stalk Damage (e.g. Tumors, trauma, compression)
  - Hypothyroidism

Outflow Tract Obstruction
- Asherman’s syndrome
- Cervical stenosis

Other
- Sheehan’s Syndrome
- Radiation
- Infection
- Infiltrative Lesions; hemochromatosis
Antenatal Care

At Every Visit
Weight, Blood pressure, Psychosocial screening, Counseling re. Indications to go to hospital

First Trimester
(0-12 weeks)
- Detailed history and physical exam
- Estimated date of delivery
- Dating ultrasound
- Prenatal labs (CBC, ABO/Rh type & screen, Antibody screen, HBsAg, Syphilis serology, Rubella IgG, Varicella, HIV)
- Chlamydia/Gonorrhea screen
- Urine culture & sensitivity

Second Trimester
(12-28 weeks)
- Fetal heart rate tones (starting at 12 weeks)
- Prenatal genetic screening
  - First trimester screen (nuchal translucency, β-hCG, PAPP-A; 11-14 weeks)
  - Maternal serum screen (AFP, uE3, β-hCG; 15-22 weeks)
- ± Prenatal diagnosis
  - Chorionic villus sampling (11-13 weeks)
  - Amniocentesis (15-17 weeks)
- Detailed 18-20 week Ultrasound (dating, number of fetuses, placental location, anatomic survey)
- Gestational diabetic screen (50g oral glucose challenge; 24-28 weeks)
- Rh antibody screen and Rh immunoglobulin if indicated

Third Trimester
(28-40 weeks)
- Fetal surveillance
  - Fetal movement counts (>6 movements in 2 hours)
  - Symphysis fundal height
  - Leopold maneuvers
- Group B Streptococcus screen (35-37 weeks)
- ± Ultrasound for growth, presentation, biophysical profile
- ± Non-stress test
Bleeding in Pregnancy

< 20 Weeks

Hemodynamically Unstable – Do ABCDEs

< 20 Weeks

Bleeding from the Os

Second / Third Trimester

Not Bleeding from the Os

• Cervical polyp/Ectropion
• Cervical/Vaginal neoplasm
• Vaginal laceration
• Infection

Cervix Open

Passing Tissue and Clots
• Complete abortion
• Incomplete abortion
• Ectopic pregnancy

Not Passing Tissue and Clots
• Missed abortion
• Inevitable abortion
• Cervical insufficiency

Cervix Closed

IUP on Transvaginal U/S

Ectopic Pregnancy on U/S
• β-hCG < 1500
• β-hCG doubled in 72h
  Viable pregnancy – monitor for ectopic or IUP (implantation bleed)

No IUP on Transvaginal U/S

No Ectopic Pregnancy on U/S
• β -hCG > 1500
  Ectopic likely

β-hCG not doubled in 72h
  Ectopic pregnancy or failed pregnancy

β-hCG

Viable pregnancy – monitor for ectopic or IUP (implantation bleed)
Bleeding in Pregnancy

Hemodynamically Unstable – Do ABCDEs

< 20 Weeks

Bleeding from the Os

Painful

• Placental abruption
• Uterine rupture
• Labour (bloody show)

Second / Third Trimester

Do NOT perform digital examination until the placental location is known

Not Bleeding from the Os

Painless

• Placenta previa
• Vasa previa

Cervical polyp/Ectropion
• Cervical/Vaginal neoplasm
• Vaginal laceration
• Infection
Breast Disorder

Breast Disorders

Breast Infection
- Lactational
  - Mastitis
  - Abscess
- Non Lactational
  - Subareolar abscess
  - Acute mastitis

Breast Mass
- Malignant
- Benign

Gynecomastia
- Physiologic
  - Newborn
  - Adolescence
  - Aging
- Pathologic
  - Drugs
  - Decreased testosterone
  - Increased estrogen
  - Idiopathic

Non-Invasive
- Ductal carcinoma
  - In situ
- Lobular carcinoma
  - In situ

Invasive
- Ductal carcinoma
- Lobular carcinoma
- Tubular carcinoma
- Medullary carcinoma
- Papillary carcinoma
- Mucinous carcinoma

Solid
- Fibroadenoma

Cystic
- Gross cyst
- Galactocele
- Fibrocystic
Growth Discrepancy

Small for Gestational Age / Intrauterine Growth Restriction

- **Large for Gestational Age** (Growth > 90th percentile for GA)
- **Small for Gestational Age** (Growth < 10th percentile for GA)

**Maternal Factors**
- TORCH Infections
- Placental Ischemia/Infarction
  - Placenta previa
  - Chronic insufficiency

**Fetal Factors**
- Multiple Gestation
- Placental Abruption

**Placental Factors**
- Chromosomal Abnormalities
  - Trisomy 13, 18, 21
  - Turner syndrome, 45X
- Placental Malformations
- Confined Placental Mosaicism (Rare)
  - Vasa previa

**Decreased Utero-placental Flow**
- Gestational hypertension/Pre-eclampsia
- Renal insufficiency
- Diabetes mellitus
- Autoimmune disorders

**Maternal Lifestyle**
- Malnutrition
- Smoking
- Alcohol
- Drugs

**Maternal Hypoxemia**
- Pulmonary diseases
- Chronic anemia
- High altitude

**Iatrogenic**
- Folic acid antagonists
- Anti-convulsants
Growth Discrepancy
Large for Gestational Age

**Large for Gestational Age**
(Growth > 90th percentile for GA)

- Maternal Factors
  - Multiparity
  - Previous history of large for gestational age fetus
  - Aboriginal, Hispanic, and Caucasian races
  - Maternal co-morbidities (e.g. diabetes, obesity)
  - Excessive weight gain over course of pregnancy (>40 lbs)

**Fetal factors**
- Male infant
- Prolonged gestation (>41 weeks)
- Genetic disorder (e.g. Sotos syndrome, Beckwith-Wiedemann syndrome, Weaver’s syndrome)

**MATERNAL COMPLICATIONS**
- Prolonged labour
- Operative vaginal delivery
- Caesarean section
- Genital tract lacerations
- Post-partum hemorrhage
- Uterine rupture

**FETAL COMPLICATIONS**
- Shoulder dystocia
- Birth injury (brachial plexus injury, clavicular fracture)
- Cerebral palsy secondary to hypoxia
- Hypoglycemia
- Polycythemia
- Perinatal asphyxia
- Hyperbilirubinemia
Infertility (Female)

Failure to conceive following > 1 year of unprotected sexual intercourse

- Male (35%)
- Unexplained (15%)
- Female (50%)

Uterus
HSG or SHG or hysteroscopy
- Fibroids/polyps
- Asherman’s syndrome
- Congenital anomalies
- Adenomyosis
- Unfavourable cervical mucous
- Cervical stenosis

Fallopian Tube
HSG or SHG or laparoscopy
- Pelvic inflammatory disease
- Endometriosis
- Adhesions
- Previous tubal pregnancy
- Congenital Anomalies

Ovary
Ovulation confirmation: mid-luteal serum progesterone
Ovarian reserve: Day 3 FSH +/- Estradiol

- Decreased FSH
- Normal FSH
- Increased FSH

- Hypothalamic
- Hypopituitarism

Decreased FSH
- Polycystic ovarian syndrome
- Obesity

Normal FSH
- Hypothyroidism
- Hyperprolactinemia
- Tumors (e.g. Prolactinoma)

Increased FSH
- Premature ovarian failure
- Premenopausal changes
- Turner’s syndrome

Weight loss/malnutrition
Excessive exercise
Stress/psychosis
Systemic disease
Factors affecting fetal oxygenation

**Uteroplacental Factors**
- Excessive Uterine Activity
  - Hyperstimulation
  - Placental abruption
- Uteroplacental Dysfunction
  - Placental abruption
  - Placental infarction
  - Chorioamnionitis
  - Post-dates pregnancy

**Maternal Factors**
- Cord Compression
  - Oligohydramnios
  - Cord prolapse
  - Cord entanglement
- Decreased Fetal O₂ Carrying Capacity
  - Fetal anemia
  - Carboxyhemoglobin
  - Intrauterine growth restriction
  - Prematurity
  - Fetal sepsis

**Fetal Factors**
- Decreased Maternal Arterial O₂ Tension
  - Smoking
  - Hypoventilation
  - Respiratory disease
  - Seizure
  - Trauma
- Decreased Maternal O₂ Carrying Capacity
  - Maternal anemia
  - Carboxyhemoglobin
- Decreased Uterine Blood Flow
  - Hypotension
  - Anesthesia
  - Maternal positioning
- Maternal Medical Conditions
  - Fever
  - Vasculopathy (SLE, Type 1 diabetes mellitus, HTN)
  - Hyperthyroidism
  - Antiphospholipid syndrome
Pelvic Mass

Do Pelvic U/S

Gynecologic

Non-Pregnant

Uterus
- Fibroid
- Adenomyosis
- Neoplasm
- Pyometra
- Hematometra

Fallopian Tube
- Tubo-ovarian abscess
- Paratubal cyst
- Neoplasm
- Pyosalpinx
- Hydrosalpinx

Ovary
- Intrauterine pregnancy
- Tubal ectopic pregnancy
- Ovarian ectopic pregnancy

See Ovarian Mass scheme

Non-Gynecologic

Gastrointestinal
- Appendiceal abscess
- Diverticular abscess
- Diverticulosis
- Rectal/Colon cancer

Genitourinary
- Distended bladder
- Bladder cancer
- Pelvic kidney
- Peritoneal Cyst

Pregnant

Uterus

Fallopian Tube

Ovary
Ovarian Mass

Benign Neoplasms

Hyperplastic
- Polycystic ovary
- Endometrioid cyst

Functional
- Follicular cyst
- Corpus lutein cyst
- Theca lutein cyst

Malignant Neoplasms

Epithelial
- Serous cystadenoma
- Mucinous cystadenoma

Germ Cell
- Mature teratoma (may be cystic)
- Gonadoblastoma (can become malignant)

Sex Cord Stromal
- Fibroma
- Thecoma
- Granulosa cell tumor

Epithelial
- Serous cystadenocarcinoma
- Mucinous cystadenocarcinoma
- Endometrioid
- Clear Cell

Germ Cell
- Dysgerminoma
- Immature teratoma
- Yolk Sac

Sex Cord Stromal
- Granulosa cell tumor
- Sertoli Cell
- Sertoli-Leydig

Metastases
- Krukenberg tumor (gastrointestinal metastasis)
- Breast
Pelvic Organ Prolapse

Herniation of one or more pelvic organs
Risk factors: genetics, multiparity, operative vaginal delivery, obesity, increasing age, estrogen deficiency, pelvic floor neurogenic damage (i.e. surgical), strenuous activity (i.e. weight bearing)

- Uterus
  Sensation of object “falling out of vagina,” possible lower back pain
  - Uterine prolapse
  - Cervical prolapse

- Vaginal Apex
  Pelvic pressure, urinary retention, stress incontinence
  - Vaginal vault prolapse

- Bladder
  Slow urinary stream, stress incontinence, bladder neck hypermobility
  - Cystocele (anterior prolapse)
  - Cystourethrocele

- Bowel/Rectum
  Defecatory symptoms
  - Enterocele
  - Rectocele (posterior prolapse)
Post-Partum Fever

6 W's for Causes of PPF
Wind: pneumonia, atelectasis
Water: UTI
"Woobies": mastitis
Womb
Wound: cellulitis, vulvas incision, endomyometritis
Walking: DVT

Post-Partum Fever (Puerperal)

<6 Weeks Post-Partum

Infectious

Non-Infectious

Respiratory

Uterine

Thrombotic

Respiratory

Uterine

Breasts

Urinary

Wound

• Pneumonia

• Endometritis
• Retained Products of Conception

• Mastitis
• Abscess

• UTI
• Pyelonephritis

• Cesarean Incision
• Vaginal Laceration
• Episiotomy
• Abscess/Hematoma

• Atelectasis
• PE

• DVT
• Septic Pelvic Thrombophlebitis
Post-Partum Hemorrhage

Blood Loss: >500mL post vaginal delivery
OR >1000mL post Caesarean section

Uterine Atony (70%)
- Uterine fatigue (e.g. prolonged/induced labor, rapid labor, grand multiparity)
- Overdistension of uterus (e.g. multiple gestation, polyhydramnios, fetal macrosomia)
- Bladder distension
- Uterine infection (e.g. chorioamnionitis)
- Functional/anatomic distortion of uterus
- Drugs – Uterine relaxants (e.g. nifedipine, magnesium sulfate, NSAIDs)

Trauma (20%)
- Perineal laceration (e.g. episiotomy)
- Vaginal laceration/hematoma
- Cervical laceration (e.g. forceps/vacuum delivery)
- Uterine rupture
- Uterine inversion

Remnant Tissue (10%)
- Retained blood clots
- Retained cotyledon or succenturiate lobe
- Abnormal placentation (placenta accreta, increta, or percreta)

Thrombin (1%)
- Thrombocytopenia
- Idiopathic thrombocytopenic purpura (ITP)
- Thrombotic thrombocytopenic purpura (TTP)
- HELLP syndrome
- Disseminated intravascular coagulation (DIC)
- Anti-coagulation agents (e.g. heparin)
- Pre-existing coagulopathy (e.g. von Willebrand's disease, Hemophilia A)
Recurrent Pregnancy Loss

Post-Partum Hemorrhage

Blood Loss: >500mL post vaginal delivery OR >1000mL post Caesarean section

Uterine Atony (70%)
- Uterine fatigue (e.g. prolonged/induced labor, rapid labor, grand multiparity)
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- HELLP syndrome
- Disseminated intravascular coagulation (DIC)
- Anti-coagulation agents (e.g. heparin)
- Pre-existing coagulopathy (e.g. von Willebrand’s disease, Hemophilia A)
Vaginal Discharge

Infectious

Inflammatory

Neoplastic

Sexually Transmitted Infection

- Chlamydia trachomatis
- Neisseria gonorrhoeae

Toxic Shock Syndrome

- Chemical irritant
- Douching
- Atrophic vaginitis
- Foreign body
- Lichen planus

Systemic

- Crohn’s disease
- Collagen vascular disease
- Dermatologic

Local

- Vulvovaginal candidiasis
- Bacterial vaginosis
- Trichomonas vaginalis

Vulvovaginitis

- Endometrium
- Cervix
- Vulva
- Vagina
Dermatologic

Burns .................................................................225
Dermatoses in Pregnancy Physiologic
   Changes ........................................................................226
Dermatoses in Pregnancy Specific Skin
   Conditions ......................................................................227
Disorders of Pigmentations
   Hyperpigmentation ..............................................228
Disorders of Pigmentations
   Hypopigmentation .............................................229
Genital Lesion ..........................................................230
Hair Loss (Alopecia) Diffuse .................................231
Hair Loss (Alopecia) Localized ............................232
Morphology of Skin Lesions Primary Skin
   Lesions .................................................................233
Morphology of Skin Lesions Secondary Skin
   Lesions ......................................................................234
Mucous Membrane Disorder Oral Cavity .........235
Nail Disorders Primary Dermatologic Disease
   .............................................................................236
Nail Disorders Systemic Disease ......................237
Nail Disorders Systemic Disease - Clubbing
   .............................................................................238
Pruritus No Primary Skin Lesion .....................239
Pruritus Primary Skin Lesion ............................240
Skin Rash Eczematous ........................................241
Skin Rash Papulosquamous ..............................242
Skin Rash Pustular ...............................................243
Skin Rash Reactive ..............................................244
Skin Rash Vesiculobullous .................. 245
Skin Ulcer by Etiology ...................... 246
Skin Ulcer by Location Genitals .......... 247
Skin Ulcer by Location Head & Neck ... 248
Skin Ulcer by Location Lower Legs / Feet ........................................ 249
Skin Ulcer by Location Oral Ulcers ...... 250
Skin Ulcer by Location Trunk / Sacral Region ....................................... 251
Vascular Lesions ................................. 252

Submaxillary triangle
Hyoid bone
Thyroid cartilage
Cricoid cartilage
Historical Editors
Danny Guo
Rachel Lim
Dave Campbell
Joanna Deboz
Safiya Karim
Beata Komierowski
Natalia Liston
Arjun Rash
Jennifer Rodrigues
Sarah Surette
Yang Zhan

Student Editors
Noelle Wong (Co-editor)
Heena Singh (Co-editor)

Faculty Editor
Dr. Laurie Parsons
Burns

- Thermal Burn
- Cold Burn
- Electrical Burn
- Sun Burn

Physical Agents

- Acid
- Alkali
- Oxidants (Bleaches, peroxides, chromates, manganates)
- Vesicants (sulfur and nitrogen, mustards, arsenicals, phosgene oxime)
- Others (white phosphorus, metals, persulfates, sodium azide)

Chemical Agents

Parkland formula for fluid resuscitation:

\[ 4 \text{cc} \times \text{Weight (kg)} \times \% \text{TBSA burn} \]
Dermatoses in Pregnancy

Physiologic Changes

Dermatoses in Pregnancy

Physiologic Skin Changes

Pigmented

Face
- Melasma

Abdomen
- Linea Nigra

Hormone induced
- Hyperpigmentation of areolae, axillae & genitalia
  - Increase in mole size & number (probable)

Specific Skin Conditions

Other

- Striae Distensae (striae gravidarum)
- Distal Onycholysis
- Subungual Keratosis
- Hyperhidrosis
- Miliaria
- Dyshidrotic Eczema
- Hirsutism (face, limbs, and back)

Vascular

- Palmar erythema
- Spider Nevi
- Cherry Hemangioma (Campbell de Morgan spot)
- Pyogenic granuloma

Mucous Membranes

- Chadwick's sign (bluish discoloration of cervix/vagina/vulva)
Dermatoses in Pregnancy

Specific Skin Conditions

Physiologic Skin Changes

Non-Pruritic

• Pustular psoriasis of pregnancy
• Impetigo Herpetiformis

Non-Primary Skin Lesion

• Intrahepatic cholestasis of pregnancy (pruritis worse at night, 3rd trimester)

Specific Skin Conditions

Pruritic

Primary Skin Lesion

• Pemphigoid gestationis
• Pruritic urticarial plaques & papules of pregnancy (PUPPP)
Disorders of Pigmentations

Hyperpigmentation

Disorder of Pigmentation

Hypopigmentation

Hyperpigmentation

Diffuse

Localized
Discrete Areas

Hypopigmentation

• Tanning
• Adverse cutaneous drug eruption
• Addison’s disease
• Hemochromatosis
• Porphyria cutanea tarda

Congenital

Acquired

• Café au lait macules (neurofibromatosis or McCune Albright syndrome)
• Congenital melanocytic nevi

• Freckles (ephelides)
• Lentigines
• Melasma
• Tinea versicolor (more commonly hypopigmented)
• Post-Inflammatory hyperpigmentation
Disorders of Pigmentation

Hypopigmentation

- Localized
  - Congenital
    - Tuberous sclerosis (white “ash leaf” macules)
  - Acquired
    - Tinea versicolor (can also be hyperpigmented)
    - Pityriasis alba

- Diffuse
  - Congenital
    - Generalized hypopigmentation of hair, eyes, skin
  - Acquired
    - Vitiligo
    - Post-Inflammatory hypopigmentation

Hyperpigmentation

- Localized
- Diffuse

Acquired

- Phenylketonuria
- Albinism
- Piebaldism
- Vitiligo

Congenital
Genital Lesion

Elevated

Vesicles
- Herpes simplex

Papules/Plaques

Infectious
- Molluscum contagiosum
- Human papilloma virus warts (condyloma acuminata)
- Secondary Syphilis (condyloma lata)
- Reiter’s syndrome (circinate balanitis)

Non-Infectious

Inflammatory
- Lichen planus
- Psoriasis

Depressed

Erosions/Ulcers
- Herpes simplex
- *Haemophilus ducreyi* (chancroid)
- Behçet’s syndrome
- Pemphigus vulgaris
- Lichen Sclerosis
- Erosive Lichen Planus

Excoriations
- Scabies
- Pubic lice

Non-Infectious
- Squamous cell carcinoma (can be in situ)
- Melanoma
Hair Loss (Alopecia)

Diffuse

- Localized (focal)
  - Scarring
    - Irreversible-biopsy required
      - Lupus erythematosus
      - Lichen planopilaris
  - Pattern
    - Androgenetic alopecia
  - Anagen Effluvium
    - Chemotherapy
    - Loose anagen syndrome
  - Telogen Effluvium
    - Alopecia totalis (all scalp and facial hair)
    - Alopecia universalis (all body hair)

- Non-Scarring
  - Reversible
  - Discrete Patches
    - Alopecia totalis (all scalp and facial hair)
    - Alopecia universalis (all body hair)

- Endocrine
  - Hypothyroidism
  - Hyperthyroidism
  - Hypopituitarism
  - Post-Partum

- Dietary
  - Iron deficiency
  - Zinc deficiency
  - Copper deficiency
  - Vitamin A Excess

- Drugs
  - Oral contraceptives
  - Hyperthyroid drugs
  - Anticoagulants
  - Lithium

- Stress Related
  - Post-infectious
  - Post-operative
  - Psychological stress
Hair Loss (Alopecia)

Localized

- Localized (focal)
  - Scarring
    - Irreversible - biopsy required
  - Non-Scarring
    - Reversible
      - Infectious
        - Tinea capitis with kerion
        - Folliculitis decalvans
      - Secondary to Skin Disease
        - Discoid lupus erythematosus
        - Lichen planopilaris
        - Pseudopelade of Brocq
        - Alopecia Mucinosa
        - Keratosis Follicularis
        - Aplasia cutis
      - Broken Hair Shafts
        - Tinea capitis
        - Trichotillomania
        - Traction alopecia
        - Congenital hair shaft abnormalities
      - Hair Shafts Intact or Absent
        - Alopecia areata
        - Secondary syphilis
Morphology of Skin Lesions

Primary Skin Lesions

Skin Lesion

Primary Skin Lesion
- Initial lesion not altered by trauma, manipulation (rubbing, scratching), complication (infection), or natural regression over time.

Flat
- Macule (≤ 1 cm diameter)
- Patch (> 1 cm diameter)

Solid
- No Deep Component
  - Papule (≤ 1 cm diameter)
  - Plaque (> 1 cm diameter)
  - Firm/Edematous

Fluid-Filled OR Semi-Solid-Filled
- Deep Component
  - Nodule (1-3 cm diameter)
  - Tumor (> 3 cm diameter)
  - Transient/Itchy

Secondary Skin Lesion
- Lesion that develops from trauma, manipulation (rubbing, scratching), complication (infection) of initial lesion, or develops naturally over time

Elevated
- Fluid-Filled
  - Purulent
    - Pustule
  - Non-Purulent Fluid
    - Vesicle (≤ 1 cm diameter)
    - Bulla (> 1 cm diameter)

- Wheals/Hives

Wheals/Hives
Morphology of Skin Lesions

Secondary Skin Lesions

Skin Lesion

Primary Skin Lesion
Initial lesion not altered by trauma, manipulation (rubbing, scratching), complication (infection), or natural regression over time.

Secondary Skin Lesion
Lesion that develops from trauma, manipulation (rubbing, scratching), complication (infection) of initial lesion, or develops naturally over time.

Elevated
- Crust/Scab (dried serum, blood, or pus overlying the lesion)
- Scale (dry, thin or thick flakes of skin overlying the lesion)
- Lichenification (thickened skin with accentuation of normal skin lines)
- Hypertrophic Scar (within boundary of injury)
- Keloid Scar (extend beyond boundary of injury)

Depressed
- Atrophic Scar (fibrotic replacement of tissue at site of injury)
- Ulcer (complete loss of epidermis extending into dermis or deeper; heals with scar)
- Erosion (partial loss of epidermis only; heals without scar)
- Fissure (linear slit-like cleavage of skin)
- Excoriation/Scratch (linear erosion induced by scratching)
Mucous Membrane Disorder

Oral Cavity

Primary Dermatologic Diseases
- Aphthous Stomatitis (recurrent, punched out ulcers, often preceded by trauma/emotional stress)
- Herpetic gingivostomatitis
- Pemphigus vulgaris
- Bullous pemphigoid
- Erythema multiforme
- Stevens-Johnson Syndrome
- Toxic epidermal necrolysis

Systemic Disease
- Systemic lupus erythematosus
- Inflammatory bowel disease (ulcerative colitis more than Crohn’s disease)
- Behçet’s syndrome

Erosions/Ulcers/Blisters

White Lesions

Non-neoplastic
- Candidiasis
  White/cottage cheese like plaques/scrape off easily

Neoplastic
- Leukoplakia
- Squamous cell carcinoma
- Lichen Planus
  Reticular (lace-like) white lines & papules
Nail Disorders
Primary Dermatologic Disease

Nail Disorder

Primary Dermatologic Disease

Nail Plate Abnormality

Discolouration

Pitting

Thickening

Onycholysis

Systemic Disease

Nail Fold Abnormality

Inflammation

Telangiectasia

• Erythema, Swelling, Pain

• SLE
• Scleroderma
• Dermatomyositis

Discolouration

• Psoriasis
• Alopecia Areata

Pitting

• Psoriasis
• Onychomycosis
• Onychogryphosis

Thickening

• Psoriasis
• Onychomycosis

Onycholysis

• Psoriasis
• Onychomycosis

Telangiectasia

• White/Yellow-Brown
• Onychomycosis

Fungal Culture

• Green
• Pseudomonas infection

Oil Drop Sign

Brown/Black

• Linear Streak
• Junctional/Melanocytic Nevus
• Malignant Melanoma Under Nails
• Drug-Induced

Proximal & Lateral

• Acute Trauma/Infection
• Acute Paronychia

Chronic

• Chronic Paronychia

Lateral Only

• Ingrown Nail

Discolouration

• White/Yellow-Brown

Fungal Culture

• Green
• Pseudomonas infection

Oil Drop Sign

• Psoriasis

Fungal Culture

• White/Yellow-Brown

Onychomycosis

• Psoriasis
• Onychomycosis

Psoriasis

• Alopecia Areata

Alopecia Areata

• Psoriasis

Onychomycosis

• Psoriasis

Onychogryphosis

Psoriasis

• Alopecia Areata
Nail Disorders
Systemic Disease

Nail Disorder

Primary Dermatologic Disease

Nail Plate Abnormality

Koilonychia
Spoon-Shaped
• Iron deficiency anemia

Onycholysis
Plate Separating from Bed
• Hyperthyroidism

Beau’s Lines
Horizontal Grooves
• Any systemic disease severe enough to transiently halt nail growth (e.g., shock, malnutrition)

Clubbing

Nail Fold Abnormality

Blue Discoloration
• Medications
• Wilson’s disease
• Silver poisoning
• Cyanosis

White Discoloration

Red Discoloration
Splinter hemorrhages (dark red, thin lines, usually painful)
• Bacterial endocarditis
• Trauma

Nail Bed Abnormality

Terry’s Nails
Proximal 90%
• Liver cirrhosis
• Congestive heart failure
• Diabetes Mellitus

Half-and-Half Nails
50%
• Chronic renal failure
• Uremia

Muehrcke’s Lines
Transverse lines
• Nephrotic syndrome

SLE
• Scleroderma
• Dermatomyositis

Medications
• Wilson’s disease
• Silver poisoning
• Cyanosis

Iron deficiency anemia

Hyperthyroidism

Any systemic disease severe enough to transiently halt nail growth (e.g., shock, malnutrition)

Liver cirrhosis

Congestive heart failure

Diabetes Mellitus

Chronic renal failure

Uremia

Nephrotic syndrome
Nail Disorders
Systemic Disease - Clubbing

Nail Disorder

Primary Dermatologic Disease

Systemic Disease

Nail Plate Abnormality

Nail Fold Abnormality

Nail Bed Abnormality

Koilonychia
Spooner-Shaped

Onycholysis
Plate Separating from Bed

Beau's Lines
Horizontal Grooves

Clubbing

Bronchopulmonary Disease

• Bronchiectasis
• Chronic Lung Infection
• Lung Cancer
• Asbestosis
• Cystic Fibrosis
• Chronic Hypoxia

Cardiovascular Disease

• Cyanotic Heart Disease

Gastrointestinal Disease

• Inflammatory Bowel Disease (Crohn's Disease, Ulcerative Colitis)
• Gastrointestinal Cancer

Endocrine Disease

• Hyperthyroidism (Grave's Disease)

Other

• Human Immunodeficiency Virus
• Congenital Defect
Pruritus
No Primary Skin Lesion

Blood Glucose
- Diabetes Mellitus

Liver Function Tests/Enzymes
- Cholestatic liver disease

Creatinine & BUN
- Chronic renal failure/uremia

TSH & T4
- Hypothyroidism
- Hyperthyroidism

CBC & Differential
- Lymphoma
- Leukemia
- Polycythemia rubra vera
- Essential Thrombocythemia
- Myelodisplastic syndrome

Psychiatric Disease
- Delusions of parasitosis
Pruritus

Primary Skin Lesion

- Macules/Papules/Plaques
  - Xerosis (dry skin)
  - Atopic dermatitis
  - Nummular dermatitis
  - Seborrheic dermatitis
  - Stasis dermatitis
  - Psoriasis
  - Lichen Planus
  - Infestations (scabies, lice)
  - Arthropod bites

- Vesicles/Bullae
  - Varicella zoster (chickenpox)
  - Dermatitis herpetiformis
  - Bullous pemphigoid

- Wheals/Hives
  - Urticaria

No Primary skin Lesion
Skin Rash

Eczematous

Pruritic/Scaly/Erythematous lesions. Usually poorly demarcated

Papulosquamous
Erythematous or violaceous papules & plaques with overlying scale

Vesiculobullous
Blisters containing non-purulent fluid

Pustular
Blisters containing purulent fluid

Reactive
Reactive erythematous with various morphology

Atopic Dermatitis
(Eczema)
Erythematous papules and vesicles (acute) or lichenification (chronic)

Nummular Dermatitis
(Discoid Eczema)
Coin shaped (discoid) erythematous plaques. Usually on lower legs

Seborrheic Dermatitis
Yellowish-red plaques with greasy distinct margins on scalp/facet/central chest folds

Stasis Dermatitis
Erythematous eruption on lower legs. Secondary to venous insufficiency. +/- pigmentation, edema, varicose veins, venous ulcers

Dyshidrotic Eczema
(pompholyx)
Deep-Seated tapioca-like vesicles on hands/feet/sides of digits.

Contact Dermatitis
Well-demarcated erythema, papules, vesicles, erosions scaling confined to area of contact

Irritant
Rapid onset, requires high doses of the agent. May occur in anyone

Allergic
Delayed onset (12-72 hrs). Very low concentrations sufficient. Occurs only in those sensitized

Age dependent distribution:
Infants: scalp, face, extensor extremities
Children: flexural areas
Adults: flexural areas/hands/face/nipples
Skin Rash

Papulosquamous

Eczematous
Pruritic/Scaly/Erythematous lesions Usually poorly demarcated

Papulosquamous
Erythematous or violaceous papules & plaques with overlying scale

Vesiculobullous
Blisters containing non-purulent fluid

Pustular
Blisters containing purulent fluid

Reactive
Reactive erythematous with various morphology

Psoriasis
Well demarcated plaques, thick silvery scale on elbows & knees. Auspitz sign Koebner’s phenomenon

Lichen Planus
Purple, pruritic, polygonal, planar (flat-topped) papules on wrists/ankles/genital s (especially penis) Wickham’s striae Koebner’s phenomenon

Pityriasis Rosea
Oval, tannish-pink or salmon-coloured patches, plaques with scaling border in Christmas tree pattern on trunk, begins with a large lesion patch (Herald’s patch)

Tinea (Ring Worm)
Annular (Ring-shaped) lesion with elevated scaling, red border, central clearing

Secondary Syphilis
Red brown or copper coloured scaling papules and plaques on palms and soles

Discoid Lupus Erythematosus
Scarring and/or atrophic red/purple plaques with white adherent scales on sun-exposed area
Skin Rash

Pustular

- **Eczematous**
  - Pruritic/Scaly/Erythematous lesions
  - Usually poorly demarcated

- **Papulosquamous**
  - Erythematous or violaceous papules & plaques with overlying scale

- **Vesiculobullous**
  - Blisters containing non-purulent fluid

- **Pustular**
  - Blisters containing purulent fluid

- **Reactive**
  - Reactive erythematous with various morphology

  **Acneiform**
  - Erythematous papules and pustules on face

  - **Acne Vulgaris**
    - Comedones +/- nodules, cysts, scars on face & trunk

  - **Comedones Absent**
    - Pustules centered around hair follicles

  - **Impetigo**
    - Pustules with overlying thick honey-yellow crusts

  - **Candidiasis**
    - “Beefy red” erythematous patches in body folds with satellite pustules at periphery

  - **Folliculitis**
    - Pustules centered around hair follicles

  - **Perioral Dermatitis**
    - Perioral, periorbital & nasolabial distribution, sparing vermillion borders of lips

  - **Acne Rosacea**
    - Telangiectasia, episodic flushing after sunlight, alcohol, hot or spicy food & drinks

  - **Perioral**
    - Perioral, periorbital & nasolabial distribution, sparing vermillion borders of lips
Skin Rash

- **Eczematous**: Pruritic/Scaly/Erythematous lesions. Usually poorly demarcated.
- **Papulosquamous**: Erythematous or violaceous papules & plaques with overlying scale.
- **Vesiculobullous**: Blisters containing non-purulent fluid.
- **Pustular**: Blisters containing purulent fluid.
- **Reactive**: Reactive erythematous with various morphology.

---

**Urticaria**: Firm/edematous papules & plaques that are transient & itchy. Usually lasts <24hrs.

**Erythema Nodosum**: Tender or painful red nodules on shins.

**Erythema Multiforme**: Target lesions possibly with macules, papules, vesicles &/or bullae on palms soles and mucous membranes.
Skin Rash

Vesiculobullous

Eczematous
Pruritic/Scaly/Erythematous lesions Usually poorly demarcated

Papulosquamous
Erythematous or violaceous papules & plaques with overlying scale

Vesiculobullous
Blisters containing non-purulent fluid

Pustular
Blisters containing purulent fluid

Reactive
Reactive erythematous with various morphology

Vesicles Fragile/Easily Ruptured
Intraepidermal blisters, possibly crusts/erosions

Inflammatory
• Pemphigus vulgaris
• Pemphigus foliaceus

Infectious
• Varicella zoster (chickenpox)
• Herpes zoster (shingles)
• Herpes simplex
• Bullous impetigo

Reaction to Agent
• Contact dermatitis

Vesicles NOT Fragile/NOT Easily Ruptured
Subepidermal blisters, tense intact blisters

Inflammatory
• Bullous pemphigoid
• Mucous membrane pemphigoid
• Dermatitis herpetiformis
• Bullous systemic lupus erythematosus

Metabolic
• Porphyria cutanea tarda
• Diabetic bullae (bullous diabeticorum)

Reactive
• Phototoxic drug eruption
Skin Ulcer by Etiology

**Physical**
- Trauma
- Pressure
- Radiation

**Vascular**
- Arterial Insufficiency
- Venous insufficiency
- Vasculitis

**Hematologic**
- Squamous cell carcinoma
- Basal cell carcinoma
- Melanoma
- Mycosis fungoides (cutaneous t-cell lymphoma)

**Neoplastic**
- Diabetic neuropathy
- Tabes dorsalis (syphilis)
- Factitious disorder
- Delusions of parasitosis

**Neurological**
- Pyoderma gangrenosum
- Diabetic dermopathy
- Necrobiosis lipoidica

**Infectious**
- Sickle cell anemia
- Thalessemia
- Cryoglobulinemia
- Leishmaniasis
- Tuberculosis
- Syphilis
- Chlamydia trachomatis
- Herpes simplex
- Histoplasmosis
- Coccidioidomycosis
- Cryptococcosis
- Coumadin
- Heparin
- Bleomycine
Skin Ulcer by Location

Genitals

Skin Ulcer

- Oral
- Head/Neck
- Trunk/Sacral Region
- Genitals
- Lower Legs/Feet

Painless

- Herpes simplex
- *Haemophilus ducreyi* (chancroid)
- Behçet’s syndrome
- Pemphigus vulgaris
- Lichen sclerosis
- Erosive lichen planus

Painful

- Primary syphilis (chancre)
- Granuloma inguinale
- Lymphogranuloma venereum
Skin Ulcer by Location

Head & Neck

Skin Ulcer

- Oral
- Head/Neck
- Trunk/Sacral Region
- Genitals
- Lower Legs/Feet

Neoplastic
- Squamous cell carcinoma
- Basal cell carcinoma
- Melanoma

Metabolic
- Pyoderma gangrenosum

Vascular
- Wegner’s granulomatosis
- Radiation

Other
Skin Ulcer by Location

Lower Legs / Feet

Skin Ulcer

- Oral
- Head/Neck
- Trunk/Sacral Region
- Genitals
- Lower Legs/Feet

Physical
- Pressure
- Trauma
- Radiation

Vascular
- Arterial insufficiency
- Vascular insufficiency
- Vasculitis

Neurological
- Diabetic neuropathy
- Tabes dorsalis (syphilis)

Metabolic
- Pyoderma gangrenosum
- Diabetic dermopathy
- Necrobiosis lipoidica

Neoplastic
- Squamous cell carcinoma
- Basal cell carcinoma
- Melanoma

Other
### Skin Ulcer by Location

#### Oral Ulcers

- **Skin Ulcer**
  - **Oral**
    - **Single Ulcer**
      - Traumatic ulcer
      - Angular ulcer
      - Aphthous ulcer
      - Herpes simplex
    - **Multiple Acute Ulcers**
      - Viral stomatitis
      - Erythema multiforme
      - Acute necrotizing ulcerative gingivitis
    - **Multiple Recurrent Ulcers**
      - Aphthous stomatitis
      - Herpes simplex infection
    - **Multiple Chronic Ulcers**
      - Pemphigus vulgaris
      - Lichen planus
      - Lupus erythematosus
      - Bullous pemphigoid
Skin Ulcer by Location

Trunk / Sacral Region

- **Skin Ulcer**
  - Oral
  - Head/Neck
  - Trunk/Sacral Region
  - Genitals
  - Lower Legs/Feet

**Neoplastic**
- Squamous cell carcinoma
- Basal cell carcinoma
- Melanoma
- Mycosis fungoides (cutaneous t-cell lymphoma)

**Physical**
- Physical
- Trauma
- Radiation

**Other**
Vascular Lesions

Blanches with Pressure
Small, dilated superficial blood vessels

- Telangiectasia

Does not blanche with pressure
Erythematous or violaceous discolorations of skin due to extravasation of RBCs in dermis

Petechiae < 0.2 cm diameter
Purpura 0.2 - 1.0 cm diameter
Ecchymosis > 1 cm diameter

Congenital
- Hemangioma

Acquired
- Vasculitis
Musculoskeletal

Acute Joint Pain Vitamin CD ................................................. 255
Back Pain ............................................................................. 256
Bone Lesion ........................................................................ 257
Chronic Joint Pain ............................................................. 258
Deformity / Limp .................................................................. 259
Fracture Healing ................................................................. 260
Guide to Spinal Cord Injury .................................................. 261
Infectious Joint Pain ............................................................. 262
Inflammatory Joint Pain ....................................................... 263
Myotomes Segmental Innervation of Muscles ..................... 264
Pathologic Fractures ............................................................. 265
Soft Tissue .......................................................................... 266
Osteoporosis BMD Testing .................................................. 267
Tumour ............................................................................... 268
Vascular Joint Pain ............................................................... 269
Historical Editors
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Dr. Carol Hutchison
# Acute Joint Pain

**Vitamin CD**

### Vascular
- See vascular joint pain

### Infectious
- See infectious joint pain

### Trauma
- Multiple injury sites, Open Fracture, Infectious joint pain

### Autoimmune
- See inflammatory joint pain

### Metabolic
- See pathologic fractures

### Iatrogenic
- Hx of prior surgery

### Neoplastic
- See Tumour

### Congenital
- Scoliosis, Talipes Equinovarus, Meta tarsus adductus, Bow leg, Knock-Knee’d

### Degenerative
- Degenerative Disc Disease, Osteoarthritis, Osteoporosis
Back Pain

Always assess for red flags. If no red flags, assess after 6 weeks

Acute/Subacute + Red Flags < 6 weeks
- Fracture
- Tumor/Infection
- Cauda Equina Syndrome
  - Unresolved Radicular Symptoms

Chronic/Acute After 6 weeks + No Red Flags > 6 weeks
- Myelopathic
- Spondyloarthropathies or Osteoarthritis

Red Flags: bowel or bladder dysfunction, saddle paresthesia, constitutional symptoms, parasthesis, age >50, <18, IV drug use, neuromotor deficits, nocturnal pain, high energy trauma, past history of neoplasm
Musculoskeletal

Bone Lesion

Bone Lesion on X-ray

Rule Out Osteomyelitis & Secondary Metastases

Non-aggressive

Exostotic
  - Osteochondroma

Asymptomatic &/or Non-Active Bone Scan
  - Unicameral Bone Cysts
  - Aneurysmal Bone Cysts
  - Non-ossifying Fibroma

Symptomatic &/or Active Bone Scan

Broad or Indistinct Margin &/or Soft Tissue Invasion
  - Enchondroma (can calcify &/or turn malignant)
  - Giant Cell Tumor ("Soap Bubble" appearance)

Multiple Lytic Lesions
  - Multiple Myeloma

Benign
  - No Bone Mineralization

Benign
  - Bone Mineralization,
    Constitutional Symptoms,
    Codman’s Triangle, Excessive
    Scalloping & Destruction of
    Cortical Bone

Malignant

Inflammatory Appearance
  - Osteoid Osteoma ("Nidus"
    appearance)
  - Osteoblastoma (may be
    malignant or sclerotic in
    appearance)

Not Inflammatory Appearance
  - Chondroblastoma
  - Chondromyxoid Fibroma

Aggressive

Non-aggressive &/or Non-Active Bone Scan

Asymptomatic &/or Non-Active Bone Scan

Symptomatic &/or Active Bone Scan

Multiple Lytic Lesions

Benign

Malignant

Osteosarcoma (Codman’s Triangle)

Chondrosarcoma ("Popcorn" appearance)

Ewing’s Sarcoma
Chronic Joint Pain

Chronic/Degenerative Change

Peri-Articular

Bone
- Stress Fracture
- Charcot Joint

Articular Cartilage
- Osteoarthritis
- Chondromalacia

Joint Capsule
- Baker Cyst
- Ganglion Cyst
- Adhesive Capsulitis

Synovium
- Monoarthritis
- Polyarthritis

Intra-Articular

Bursa
- Aseptic Bursitis

Epiphysitis/Apophysitis
- Slipped Epiphysis
- Apophysitis (Osgood-Schlatter Disease)

Tendon
- Enthesitis
- Tendinopathy
- Tendon Rupture
- Impingement
- Tenosynovitis
- Ganglion Cyst

Bone
- Stress Fracture
- Charcot Joint
- Pathologic Fracture
- Periostitis
- Epicondylitis

Skin/Fascia
- Fascitis (e.g., Myofascial Pain, Iliotibial Band Friction, Plantar Fasciitis

Muscle
- Delayed Onset Muscle Soreness
- Fibromyalgia
- Myositis
- Ossificans

Musculoskeletal
Deformity / Limp

Always check neurological and vascular status one joint below the injury

Infection
- Septic Arthritis
- Cortical Hypertrophy
- Osteomyelitis

Inflammation
- Rheumatoid Arthritis
- Toxic Synovitis
- Reactive Arthritis

Other Causes
- Osteoarthritis
- Osteomalacia
- Rickets

Hip Joint
- Hip Dysplasia
- Slipped Capital Femoral Epiphysis
- Legg-Calvé-Perthes Disease

Knee Joint
- Patellofemoral Syndrome (Chondromalacia Patellae)
- Osgood-Schlatter Disease
- Patella (e.g., Tendon Rupture, Dislocation, Subluxation)

Spine/Stature
- Osteoporosis
- Scoliosis/Spinal Curvature
- Dwarfism
Fracture Healing

Delayed Union (3 – 6 months)
- Tobacco / nicotine
- NSAIDS
- Ca²⁺ / Vitamin D deficiency

Non-Union (after 6 months)
- Septic (R/O First)
- Hypertrophic (adequate blood flow)
  - Mechanical failure
  - Excessive motion
  - Excessive bone gap
- Aseptic
- Atrophic (inadequate blood flow)
  - Tobacco / nicotine
  - NSAIDS
  - Medications
  - Allergies
  - Biologic Failure

Malunion
- Functional
  - Small deviations from normal axis
- Non Functional
  - Inadequate immobilization/reduction
  - Misalignment before casting
  - Premature cast removal

RED FLAGS (life threatening)
- Multi-trauma
- Pelvic Fracture
- Femur Fracture
- High Cervical Spine Fracture

Operative Fractures:
- Open
- Unstable
- Displaced
- Intra-articular

Non-Operative Fractures:
- Closed
- Stable
- Undisplaced
- Extra-articular

Inflammation ➔ Soft Callus ➔ Hard Callus ➔ Remodelling
- Hours- Days
- Days- Weeks
- Weeks- Months
- Years
Guide to Spinal Cord Injury

<table>
<thead>
<tr>
<th>Spinal Root</th>
<th>Sensory</th>
<th>Motor</th>
<th>Reflex</th>
</tr>
</thead>
<tbody>
<tr>
<td>C4</td>
<td>Acromioclavicular Joint</td>
<td>Respiration</td>
<td>None</td>
</tr>
<tr>
<td>C5</td>
<td>Radial Antecubital Fossa</td>
<td>Elbow Flexion</td>
<td>Biceps Reflex</td>
</tr>
<tr>
<td>C6</td>
<td>Dorsal Thumb</td>
<td>Wrist Extension</td>
<td>Brachioradialis Reflex</td>
</tr>
<tr>
<td>C7</td>
<td>Dorsal Middle Finger</td>
<td>Elbow Extension</td>
<td>Triceps Reflex</td>
</tr>
<tr>
<td>C8</td>
<td>Dorsal Little Finger</td>
<td>Finger Flexion</td>
<td>None</td>
</tr>
<tr>
<td>T1</td>
<td>Ulnar Antecubital Fossa</td>
<td>Finger Abduction</td>
<td>None</td>
</tr>
<tr>
<td>T7-12</td>
<td>See Dermatomes</td>
<td>Abdominal Muscles</td>
<td>Abdominal Reflex</td>
</tr>
<tr>
<td>L2</td>
<td>Anterior Medial Thigh</td>
<td>Hip Flexion</td>
<td>Cremasteric Reflex</td>
</tr>
<tr>
<td>L3</td>
<td>Medial Femoral Condyle</td>
<td>Knee Extension</td>
<td>None</td>
</tr>
<tr>
<td>L4</td>
<td>Medial Malleolus</td>
<td>Ankle Dorsiflexion</td>
<td>Knee Jerk Reflex</td>
</tr>
<tr>
<td>L5</td>
<td>First Web Space (1\textsuperscript{st}/2\textsuperscript{nd} MTP)</td>
<td>Big Toe Extension</td>
<td>Hamstring Reflex</td>
</tr>
<tr>
<td>S1</td>
<td>Lateral Calcaneus</td>
<td>Ankle Plantarflexion</td>
<td>Ankle Jerk Reflex</td>
</tr>
<tr>
<td>S2</td>
<td>Popliteal Fossa</td>
<td>Anal Sphincter</td>
<td>Bulbocavernosus</td>
</tr>
<tr>
<td>S3/S4</td>
<td>Perianal Region</td>
<td>Anal Sphincter</td>
<td>None</td>
</tr>
</tbody>
</table>

N.B. There is considerable variability in spinal cord levels for motor and reflex testing. Always test the level above and below the suspected injury.
Infectious Joint Pain

Fever/Chills/Myalgia
Constant Pain
Increased Heat and Swelling
Signs & Symptoms of Viral Infection (e.g., Rhinitis/Cough)

Polyarticular
- Viral Myalgia
- Viral Arthritis
- Disseminated Gonococcal Infection (Dermatitis, Migratory Arthralgia & Tenosynovitis)
- Secondary Syphilis (Red/Copper Papules & Mucosal Lesions)
- Fifth Disease (Erythema Infectiosum & Symmetrical Rash)
- Rubella (Measles-like rash)
- Primary HIV Infection
- Endocarditis

Monoarticular

Articular
- Cellulitis
- Necrotizing Fascitis
- Septic Bursitis
- Abscess
- Osteomyelitis
- Lymphadenitis
- Warts

Peri-Articular

Acute Onset
- Septic Arthritis

Insidious Onset
- Fungal tuberculosis
- Lyme Disease (Erythema Migrans)
Inflammatory Joint Pain

**Monoarticular**
- Gout (Podagra, Tophi)
- Pseudogout
- Early Rheumatic Disease
- Reactive (e.g. Genitourinary Infection)

**Oligoarticular (1-4 joints)**
- Gout
- Psoriatic (Nail Changes, Plaques)
- Enteropathic (e.g. Inflammatory Bowel Disease)
- Reactive
- Rheumatic Fever (recent Pharyngitis, Carditis)
- Lyme Disease (Tick bite, Migratory red Macules)

**Polyarticular (>4 joints)**
- Reactive

**Peripheral Only**
- Subacute & Symmetrical
  - Rheumatoid Arthritis
  - Systemic Lupus Erythematosus
  - Sjögren's (a.k.a. Sicca Syndrome
  - Scleroderma
  - Henoch-Schonlein Purpura
  - Polymyalgia Rheumatica
  - Wegener’s Granulomatosis

- Insidious Monoarticular
  - Symmetric (Polymyositis/Dermatomyositis)
  - Asymmetric (Psoriatic Arthritis)

**Peripheral & Axial**
- Migratory
  - Rheumatic Fever
- Acute Onset
  - Reactive
- Insidious Onset
  - Ankylosing Spondylitis
  - Enteropathic (e.g. Inflammatory Bowel Disease)
  - Psoriatic Arthritis
<table>
<thead>
<tr>
<th>Muscle Group</th>
<th>Action</th>
<th>Myotome</th>
<th>Peripheral Nerve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder</td>
<td>Abduction</td>
<td>C5</td>
<td>Axillary Nerve</td>
</tr>
<tr>
<td></td>
<td>Adduction</td>
<td>C6-C8</td>
<td>Thoracodorsal Nerve</td>
</tr>
<tr>
<td>Elbow</td>
<td>Flexion</td>
<td>C5</td>
<td>Musculocutaneous Nerve</td>
</tr>
<tr>
<td></td>
<td>Extension</td>
<td>C7</td>
<td>Radial Nerve</td>
</tr>
<tr>
<td>Wrist</td>
<td>Extension</td>
<td>C6</td>
<td>Radial Nerve</td>
</tr>
<tr>
<td>Fingers</td>
<td>Flexion</td>
<td>C8</td>
<td>Median Nerve</td>
</tr>
<tr>
<td></td>
<td>Abduction</td>
<td>T1</td>
<td>Ulnar Nerve</td>
</tr>
<tr>
<td>Hip</td>
<td>Flexion</td>
<td>L2</td>
<td>Nerve to Psoas</td>
</tr>
<tr>
<td></td>
<td>Extension</td>
<td>S1</td>
<td>Inferior Gluteal Nerve</td>
</tr>
<tr>
<td></td>
<td>Abduction</td>
<td>L5</td>
<td>Superior Gluteal Nerve</td>
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<tr>
<td>Knee</td>
<td>Flexion</td>
<td>L5</td>
<td>Tibial Nerve</td>
</tr>
<tr>
<td></td>
<td>Extension</td>
<td>L3</td>
<td>Femoral Nerve</td>
</tr>
<tr>
<td>Ankle</td>
<td>Dorsiflexion</td>
<td>L4</td>
<td>Deep Peroneal Nerve</td>
</tr>
<tr>
<td></td>
<td>Plantarflexion</td>
<td>S1</td>
<td>Tibial Nerve</td>
</tr>
</tbody>
</table>

N.B. There is considerable overlap between myotomes for some actions. The myotomes listed are the dominant segments involved.
Pathologic Fractures

- Low Energy/No Exercise/Repeated Use
  Always Check neurological and vascular status
  one joint below the injury

Tumours
See Bone Lesions Scheme

Metabolic Bone Disease

Osteoporosis
Vertebrae/Hip/Distal Radius

- Primary
  - Post-Menopausal
  - Elderly

- Secondary
  - Gastrointestinal Disease
  - Bone Marrow Disorder
  - Endocrinopathy
  - Malignancy
  - Drugs (e.g. corticosteroids)
  - Rheumatoid Disease
  - Renal Disease
  - Poor Nutrition
  - Immobilization

Paget’s Disease
Skull/Spine/Pelvis
Positive Alkaline Phosphatase

Renal Osteodystrophy
Secondary to Chronic Renal Failure

Osteomalacia/Rickets
Diffuse Pain/Proximal Muscle Weakness

- Vitamin D Deficiency
- Mineralization Defect
- Phosphate Deficiency
Soft Tissue

Septic
- Septic Bursitis
- Necrotizing Fasciitis
- Septic Tenosynovitis
- Cellulitis

Aseptic

Intra-articular

Ligament
- Sprain
- Dislocation (3rd Degree Sprain)

Articular Cartilage
- Osteochondritis Dissecans
- Bone Contusion
- Chondromalacia

Synovium
- Traumatic Synovitis
- Monoarthritis
- Polyarthritis
- Synovial Osteochondromatosis

Fibrous Cartilage
- Meniscal Injury
- Labral Injury
- SLAP Lesion

Bone
- Fracture
- Spontaneous Osteonecrosis

Septic Bursa
- Aseptic Bursitis

Ligament
- Sprain
- Dislocation (3rd Degree Sprain)

Tendon/Muscle
- Tendon Rupture
- Muscle Strain
- Confusion

Bone
- Fracture

Skin/Fascia
- Laceration
- Contusion
- Fat Pad Contusion
Osteoporosis

BMD Testing

Osteoporosis

T-Scores:
Normal ≥ -1
-2.49 < Osteopenia < -1
Osteoporosis ≤ -2.5

Age > 50 years

• All men and women >65
• Prior fragility fracture
• Prolonged glucocorticoid use
• Rheumatoid Arthritis
• Falls in past 12 months
• Parental Hip Fracture
• Other medications
• Vertebral fracture
• Osteopenia on X ray
• Smoking/ETOH
• Low body weight (<60kg) or major loss (>10% of when 25)

Age < 50 years

• Fragility Fracture
• Prolonged Glucocorticoid use
• Use of other high risk medications
  • Aromatase Inhibitors
  • Androgen Deprivation Therapy
• Hypogonadism/Premature Menopause
• Malabsorption Syndrome
• Primary Hyperparathyroidism
• Other disorders strongly associated with rapid bone loss and/or fracture

OSTEOPOROSIS-BMD Testing

T-Scores:
Normal ≥ -1
-2.49 < Osteopenia < -1
Osteoporosis ≤ -2.5
Metastatic - Most common tumour in adults

- Breast
- Prostate
- Thyroid
- Lung
- Renal

Primary

Benign

- Osteochondroma
- Osteoid osteoma
- Chondroblastoma
- Fibroxanthoma
- Fibrous Dysplasia
- Non-ossifying fibroma
- Chondromyxoid Fibroma
- Periosteal Chondroma

Aggressive, Non-Malignant

- Giant Cell Tumour
- Enchondroma
- Aneurysmal Bone Cyst

Malignant 66% of adult tumours

- Multiple Myeloma - most common
- Osteosarcoma
- Chondrosarcoma
- Ewing's Sarcoma
- Fibrosarcoma
- Liposarcoma
- Rhabdomyosarcoma
- Leiomyosarcoma
- Malignant Fibrous Histiocytoma
Vascular Joint Pain

Constant Pain (Ischemia)
Acute Onset
Increased Pain with Activity (Claudication)
Cold Extremity or Hyperemia

- Spasm
  - Vasculitis

- Occlusion
  - Sickle Cell Anemia
  - Peripheral Vascular Disease
  - Atherosclerosis
  - Deep Vein Thrombosis
  - Septic Embolism (e.g. Infective Endocarditis)
  - Fat Embolism (e.g. fractured long bone)
  - Air Embolism
  - Vasculitis

- Disruption
  - Trauma to Vessel (dislocation/fracture)
  - Hemarthrosis (Hemophilia or Trauma)
  - Peripheral/Mycotic Aneurysm (e.g. Marfan’s Syndrome, Infective Endocarditis, Atherosclerosis)

- Compression
  - Any structure compressing the blood vessels
  - Abscess
  - Cyst
  - Neoplasm
  - Dislocated Bone
Psychiatric

- Anxiety Disorders Associated with Panic
- Anxiety Disorders Recurrent Anxious Thoughts
- Mood Disorders Depressed Mood
- Mood Disorders Elevated Mood
- Obsessive-Compulsive & Related Disorders
- Personality Disorder
- Psychotic Disorders
- Somatoform Disorders
- Trauma & Stressor Related Disorders
Anxiety Disorders
Associated with Panic

- Excessive Anxiety, Fear, Avoidance, and/or Increased Arousal

  - Rule out Anxiety Disorder due to General Medical Condition (e.g., hyperthyroidism, anemia, CHF), Another Mental Disorder, or Substance/Medication-Induced Anxiety Disorder

  - Associated with Panic and/or Physical (Autonomic) Symptoms
    - Associated with Specific Situation/Avoidance of the Specific Situation
      - Specific Trigger (e.g. water, heights, animals, etc.) — Specific Phobia
      - Separation From Attachment Figure — Separation Anxiety Disorder

  - Associated with Recurrent Anxious Thoughts
    - Recurrent, Unexpected Panic Attacks
      - Panic Disorder
        - Specific Trigger (e.g. water, heights, animals, etc.) — Specific Phobia
        - Separation From Attachment Figure — Separation Anxiety Disorder
        - Using Public Transportation, Open Spaces, Enclosed Spaces, Being in a Line, Crowd, or Outside the Home — Agoraphobia
        - Public Setting Where a Negative Evaluation May Occur — Social Anxiety Disorder

Anxiety Disorders
Recurrent Anxious Thoughts

Excessive Anxiety, Fear, Avoidance, and/or Increased Arousal

Rule out Anxiety Disorder due to Another Medical Condition (e.g. hyperthyroidism, anemia, CHF), Another Mental Disorder, or Substance/Medication-Induced Anxiety Disorder

Associated with Panic and/or Physical (Autonomic) Symptoms
- Generalized Worry
  - Worry about Several Events or Activities for >6 months (e.g. Work or School)
  - Generalized Anxiety Disorder
- Setting Where Patient May Sense Difficulty in Escape (e.g. Public transportation, Lines, Crowds etc.)
  - Agoraphobia

(*)NB: if the symptoms are clinically significant but do not meet the criteria for a specific anxiety disorder, consider Other Specified Anxiety Disorder or Unspecified Anxiety Disorder

Associated with Recurrent Anxious Thoughts
- Specific Worries
- Intrusive/ Inappropriate/ Distressing Thoughts With Repetitive Behaviour Meant to Neutralize Anxiety
  - *Obsessive Compulsive Disorder
- Excessive Worry or Fear About Social Situations
  - Social Anxiety Disorder (Social Phobia)

* Not considered an anxiety disorder according to DSM-V

Mood Disorders

Depressed Mood

**Medical Conditions:**
- Neurological: C.V.A, Parkinson’s, MS
- Viral: Mononucleosis, HIV, Hepatitis
- Endocrine: Cushing’s, Hyper/hypothyroid
- Other: Cancer, B12 deficiency

**Drugs of Abuse:**
- Amphetamines
- Alcohol
- Cocaine

**Medications:**
- Corticosteroids
- Antihypertensives
- Antipsychotics
- Oral contraceptives

---

**Depressed or Elevated Mood**

Rule out depressed or elevated mood disorder due to substances and/or general medical condition

---

**Elevated Mood +/- Depressed Mood**

- 2 week period, depressed mood nearly everyday
  - Major Depressive Disorder

**Depressed Mood Only**

- Depressed mood more days than not for > 2 years
  - Persistent Depressive Disorder

- Depressed mood in context of specific stressor < 6 months
  - Adjustment Disorder with Depressed Mood

- Depressed mood in context of personal loss < 2 months
  - Bereavement

---

**Depressed Mood**

- Sleep changes
- Interest – anhedonia
- Guilt
- Energy – anergia
- Concentration - decrease
- Appetite +/- 5% body weight in one month
- Psychomotor agitation or retardation
- Suicidal thoughts

**Suicide** = 15% over lifetime

---

**Prevalence** = 3% over lifetime

---

**Prevalence** = 5% Hospitalized patients

---

None of:

1) Suicidal ideation
2) Psychosis (except hallucinations of deceased)
3) Guilt (except deceased)
Mood Disorders

Elevated Mood

Depressed or Elevated Mood

Rule out depressed or elevated mood disorder due to substances and/or general medical condition

Elevated Mood with or without Depressed Mood

Manic Episode (may have hx of ≥ 1 MDE)

• Bipolar I

MANIA: 1 week elevated or irritable mood
PLUS 3 or more:
1) Grandiosity
2) Decreased sleep
3) Pressure of speech
4) Flight of ideas
5) Distractibility
6) Increase in goal directed activity
7) Excessive pleasureable but harmful activities
Suicide = 15% over lifetime

Hypomanic Episode (must have hx of ≥ 1 MDE)

• Bipolar II

HYPOMANIA: No marked impairment, no psychosis, no hospitalization. At least 4 days.
PLUS 3 or more:
1) Grandiosity
2) Decreased sleep
3) Pressure of speech
4) Flight of ideas
5) Distractibility
6) Increase in goal directed activity
7) Excessive pleasureable but harmful activities

Depressed Mood Only

2 Years Hypomanic Episodes and Depressed Mood

• Cyclothymia

Symptoms without clear mood episode

Medical Conditions:
Neurological: C.V.A, Parkinson’s, MS
Viral: Mononucleosis, HIV, Hepatitis
Endocrine: Cushing’s, Hyper/hypothyroid
Other: Cancer, B12 deficiency

Drugs of Abuse:
Amphetamines, Alcohol, Cocaine

Medications:
Corticosteroids, Antihypertensives, Antipsychotics, Oral contraceptives

Psychiatric
Obsessive-Compulsive & Related Disorders

Recurrent, Persistent Thoughts, Urges or Images Associated with Repetitive Behaviours

Rule out Obsessive-Compulsive and Related Disorder due to Another Medical Condition (e.g. hyperthyroidism, anemia, CHF), Another Mental Disorder, or Substance/Medication-Induced Obsessive-Compulsive and Related Disorder

Non-Specific Obsessions and/or Compulsions

Specific Obsessions or Compulsions Associated with:

Intrusive/ Inappropriate/ Distressing Thoughts With Repetitive Behaviour Meant to Neutralize Anxiety

Preoccupation with Perceived Physical Appearance

Hair Pulling

Skin Picking

Trichotillomania

Excoration Disorder

Body Dysmorphic Disorder

Difficulty Discarding Possessions

Hoardin Disorder

NB: If the symptoms are clinically significant but do not meet the criteria for a specific Obsessive-Compulsive or Related Disorder consider Other Specified Obsessive-Compulsive or Related Disorder or Unspecified Obsessive-Compulsive or Related Disorder

1. American Psychiatric Association (2013). Diagnostic and Statistical Manual of Mental Disorders (5th ed. DSM-V.)
Personality Disorder

- **Enduring pattern of experience and behaviour that deviates from cultural expectations**, manifest in two or more of the following areas: cognition, affectivity, interpersonal functioning, and impulse control
- The pattern is **inflexible and pervasive** across many social and personal situations
- The pattern leads to **distress or impairment** in important areas of functioning
- The pattern is **stable and of long duration**, with an onset that can be traced back to childhood or adolescence
- The pattern is **not due to another mental illness, a general medical condition, or substance use**

**Cluster A: Odd or Eccentric**
- **Paranoid** - irrational suspicion or mistrust
- **Schizoid** - emotional detachment, lack of interest in social relationships
- **Schizotypal** - Odd beliefs

**Cluster B: Dramatic, Emotional, or Social**
- **Antisocial** - disregard for social norms, the law, and rights of others
- **Borderline** - instability of identity, relationships, and behaviour
- **Histrionic** - attention-seeking, exaggerated emotional expression
- **Narcissistic** - grandiosity, need for admiration, lack of empathy

**Cluster C: Anxious or Fearful**
- **Avoidant** - social inhibition, inadequacy, hypersensitivity
- **Dependent** - psychological dependence on others
- **Obsessive-Compulsive** - rigid, inflexible conformity to rules, order, and codes

Psychotic Disorders

Prominent mood syndrome (major depression, mania) present for significant portion of illness

- Mood disorder with psychotic features
  - Duration of illness ≤ 1 month
    - Brief psychotic disorder
      - 1 or more:
        1) Delusions
        2) Hallucinations
        3) Disorganized speech
        4) Grossly disorganized or catatonic behaviour
  - Duration of illness 1-6 months
    - Schizophreniform disorder
      - 2 or more (1 must be 1-3):
        1) Delusions
        2) Hallucinations
        3) Disorganized speech
        4) Grossly disorganized or catatonic behaviour
        5) Negative sx (affective flattening, alogia, avolition)
      - Criteria: see schizophreniform disorder

- Delusional disorder
  - Non-bizarre delusions ≥ 1 month, no decline in functioning, behaviour is not odd

- Schizophrenia
  - Duration of illness ≥ 6 months
    - Delusions developed in context of close relationship with a person with already established similar delusion

Psychotic symptoms also present outside of mood episodes

- Schizoaffective disorder (bipolar & depressive)
  - Duration of illness 1-6 months
    - Schizophreniform disorder
      - 2 or more (1 must be 1-3):
        1) Delusions
        2) Hallucinations
        3) Disorganized speech
        4) Grossly disorganized or catatonic behaviour
        5) Negative sx (affective flattening, alogia, avolition)
      - Criteria: see schizophreniform disorder

Mood syndromes absent (or brief relative to duration of psychotic symptoms)

- Psychotic symptoms not limited to delusions
  - Duration of illness 1-6 months
    - Schizophreniform disorder
      - 2 or more (1 must be 1-3):
        1) Delusions
        2) Hallucinations
        3) Disorganized speech
        4) Grossly disorganized or catatonic behaviour
        5) Negative sx (affective flattening, alogia, avolition)
      - Criteria: see schizophreniform disorder

- Delusional disorder
  - Duration of illness ≥ 6 months
    - Schizophrenia
      - Delusions developed in context of close relationship with a person with already established similar delusion

Rule out psychotic disorder due to substances and/or general medical condition

Medical Conditions:
- Para/Neoplastic: Brain tumour, Stroke
- Parkinson’s: AIDS, syphilis, Epilepsy
- Infectious: Cushing’s, MS, SLE
- Degenerative: Endocrine, Vascular

Drugs of Abuse:
- Cocaine
- Cannabis
- Amphetamines: Opiates (rare), PCP
- Hallucinogens

Medications:
- Amphetamines: Methylphenidate, Steroids
- Dopamine Agonist: Anticholinergic, L-Dopa

Psychiatric

Suicide = 10%
Neuroleptic Malignant Syndrome:
- Side effects of anti-psychotics: Sx: Hyperpyrexia (>38.5°C), muscle rigidity and mental status changes
- 20% mortality
Somatoform Disorder

Patient presents with complex medical problem or symptoms that cannot be explained medically

Symptoms Consciously Produced
- Motivation is primary gain (to assume the sick role)
  - Factitious Disorder
- Motivation is secondary gain
  - Malingering
- Pain; psychological factors important
  - Pain Disorder
- Multiple symptoms; long history
  - Somatization Disorder
  - Criteria
    - 4 pain sx
    - 2 GI sx
    - 1 sexual sx
    - 1 pseudo-neuro sx

Symptoms Not Consciously Produced
- Focus is the sick role; not accepting reassurance
  - Illness Anxiety Disorder
- Focus is a physical symptom
  - Body Dysmorphic Disorder
- Focus is appearance; exhibit significant distress
  - Undifferentiated Somatoform Disorder
- One or more symptoms for at least six months
  - Conversion Disorder
  - Must have symptoms affecting movement or sensation (non-anatomic and unexplainable)
Trauma & Stressor
Related Disorders

Involuntary, Intrusive Thoughts, Memories, Images, Dreams, or Flashbacks Causing Psychological Distress

Rule out General Medical Condition (e.g. hyperthyroidism, anemia, CHF), Another Mental Disorder, or Substance/Medication-Induced

- Associated with a Stressful Event
  - Rule out Normal Bereavement
    - Development of Emotional or Behavioural Symptoms Within 3 Months of Event Onset, Symptoms Resolve <6 Months Post Event
      - Adjustment Disorder

- Associated with a Traumatic Event
  - < 1 Month Post-Event
    - Acute Stress Disorder
  - > 1 Month Post-Event
    - Post-Traumatic Stress Disorder

NB: If the symptoms are clinically significant but do not meet the criteria for a specific Trauma- and Stressor-Related Disorder consider Other Specified Trauma- and Stressor-Related Disorder or Unspecified Trauma- and Stressor-Related Disorder

Otolaryngologic

Hearing Loss Conductive ........................................ 285
Hearing Loss Sensorineural .................................. 286
Hoarseness Acute .................................................. 287
Hoarseness Non-Acute .......................................... 288
Neck Mass .......................................................... 289
Otaligia ................................................................. 290
Smell Dysfunction ............................................... 291
Tinnitus Objective ............................................... 292
Tinnitus Subjective .............................................. 293
Hearing Loss

Conductive

Hearing Loss

Otoscopy, Tuning Fork, Confirm with Audiogram

Conductive Hearing Loss

Normal Otoscopy

Middle Ear
- Otosclerosis
- Congenital (Ossicular Chain Malformation)
- Eustachian Tube Dysfunction

Abnormal Otoscopy

External Ear
- Cerumen
- Foreign Body
- Otitis Externa
- Inflammation
- Congenital (Atresia)
- Trauma
- Benign Mass (Polyp, Osteoma, Exostosis)
- Tumors (SCC)
- Dermatologic

Middle Ear
- Otitis Media
- Tympanic Membrane Perforation
- Cholesteatoma
- Trauma (barotrauma)
- Tumors (Glomus, Adenoma)
- Eustachian Tube Dysfunction
Hearing Loss

Otoscropy, Tuning Fork, Confirm with Audiogram

Conductive Hearing Loss

Sensorineural Hearing Loss

Symmetric

Asymmetric
  - Neoplastic (Vestibular Schwannoma)
  - Retrocochlear Tumor
  - Iatrogenic (Radiation, Surgery)
  - Idiopathic Unilateral Sensorineural Hearing Loss

Congenital
  - Hereditary
    - Mondini dysplasia
    - Atresia
  - Non-hereditary:
    - Developing Cochlear Insults: CMV, Rubella, Toxoplasmosis, HIV, Syphilis, Hepatitis
    - Teratogenic drugs, Alcohol

Neurogenic (Central)
  - Infection (Meningitis)
  - Cardiovascular Ischemia
  - Multiple Sclerosis

Cochlear (Inner-Ear)
  - Presbycusis
  - Loud Noise/ Trauma
  - Cochleitis
  - Otoxic Drugs (Oral Aminoglycosides, etc.)
  - Meniere’s Disease
  - Autoimmune (Cogan’s Syndrome)
Hoarseness

Acute

If Hoarseness persists > 3 months, Refer to ENT

- Acute
  - < 3 weeks
    - Constant
      - Infectious
        - Viral Laryngitis
        - Fungal Laryngitis (Monilia)
        - Bacterial Laryngitis
        - Bacterial Tracheitis
      - Inflammatory
        - Acute Nonspecific Laryngitis (GERD, Smoking, Allergies, Vocal Abuse)
        - Inhaled Steroids
      - Trauma
        - External Laryngeal Trauma
        - Iatrogenic
          - Endoscopy
          - Endotracheal intubation
    - Variable
      - Infectious
      - Inflammatory
        - Voice Overuse
      - Hyperfunction
        - Muscle Tension Dysphonia
Hoarseness

Non-Acute

If Hoarseness persists > 3 months, Refer to ENT

Acute
< 3 weeks

Constant

Infectious
- Bacterial Infection
- Fungal Infection (Monilia)

Inflammatory
- Chronic Laryngitis
- GERD
- Smoking

Trauma
- External
- Internal (Surgery, Intubation)

Benign Mucosal Changes
- Nodules
- Polyps
- Granuloma Cysts
- Reinke’s Edema

Neoplastic
- Malignancy: Squamous Cell Carcinoma
- Benign: Papilloma (HPV 6 & 11)
- Dysplasia: Leukoplakia

Neurological
- Vocal Cord Paralysis
- Spasmodic Dysphonia
- Tremor

Non-Acute
> 3 weeks

Variable
- Functional

Constant

Infectious
- Bacterial Infection
- Fungal Infection (Monilia)

Inflammatory
- Chronic Laryngitis
- GERD
- Smoking

Trauma
- External
- Internal (Surgery, Intubation)

Benign Mucosal Changes
- Nodules
- Polyps
- Granuloma Cysts
- Reinke’s Edema

Neoplastic
- Malignancy: Squamous Cell Carcinoma
- Benign: Papilloma (HPV 6 & 11)
- Dysplasia: Leukoplakia

Neurological
- Vocal Cord Paralysis
- Spasmodic Dysphonia
- Tremor

Hoarseness:
- Non-Acute
  - Functional

Acute
< 3 weeks

Constant

Infectious
- Bacterial Infection
- Fungal Infection (Monilia)

Inflammatory
- Chronic Laryngitis
- GERD
- Smoking

Trauma
- External
- Internal (Surgery, Intubation)

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Neurological
- Vocal Cord Paralysis
- Spasmodic Dysphonia
- Tremor

Hoarseness:
- Non-Acute
  - Functional

Acute
< 3 weeks

Constant

Infectious
- Bacterial Infection
- Fungal Infection (Monilia)

Inflammatory
- Chronic Laryngitis
- GERD
- Smoking

Trauma
- External
- Internal (Surgery, Intubation)

Benign Mucosal Changes
- Nodules
- Polyps
- Granuloma Cysts
- Reinke’s Edema

Neoplastic
- Malignancy: Squamous Cell Carcinoma
- Benign: Papilloma (HPV 6 & 11)
- Dysplasia: Leukoplakia

Neurological
- Vocal Cord Paralysis
- Spasmodic Dysphonia
- Tremor
Neck Mass

Inflammatory

- Lymphadenitis
  - Bacterial
  - Viral
  - Granulomatous Disease
    - Tuberculosis
    - Atypical Mycobacterium
    - Actinomycosis
    - Cat-Scratch Disease

- Sialadenitis
  - Parotid Salivary Gland
  - Submandibular Salivary Gland

Congenital

- Thyroglossal Duct Cyst
- Branchial Cleft Anomalies
- Dermoid Cyst
- Teratoma
- Lymphatic Malformation
- Hemangioma

Neoplasms

Primary

- Lymphoma
- Thyroid Neoplasm
- Neoplasm of Salivary Glands
- Neurogenic Neoplasm
  - Schwannoma
  - Neuroblastoma
  - Ganglioneuroma
- Paragangliomas
  - Carotid Body Tumors

Metastatic

- Squamous Cell Carcinoma
- Thyroid (Spread to Cervical Lymph Nodes)
- Melanoma
- Distant site (Stomach, etc.)
Otalgia

Otologic

Reflected

• Via Vagus or Glossopharyngeal Nerves
• Nasopharyngeal, Oropharyngeal, Laryngeal, Hypopharyngeal Pain
• Thyroiditis
• Aerodigestive Tract Malignancy
• Post-tonsillectomy

Periauricular

• TMJ Pathology
• Parotiditis

Increased Pain With Pinna Manipulation

External Auditory Canal
• Otitis Externa
• Osteomyelitis of Temporal Bone
• Herpes Simplex Zoster (Ramsay Hunt Syndrome if Facial Nerve Paralysis)
• Furunculosis

Mastoid
• Mastoiditis

Auricle
• Cellulitis/Perichondritis
• Trauma (Frostbite, Auricular Hematoma)
• Autoimmune (Relapsing Polychondritis)

Abnormal Tympanic Membrane
• Acute Otitis Media
• Barotrauma
• Traumatic Perforation

Ulceration/Abnormal Tissue Growth
• Squamous Cell Carcinoma
• Sarcoma
• Cholesteatoma (Typically Otorrhea)
Smell Dysfunction

ENT History, Physical Exam, Anterior Rhinoscopy
Sensory Testing, CT/MRI to Rule Out Neoplasms, Fractures & Congenital abnormalities

Nasal Obstruction/URTI
- Septal Deviation
- Allergic Rhinitis
- Bacterial/ Viral Infection (Influenza)

Trauma
- Foreign Body
- Nasal Surgery
- Base of Skull Fracture
- Nasal Fracture

Endocrine/Metabolic
- Alcoholism
- Diabetes Mellitus
- Adrenal Hypofunction
- Adrenal Hyperfunction
- Vitamin B12 Deficiency
- Zinc Deficiency
- Malnutrition

Neoplastic
- Nasal Polyps
- Juvenile Nasopharyngeal Angiofibroma

Toxins and other Factors
- Smoking
- Drugs
- Radiation
- Toxin Exposure
**Tinnitus**

**Objective**

- **Vascular**
  - Potentially Auscultated
    - **Arterial**
      - Atherosclerosis
      - Idiopathic Intracranial Hypertension
      - Acute Exacerbation of Systemic Hypertension
      - Developmental Anomaly
      - Blood flow in normal artery near ear
      - Persistent Stapedial Artery
      - Glomus Tympanicum
    - **Venous**
      - AV Shunt
      - High Jugular Bulb
      - Glomus Jugulare
      - Hyperthyroidism

- **Muscular**
  - Myoclonus of Stapedius/Tensor Tympani/Palatal Muscles
  - Degenerative Disease of the Head and Neck
  - Eustachian Tube Dysfunction

**Subjective**
- (90%)

**Objective Pulsatile or Rhythmic** (10%)
Tinnitus

Subjective

- Heard only by patient (Common)

Unilateral
- On Audiogram
- Perform MRI to rule out RC Lesion
  - Acoustic Neuroma
  - Lesion of Cochlear or Auditory Nerve
  - Brainstem Lesion
  - Multiple Sclerosis
  - Infarction
  - Ménière's Disease

Bilateral
- On Audiogram
  - No Hearing Loss
    - Metabolic Causes: Thyroid Dysfunction, Vitamin A, B, Zinc Deficiency
    - Psychogenic, Anxiety, Depression
    - Drugs (Salicylates, Quinidine, Indomethacin)
    - Idiopathic
  - Hearing Loss
    - Conductive Hearing Loss
      - Lesion of External or Middle Ear
      - Impacted Cerumen
      - Otitis Media
      - Otosclerosis
    - Sensorineural Hearing Loss
      - Noise Induced
      - Ototoxicity
      - Presbycusis
      - Drugs (Propranolol, Levodopa, Loop Diuretics)
      - Congenital

Objective
- Heard by others (Rare)

Somatic
- TMJ
- Bruxism
- Whiplash
- Skull Fracture
- Closed Head Injury

Metabolic Causes:
- Thyroid Dysfunction,
- Vitamin A, B, Zinc Deficiency,
- Psychogenic, Anxiety, Depression,
- Drugs (Salicylates, Quinidine, Indomethacin),
- Idiopathic

Subjective Hearing Loss

Objective Hearing Loss

Somatic Hearing Loss
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Cross Section of the Eye & Acronyms

Ophthalmology Acronyms

- **EOM**: Extra ocular movements
- **IOL**: Intraocular Lens
- **IOP**: Intraocular Pressure
- **OD**: Oculus Dexter (right eye)
- **OS**: Oculus Sinister (left eye)
- **OU**: Oculus Uterque (both eyes)
- **PERRLA**: Pupils Equal, Round, Reactive to Light & Accommodation
- **RAPD**: Relative Afferent pupillary defect
- **SLE**: Slit Lamp Exam
- **VA**: Visual Acuity

Ophthalmologic Cross Section of the Eye & Acronyms
**Approach to an Eye Exam**

1. **History**
2. **Obvious Physical Trauma**
3. **Initial Assessment**
   - A. Visual Acuity
   - B. Pupils
     - a. Light Reflex, Accommodation, RAPD
   - C. Ocular Movements (CN 3, 4, 6)
   - D. Visual Fields by Confrontation
4. **Slit Lamp Exam**
   - A. Lids / Lashes / Lacrimal
   - B. Sclera / Conjunctiva
   - C. Cornea
   - D. Anterior Chamber
   - E. Iris
   - F. Lens
   - G. Vitreous Humor
5. **Fundoscopy**
   - A. Retina
   - B. Optic Nerve / Disc / Cup: Disc Ratio
   - C. Macula
   - D. Fovea
   - E. Blood Vessels
Acute Vision Loss

Bilateral

Clinical Pearl:
• Patients with bilateral acute vision loss should have a CT.

Vision Loss

Acute

Unilateral

Bilateral

Complete/ Partial Homonymous Hemianopia
• Infarct
• Intracranial Hemorrhage
• Tumor

Chronic

Other

• Migraine
• Systemic Hypoperfusion
Acute Vision Loss

Unilateral

- Acute Vision Loss
  - Unilateral
    - Painful
      - Optic Nerve
        - No Abnormalities of the Optic Nerve
          - Keratopathy
          - Acute Angle Closure Glaucoma (fixed dilated pupil)
        - Abnormalities of the Optic Nerve
          - Temporal Arteritis
          - Demyelination
          - MS
          - Idiopathic
          - Glaucoma
    - Painless
      - Cornea
        - Keratopathy
      - Retina
      - Transient Ischemic Attack
      - Vitreous
        - Retinal Detachment
        - Retinal Artery Occlusion
        - Retinal Vein Occlusion
        - Ischemic Optic Neuropathy
      - Retina Visible
        - Visual Cortex Infarction
      - Retina Not Visible
        - Retinal Hemorrhage
        - Vitreous Hemorrhage

Clinical Pearls:
- Optic neuritis causes pain with EOM
- Temporal arteritis causes temporalis pain and pain with mastication
- Acute angle closure glaucoma causes high intraocular pressure, unilateral eye pain, mid-dilated pupil and n/v
- Retinal detachment can present as a veil over the vision and with flashes and floaters.
- TIA, vein or artery occlusion requires stroke work-up
Chronic Vision Loss

Anatomic

Chronic Vision Loss

Perform slit-lamp exam to localize: Left → Right on Scheme

Cornea
- Keratoconus
- Stromal Scaring
- Neovascularization
- Edema
- Pterygium

Lens
- Cataract (Nuclear, Subcapsular, Cortical)

Macula
- Age Related Macular Degeneration (Wet, Dry)

Retina
- Diabetic Retinopathy (Background, Pre-Proliferative, Proliferative)
- Retinitis Pigmentosa (Decreased night vision, loss of peripheral vision)
- Systemic inflammatory conditions

Optic Nerve
- Glaucoma (Open-Angle)

Optic Track
- Visual field defects, decrease in color vision

Clinical Pearls:
- Edema can cause halos in the vision.
- Bilateral disc swelling and any suspected mass require imaging.
Amblyopia

Deprivational*
Obstruction of Visual Axis

- Ptosis
- Congenital Cataracts
- Congenital Corneal Opacities
- Hemangioma
- Retinal Disease/Damage (undiagnosed not responsive to treatment)

Refractive Error

- Severe Anisometropia (Unequal Refractive Error)
- Hyperopia
- Astigmatism

Strabismic
Abnormal Binocular Interaction

See Strabismus scheme

Clinical Pearl:
- Congenital cataracts and retinoblastoma’s cause leukocoria and a decreased red reflex

* Can cause permanent visual impairment if not treated urgently in infancy
Diplopia

Clinical Pearls:
- Diplopia is almost always binocular.
- CN VI palsy is a red flag for intracranial masses.
- Look for ptosis with CN III palsy.
- Examine both eyes to determine which is affected.
- Neurologic symptoms suggest a mass as the cause.
- Myasthenia Gravis is fatiguable.
- Migraine is a diagnosis of exclusion.

Monocular
- Refractive Error
- Cataract/Lens Dislocation
- Functional
- Corneal Distortion/Scarring
- Vitreous Abnormalities

Neuromuscular Junction
- Myasthenia Gravis

Strictly Horizontal
(Cranial Nerve VI problem)
- Cannot Abduct

Binocular

Neuronal
(Non-Comitant)

Extraocular Muscle
Restriction/Entrapment
- Orbital Inflammation
- Orbital Tumor
- Orbital Floor Fracture

Horizontal and/or Vertical

Cranial Nerve III
- Eye depressed, abducted, ptosis, large/unreactive pupil

Cranial Nerve IV
- Eye cannot depress when looking medially

Grave's Ophthalmopathy
- Hyperthyroidism

- Ischemia
- Diabetes Mellitus
- Aneurysm
- Trauma

- Ischemia
- Diabetes Mellitus
- Aneurysm
- Trauma
- Subdural Hemorrhage

Diplopia
Neuro-Ophthalmology

Visual Field Defects

- Optic Chiasm Lesion (bitemporal hemianopia)
  - Pituitary/metastatic tumor
  - Craniopharyngioma
  - Meningioma
  - Optic nerve glioma
  - Aneurysm
  - Infection
  - MS
  - Sarcoidosis

- Optic Nerve Lesion (Monocular vision loss)

- Optic Tract Lesion (Incongruous right homonymous hemianopia)

- Lateral Geniculate Nucleus Lesion (Right homonymous horizontal sectroanopia)

- Meyer’s Loop Lesion (Incongruous superior homonymous quadrantanopia)

- Right Parietal Lobe Lesion (Inferior homonymous hemianopia)
Pupillary Abnormalities

Isocoria

Relative Afferent Pupil Defect

- Optic Neuritis
- Ischemic Optic Neuropathies
- Optic Nerve Tumor
- Retinal detachment
- Traumatic/Compressive Optic Neuropathy

Bilateral Impairment

Dilated Pupils (Mydriasis)

- Syphilis (light-near dissociation)
- Pharmacologic (e.g., Opioids, Alcohol)

Constricted Pupils (Miotic)

Dorsal Midbrain (Parinaud’s Syndrome)

- Tumor
- Hemorrhage
- Hydrocephalus

Neuromuscular Junction Dysfunction

- Botulism

Pharmacologic

- Atropine
- LSD
- Cocaine
- Amphetamines
Pupillary Abnormalities

Anisocoria

**Clinical Pearl:**
- Pupils should be examined in both a light and dark setting to determine whether the big pupil or the small pupil is abnormal.
Red Eye

Atraumatic

Clinical Pearl:
- Orbital cellulitis can present with pain on EOM and orbital signs of involvement
Red Eye

Traumatic

- Surface Injury
  - Corneal Abrasion
  - Ultraviolet Keratitis
  - Chemical (Acid, alkali)

- Blunt Trauma
  - Hyphema, diplopia, periorbital ecchymosis, subcutaneous emphysema of lid

- Globe Penetrating Injury
  - Hyphema, history of trauma/high velocity impact, reduced visual acuity

- Associated Injury
  - Lids: Swelling, Laceration
  - Conjunctiva: Subconjunctival hemorrhage
  - Cornea: Abrasion
  - Iris: Laceration, iritis, iridodialysis
  - Pupil: Traumatic mydriasis
  - Lens: Cataract, dislocation
  - Vitreous hemorrhage
  - Retina: Tear, hemorrhage, choroidal rupture
  - Glaucoma
  - Optic Neuropathy

Clinical Pearls:
- With chemical burns, it is important to determine if the burn was caused by acid or worse, alkali.
- With a globe-penetrating injury, call ophthalmology, shield the eye, and do not touch the eye.
Strabismus
Ocular Misalignment

Clinical Pearl:
- Strabismus is most often seen in pediatrics.
Pediatric

Abdominal Mass.................................317
Acute Abdominal Pain........................318
Acute Renal Failure............................319
Altered Level Of Consciousness............320
Anemia By MCV..................................321
Anemia By Mechanism........................322
Bleeding / Bruising.............................323
Chronic Abdominal Pain.....................324
Chronic Kidney Disease.....................325
Congenital Anomalies........................326
Constipation (Pediatric).....................327
Cyanosis in the Newborn....................328
Dehydration......................................329
Depressed / Lethargic Newborn............330
Developmental Delay..........................331
Diarrhea (Pediatric)............................332
Dysuria............................................333
Edema.............................................334
Enuresis..........................................335
Febrile Seizures..................................336
Fever (Age <1 Month).........................337
Fever (Age 1-3 Months)......................338
Fever (Age >3 Months).......................339
Global Developmental Delay / Intellectual Disability.............................340
Headache.........................................341
Hematuria.........................................342
Hypernatremia....................................343
Hypoglycemia ................................................................. 344
Hyponatremia ................................................................. 345
Hypotonic Infant (Floppy Newborn) .................. 346
Increased Urinary Frequency ................................. 347
Large for Gestational Age ........................................... 348
Limp ............................................................................ 349
Long PT (INR), Long PTT ........................................... 350
Long PT (INR), Normal PTT ...................................... 351
Lymphadenopathy ....................................................... 352
Malnutrition ................................................................. 353
Microcytic Anemia ....................................................... 354
Mouth Disorders (Pediatric) ..................................... 355
Murmur In The Newborn (<48 Hours) ............... 356
Murmur In The Newborn Beyond Neonatal Period ......................................................... 357
Neonatal Jaundice ......................................................... 358
Approach To Direct Hyperbilirubinemia .......... 358
Neonatal Jaundice Approach To Indirect Hyperbilirubinemia ......................................... 359
Noisy Breathing Pediatric Stridor ......................... 360
Noisy Breathing Pediatric Wheezing ..................... 361
Non-Epileptic Paroxysmal Event ............................ 362
Normal PT (INR), Long PTT ..................................... 363
Otalgia (Earache) ......................................................... 364
Pediatric Cough Acute ............................................... 365
Pediatric Cough .......................................................... 366
Chronic ................................................................. 366
Pediatric Dyspnea ....................................................... 367
Pediatric

Pediatric Epilepsies .................................................... 368
Pediatric Fractures ..................................................... 369
Pediatric Infectious Skin Rash ................................. 370
Pediatric Mood And Anxiety Disorders ................. 371
Pediatric Seizures ..................................................... 372
Pediatric Vomiting ..................................................... 373
Preterm Infant Complications (<34 Weeks) 374
Preterm Infant Complications (34-36 Weeks) ............. 375
Proteinurina .......................................................... 376
Rash (Eczematous) .................................................... 377
Rash (Papulosquamous) ........................................... 378
Rash (Pustular) ......................................................... 379
Rash (Reactive) ......................................................... 380
Rash (Vesiculobullous) ............................................ 381
Respiratory Distress In The Newborn ............... 382
Respiratory Distress In The Newborn
Tachypnea ................................................................. 383
Salter Harris Physeal Injury Classification ... 384
School Difficulties ..................................................... 385
Scrotal Mass .............................................................. 386
Shock ........................................................... 387
Short Stature ............................................................. 388
Skin Lesion (Primary Skin) ...................................... 389
Skin Lesion (Secondary Skin) ..................... 390
Small for Gestational Age ............................. 391
Sore Throat/Sore Mouth ........................................ 392
Sudden Paroxysmal Event ..................................... 393
Sudden Unexpected Death In Infancy (SUDI)

.................................................................................................................. 394

Thrombocytopenia................................................................. 395
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Pediatric Abdominal Mass

- Liver: Hepatomegaly
- Kidney: Hydronephrosis, Congenital cystic disease
- Bowel: Constipation, Appendicitis, Meckles
- Spleen: Splenomegaly, Splenic rupture
- Genitourinary: Ovarian cyst, Pregnancy

*Indicates Key Condition

This is not an exhaustive list of medical conditions.
*Indicates Key Condition
This is not an exhaustive list of medical conditions.

# Acute Abdominal Pain

## Acute Abdominal Pain (< 72 hours)

Evaluate for Red Flags suggestive of Surgical/Acute Abdomen:
- History and physical exam
- Consider Labs (selection depends on clinical history and exam)
- Consider Imaging (X-ray, ultrasound)

## Focal

### Upper Abdominal Pain
- Biliary/Hepatic
  - Biliary Colic
  - Cholecystitis
  - Choledocholithiasis
  - Hepatitis
- Pancreatic
  - Pancreatitis

### Upper GI tract
- Gastroesophageal reflux/gastroesophageal reflux disease*
- Malrotation/Volvulus*
- Gastroenteritis*
- Peptic Ulcer

### Other
- Referred pain (eg. Pneumonia*)
- Musculoskeletal injury

## Periumbilical/
Lower Abdominal Pain

### GI tract
- Acute Abdomen*
- Appendicitis*
- Intussusception*
- Malrotation/Volvulus*
- Incarcerated Hernia
- Obstruction
- Constipation*
- Gastroenteritis*

## Generalized

### Metabolic (eg. Diabetic Ketoacidosis*)
- Henoch-Schonlein Purpura*
- Sickle cell disease
- Gastroenteritis*
- Functional*

### Spleen
- Splenic rupture
- Acute splenic enlargement (eg. Infectious, sequestration)

### Other
- Functional*
- Musculoskeletal injury
Acute Renal Failure

Acute decrease in Glomerular Filtration Rate (GFR)

**Pre-Renal**
(FeNa < 1%, bland urine sediment)
- Shock* (Eg. Hypovolemia, decreased cardiac output, etc.)
- Renovascular Thrombi/Emboli
- Hepatorenal syndromes

**Renal**
(FeNa > 2%)

- Urinalysis, urine microscopy, CBC

**Tubular/Interstitial**
- Sterile pyuria, eosinophiluria, epithelial casts

**Post-Renal**
(Obstruction/hydronephrosis on U/S)
- Constipation*
- Tumor (Eg. Wilms Tumor*)
- Congenital defects (Eg. Posterior Urethral valve)
- Urolithiasis
- Blocked Foley catheter

**Glomerular**
- Immune-complex deposition (IgA nephropathy*, post-infectious*, lupus)
- Antibody mediated (anti-GBM antibodies)
  - Anti GBM/ Goodpastures
- Pauci-immune (+ANCA)
  - Granulomatosis with polyangitis
  - Polyarteritis Nodosa
- Henoch Schonlein Purpura*
- Hemolytic Uremic Syndrome*

*Indicates Key Condition
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Altered Level Of Consciousness

- Stabilize:
  - A: Airway
  - B: Breathing
  - C: Circulation
  - D: Disability (Glasgow Coma Scale)
  - D: Dextrose check

- History and physical exam

Drugs
- Poisoning/intoxication* (Eg. Opioids, beta blockers, diabetes medications, alcohol etc.)

Infection
- Bacterial (Eg. Meningitis*, intracranial abscess, sepsis*)
- Viral (Eg. Encephalitis*)

Metabolic
- Hypoglycemia*
- Hypernatremia*
- Hyponatremia*
- Metabolic disease*

Structural
- Trauma/head injury*
- Abusive head trauma*
- Brain tumor*
- Increased intracranial pressure* (Eg. Hydrocephalus, space occupying lesions, idiopathic, drugs)
- Vascular (Eg Stroke, arteriovenous malformation, aneurysm)
- Concussion*

Other
- Seizure/status epilepticus*
- Cardiac (Eg. Arrhythmia)
- Syncope*
- Migraine* (atypical presentation)
- Immune-mediated encephalitis

*Indicates Key Condition
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Anemia By MCV

- Iron Deficiency*
- Thalassemia*
- Lead Poisoning
- Anemia of Chronic Disease
- Sideroblastic anemia
- Anemia of Chronic Disease (Eg. Juvenile idiopathic arthritis*, IBD*, Chronic Infection, etc.)

- Bleeding*
- Hemolysis*
- Marrow Failure/infiltration (Eg. Leukemia*, Lymphoma*, Neuroblastoma*)
- Consumption/sequestration
- Anemia of Chronic Disease (e.g. Renal Disease, Liver Disease, Endocrinopathy, Chronic Inflammation, Chronic Infection)

- B12 Deficiency
- Folate Deficiency
- Drugs
- Reticulocytosis
- Liver Disease
- Hypothyroidism

*Indicates Key Condition

This is not an exhaustive list of medical conditions.
Anemia By Mechanism

- **Normocytic, normochromic RBCs Increased reticulocytes**
  - If chronic may have: Decreased Reticulocytes, MCV, MCH, MCHC, Serum Iron, Ferritin Increased TIBC, Hypochromic RBCs

- **Blood Loss**
- **Decreased RBC Production**
  - Iron Deficiency*
  - Leukemia*
  - B12/Folate Deficiency
  - Aplastic Anemia
  - Anemia of Chronic Disease
- **Chronic bleed**

- **Hemolysis*/ Increased RBC Destruction**
  - Increased Reticulocytes, Increased Unconjugated Bilirubin, decreased haptoglobin, increased LDH, Spherocytes on Smear

- **Consumption/Sequestration**
  - Hypersplenism/
  - Splenomegaly
  - Thrombus

- **Normocytic, normochromic RBCs Increased reticulocytes**

*Indicates Key Condition

This is not an exhaustive list of medical conditions.
Bleeding / Bruising

**Bleeding/Bruising**

- Detailed history and physical exam
  - Rule out purpura
  - Consider Non-accidental Injury

- Check CBC, INR and PTT

1. **History of mucosal bleeding**
   - Petechiae and bruising on exam
     - Low platelets
     - Normal INR, normal PTT

2. **Platelets**
   - Thrombocytopenia
     - See Bleed and Bruising: Approach to Thrombocytopenia
   - Disordered Platelet Function
     - Congenital disorders of platelet function
     - Drugs (Eg. Ibuprofen, aspirin)

3. **Vascular System**
   - Normal platelets
   - Normal INR, normal PTT

4. **Disorders of Coagulation**
   - May have history of prolonged bleed, hemarthrosis positive family history
   - Normal platelets
   - Increased INR and/or PTT

   - Connective Tissue Disorders
   - Inflammatory/vasculitis
   - Drugs

   - See Bleed and Bruising: Approach to Disorders of Coagulation

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Chronic Abdominal Pain

Assess for Red Flags:
- History of pain waking from sleep, bloody stools, systemic symptoms (fever, weight loss/FTT, rash, joint swelling)
- Labs: CBC, BUN, Creat, Albumin, CRP, ALT, GGT, Celiac
- Imaging: Ultrasound

Upper Abdominal Pain
- Hepatitis/ Gallbladder disease
- Chronic Pancreatitits
- Gastritis/ Duodenitis Ulcer
- Gastroesophageal reflux/Gastroesophageal reflux disease*
  - Celiac Disease*
  - Lactose Intolerance/ Dietary
  - Constipation*
  - Functional* /Irritable Bowel Syndrome
  - Inflammatory Bowel Disease*

Diffuse/ Lower Abdominal Pain

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Chronic Kidney Disease

Decreased kidney function (eGFR < 60ml/min/1.73m²) persistent over at least 3 months

- Pre-Renal
  - (Evidence of Renovascular disease)
    - Renal artery stenosis
    - Drugs (Eg. NSAIDs)
    - Chronic hypoperfusion

- Renal
  - (Abnormal urinalysis: proteinuria/pyuria)

- Post-Renal
  - (Obstruction/hydronephrosis on U/S)
    - Obstructive uropathy
    - Reflux nephropathy
    - Constipation*

- Tubular/Interstitial
  - Urinary Tract Infection* (chronic or recurrent pyelonephritis)
  - Congenital abnormalities of the kidney and urinary tract (Eg. Polycystic kidney disease)
  - Immune (sarcoid, Sjögren)
  - Hypercalcuira/nephrolithiasis
  - Drugs (NSAIDs, analgesics)

- Glomerular
  - Nephrotic Syndrome* (steroid resistant)
  - Glomerulonephritis*
  - Hemolytic Uremic Syndrome*
  - Diabetes*

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
**Congenital Anomalies**

- **Embryonic development failure or inadequacy (often multifactorial)**
- **Abnormal mechanical forces distorting otherwise normal structures (e.g. exoligohydramnios)**
- **Destruction/ Breakdown of previously normal tissue (e.g. ischemia)**
- **Chromosomal**
- **Single Gene**
- **Teratogenic**
- **Association (e.g. VACTERL)**

**Things to Consider:**
- **History** – Prenatal: maternal health, exposures, screening, ultrasounds; delivery; neonatal
- **Family History** – Three Generations: prior malformations, stillbirths, recurrent miscarriages, consanguinity
- **Physical Exam** – Variants, minor anomalies, major malformation
- **Diagnostic Procedures** – Chromosomes, molecular/DNA, radiology, photography, metabolic
- **Diagnostic Evaluations** – Prognosis, recurrence, prenatal diagnosis, surveillance, treatment
Constipation (Pediatric)


**Neonate/Infant**

**Dietary/Functional**
- Insufficient intake/
  Nutrition and feeding issues*

**Systemic Disease**
- Hypothyroidism

**Anatomic**
- Intestinal Atresia*
- Cystic Fibrosis*
- Imperforate Anus
- Anal Atresia
- Intestinal Stenosis

**Older Child**

**Dietary/Functional**
- Insufficient intake/
  Nutrition and feeding issues *
- Withholding
- Painful (eg. Fissures)
- Drugs (Narcotics, Psychotropics)

**Systemic Disease**
- Celiac disease*
- Hypothyroidism

**Neurologic**
- Hirschsprung’s Disease

**Anatomic**
- Bowel Obstruction
- Pseudo-obstruction

*Indicates Key Condition
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Cyanosis in the Newborn

*Indicates Key Condition
This is not an exhaustive list of medical conditions.

Cyanosis (<48 hrs)

- Detailed pregnancy and delivery history
- Detailed physical exam
  - check SaO2
- Otherwise appears well
  - SaO2 normal
  - Cyanosis of hands, feet, perioral

Central Cyanosis

- Apply oxygen
- Chest x-ray

Peripheral Cyanosis

- Acrocyanosis (often normal in otherwise healthy newborns)

No improvement of SaO2 with supplemental O2

Cardiovascular

- Congenital Heart Disease*
  - Transposition of the Great Arteries
  - Truncus Arteriosus
  - Total Anomalous Pulmonary Venous Return
  - Tricuspid Atresia
  - Tetralogy of Fallot
  - Pulmonary Atresia
  - Ebstein’s anomaly

Improvement of SaO2 with supplemental O2

Respiratory

- Often presents with significant respiratory distress
- May not necessarily be cyanotic

Upper Airway

- Congenital upper airway obstruction (e.g. Atresia, laryngomalacia)
- Airway compression (Eg. Congenital neck mass, mediastinal mass)

Lower Airway

- Pneumonia*
- Pneumothorax
- Meconium aspiration/meconium pneumonitis
- Congenital lung anomalies

Other

- Sepsis*
- Hematologic (e.g. Anemia*, Hemoglobinopathies*, Polycythemia
- Metabolic disease*
- Persistent Pulmonary Hypertension
- Disordered control of breathing (Eg. Seizure*, birth trauma* causing intracranial injury, peripartum maternal narcotics)

⚠️ Potentially acutely life-threatening presentation
Dehydration

History and Physical exam

Clinical assessment of dehydration severity

- Slightly decreased urine output
- Slightly increased thirst
- Slightly dry mucous membrane
- Normal to Slightly elevated heart rate
- Normal blood pressure
- Normal skin turgor

- Decreased urine output
- Moderately increased thirst
- Dry mucous membrane
- Elevated heart rate
- Normal blood pressure
- Decreased skin turgor
- Sunken eyes
- Sunken anterior fontanelle

- Markedly decreased or absent urine output
- Greatly increased thirst
- Very dry mucous membrane
- Greatly elevated heart rate
- Hypotension
- Decreased skin turgor
- Very sunken eyes
- Very sunken anterior fontanelles
- Cold extremities
- Lethargy, altered level of consciousness

Mild Dehydration*
- Infant 5%
- Child 3%

Moderate Dehydration*
- Infant 10%
- Child 6%

Severe Dehydration*
- Infant >15%
- Child >9%

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Depressed / Lethargic Newborn

Child Related
- Congenital
  - Birth Injury
  - Congenital Malformation
  - TORCH Infection
  - Congenital Heart Defect
- Respiratory
  - Respiratory Distress Syndrome
  - Birth Asphyxia
  - Pneumothorax
  - Meconium Aspiration
  - Sepsis

Maternal Related
- Drugs (Ex. SSRI)
- Diabetes Mellitus
- Gestational Hypertension

Other
- Anemia
- Shock
- Hypothermia
- Hypoglycemia
Developmental Delay

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This is not an exhaustive list of medical conditions.

Developmental Delay
(Development at least 2 Standard Deviations below expected for age)

Detailed medical and developmental history
Physical Examination
Developmental Observations
Consider social/environmental impacts

Developmental Delay
No loss of milestones

Developmental Delay
Loss of milestones

Delay in 2 or more domains

Delay in single domain

Motor Delay
(Gross Motor and/or Fine Motor)*

Speech/Language Delay*

Social Delay

Delays in 2 or more domains include:
1. Motor (fine and/or gross motor)
2. Language
3. Social

See “Development/Behavioural/Learning Problems: Clinical approach to Global Developmental Delay/Intellectual Disability”

- Metabolic disease*
- Malignancy (e.g. Brain tumor)*
- Neurodegenerative disease

- Cerebral Palsy*
- Developmental Coordination Disorder
- Benign Congenital Hypotonia
- Neuromuscular disorder

- Hearing impairment*
- Isolated speech delay
- Selective Mutism
- Mechanical (e.g. dental, cleft palate)

- Autism Spectrum Disorder* (Note that can often present with an associated speech delay as well)
- Genetic disease
**Diarrhea**
(Pediatric)

---

**Pediatric Diarrhea**

- History and physical exam

**Acute (<2 weeks)**

- **Dietary**
  - High sugar load
  - Lactose intolerance

- **Infectious**
  - Viral (Gastroenteritis*)
  - Bacteria (Eg. *E. coli*, *Salmonella*, *Yersinia*, *Campylobacter*, *Shigella*)
  - Parasitic (Eg. *Giardia*, *E histolytica*)

**Drugs**

- Antibiotics
- Laxatives

**Non-Bloody**

- Red Flags: Night time awakening, systemic symptoms (fever, weight loss/FTT, rash, joint swelling)

**Bloody (Red Flag)**

- Inflammatory bowel Disease* (Crohn’s disease, Ulcerative Colitis)
- *C Difficile
- Drugs (Eg. Antibiotics, laxatives)

**Red flags present**

- Celiac Disease*
- Inflammatory Bowel Disease* (Crohn’s Disease)
- Pancreatic Insufficiency
- Secretory neoplasm

**No red flags**

- Celiac Disease*
- Constipation* with overflow diarrhea
- Lactose Intolerance
- Bacterial Overgrowth
- Carbohydrate malabsorption
- Drugs/Toxins
- Hyperthyroid
- Irritable bowel syndrome

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
**Dysuria**

**Detailed history of physical exam**
- Urinalysis
- Urine cultures

**Normal Genitourinary exam**

- **Urine Culture positive**
  - *Urinary Tract Infection*
    - Fever, other systemic symptoms
    - Upper Urinary Tract Infection/Pyelonephritis
      - Bacterial
      - Candida
      - Sexually Transmitted Infections*
    - Lower Urinary Tract Infection/Cystitis
      - Bacterial
      - Candida
      - Sexually Transmitted Infections*
  - No fever, otherwise well

- **Urine Culture negative**
  - Further urine studies warranted
    - Viral infection
    - Inflammatory (Eg. **Kawasaki Disease***)
    - Nephrolithiasis

**Abdominal Genitourinary exam**

**Vesicles or Ulcers**
- Sexually Transmitted Infections*
- Infectious (Eg. HSV, CMV)
- Systemic inflammatory illness (Eg. Steven-Johnson syndrome)
- Autoimmune conditions (Eg. **Inflammatory bowel disease***, Becets disease)

**No vesicles or ulcers**
- **Vulvo-vaginitis*** (Eg. Group A Streptococcus infection, candida infection, irritation)
- **Balanitis***
- **Phimosis***
- Labial adhesions
- Anatomic (Eg. Trauma, chemical irritation, foreign body)
- Dermatologic (Contact dermatitis, lichen planus, psoriasis, inflammatory skin conditions)

*Indicates Key Condition

This is not an exhaustive list of medical conditions.
Edema

Clinical history
Clinical fluid assessment

Altered Starling's Forces

Increased Interstitial Oncotic Pressure
- Hypothyroid (Myxedema)

Increased Capillary Hydrostatic Pressure
- Renal
  - Renal failure*
  - Glomerulonephritis*
- Cardiac
  - Congestive heart failure*
  - Constrictive pericarditis
- Other
  - Pregnancy
  - Portal hypertension

Decreased Capillary Oncotic Pressure
- Nephrotic syndrome*
- Nephritic syndrome*
- Liver failure/Cirrhosis
- Protein losing enteropathy
- Burn*
- Malnutrition

Increased Capillary Permeability
- Sepsis*
- Vasculitis/inflammation (e.g. Henoch Schönlein Purpura, Kawasaki disease*, Systemic Lupus Erythematosus)
- Burn*
- Anaphylaxis*

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Enuresis

Rule in/out age-appropriate enuresis
Day time continence age 4
Night time continence age 5

Nocturnal Enuresis
Urinary Control Never Achieved
- Primary Nocturnal Enuresis
  (considered variation in the development of normal bladder control)
- Secondary Nocturnal Enuresis
  - Behavioural/Psychogenic (Child Abuse*)
  - Constipation*
  - Diabetes mellitus*
  - Diabetes insipidus
  - Urinary tract infection*
  - Renal failure* (Chronic kidney disease)
  - Neurologic (Cerebral palsy*, seizure*, spinal cord pathology)

Diurnal Enuresis
> 6 Month Conti neence Prior
- Bladder function
  - Overactive bladder
  - Dysfunctional voiding
  - Voiding postponement
  - Giggle incontinence
  - Vaginal voiding
- Behavioural
  - Behavioural/Psychogenic (Child Abuse*)
  - Anxiety
- Medical
  - Constipation*
  - Diabetes mellitus*
  - Diabetes insipidus
  - Urinary tract infection*
  - Renal failure* (Chronic kidney disease)
  - Neurologic (Cerebral palsy*, seizure*, spinal cord pathology)
  - Structural (ectopic ureter, posterior urethral valve)

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Febrile Seizures

1. Age 6 mo to 6 yr
2. Temp 38.5°C
3. Neurologically normal exam before and after seizure

* If < 6 mo, not a febrile seizure -> LP

* If neuro deficits or lethargic on exam need to rule out CNS infection -> CT, LP

Simple Febrile Seizures

1. Generalized
2. < 15 min
3. 1 seizure in 24 hours

1. No Investigations for seizure
2. Work-up source of fever (ear exam, consider urinalysis and culture, CBC)

1. 1/3 risk of having future febrile seizure
2. No significant increased risk of epilepsy
3. No brain damage, no impact on intelligence

Complex (Atypical) Febrile Seizures

1. Focal
2. >= 15 min
3. > 1 seizure in 24 hours

1. ~1/3 risk of having future febrile seizure
2. Slightly increased risk of epilepsy (4-6%)
3. No brain damage from short (<15 min) sz

1. EEG
2. Consider CT/MRI, especially if focal features
3. Consider LP (clinical decision; higher threshold to do LP if prolonged seizure, age 6-12 mo, or focal features)
4. Work up source of fever

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Fever (Age <1 Month)

Detailed History and Physical Exam

Rule out sepsis:
CSF, blood and urine cultures
Always consider and treat for bacterial sepsis, until proven otherwise

Non infectious

Extremely rare. Always consider and treat for bacterial sepsis first

Infectious

Bacterial
  - Urinary Tract Infection*
  - Meningitis*
  - Occult bacteremia/sepsis*
  - Skin and soft tissue infections (Osteomyelitis*, septic arthritis*)
  - Pneumonia*

Viral*
  - Encephalitis* (Herpes Simplex Virus)
  - Respiratory viruses

Other
  - Extremely rare. Seen mostly in immunodeficiency. Always consider and treat for bacterial sepsis first
    - Fungal
    - Parasites

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Fever (Age 1-3 Months)

1. Fever
   Age 1-3 months

2. Detailed History and Physical Exam

3. Consider both
   Clinical approach to Fever in the <1 month old, AND
   Clinical approach to Fever in the >3 month old
Fever (Age >3 Months)

Fever: Age >3 months

Clinical features and investigations not suggestive of infection
Often acute onset

Clinical features and investigations not suggestive of infection
Often fever > 5 days

Infectious

Bacterial
- Pneumonia*
- Otitis Media*
- Urinary Tract Infection*
- Occult bacteremia/sepsis*
- Meningitis*/Meningococemia*
- Skin and soft tissue infections (Osteomyelitis*, septic arthritis*)
- Bacterial respiratory tract infections (Pharyngitis*, pertussis*, tracheitis*, pertonsillar abscess*, retropharyngeal abscess/cellulitis*, cervical adenitis*)

Viral
- Respiratory viruses (Eg. Influenza, RSV, rhinovirus, enterovirus, adenovirus, etc.)
- Mononucleosis*
- Gastroenteritis*

Other
- Extremely rare. Seen mostly in immunodeficiency, or occasionally acquired while travelling
  - Fungal
  - Protozoa (eg. malaria)
  - other parasites

Non infectious

Malignancy
- Leukemia*
- Lymphoma*
- Neuroblastoma*
- Brain tumor*
- bone tumor*

Autoimmune/Inflammatory
- Kawasaki disease*
- Inflammatory Bowel Disease*
- Systemic Lupus Erythematosus
- Juvenile Idiopathic Arthritis

Other
- Acute abdomen* (Eg. appendicitis*)

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Global Developmental Delay / Intellectual Disability

Delays in 2 or more domains including:
1. Motor (fine and/or gross motor)
2. Language
3. Social

Detailed medical and developmental history
Physical Examination
Developmental Observations
Consider social/environmental impacts

Prenatal

Intrinsic
- Genetic (Eg. Trisomy 21*, Fragile X, Rett syndrome, 22q11 deletion)
- Metabolic disease*
- CNS malformations
- Congenital hypothyroidism

Extrinsic
- Teratogens/Toxins (Eg. alcohol, drugs, medications)
- Congenital infections* (Eg. TORCH infections)

Perinatal

- Prematurity*
- Birth trauma* (Eg. intracranial hemorrhage, asphyxia/Hypoxic ischemic encephalopathy)
- Neonatal complications

Postnatal

- Trauma and brain injury (hypoxia, abusive head trauma*, accidental trauma, etc.)
- CNS infection (Eg. Meningitis*, encephalitis*)
- Neglect*
- Toxins (Eg. lead)

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Headache

Evaluate for Red Flags

**Primary**
- Aura, severe throb, front/temporal, nausea and vomiting, photo/phonophobia
- Migraine*
- Tension*
- Other
  - Primary exertional headache
  - Trigeminal autonomic cephalgias

**Secondary**
- History: Fever, drugs, trauma
  - Physical Exam: Decreased level of consciousness, increased intracranial pressure, fever, focal neurological deficits

**Infection**
- Fever, ΔLOC, meningismus, focal neuro signs
  - Meningitis*
  - Encephalitis*
  - Brain Abscess

**Vascular**
- Sudden onset, may have Δ, ICP, focal neuro signs
- Hemorrhagic or ischemic stroke
- Ruptured AVM
- Immune mediated vasculitis
- Metabolic disease causing stroke
- Brain tumor*
- Hydrocephalus

**Mass/Structural**
- Morning HA, worse valsalva signs Δ, ICP, focal neuro signs
- History of head trauma (may not have a clear history if non-accidental trauma)
- Primary head/neck trauma (Eg. Abusive head trauma*)
- Concussion*

**Trauma**
- Sinusitis*
- Idiopathic Intracranial Hypertension
- Medication overuse

*Indicates Key Condition

This is not an exhaustive list of medical conditions.
Hematuria

Extraglomerular
- Vascular (Thrombosis, vascular malformations) Nutcracker syndrome
- Infectious (Pyelonephritis*, UTI*)
- Traumatic (Perineal irritation, vulvovaginitis*, trauma)
- Neoplasm (Wilms Tumor*)
- Renal calculi/hypercalciuria
- Sickle cell disease
- Bleeding diathesis (Eg. Hemophilia*, Immune Thrombocytopenia Purpura*)

Glomerular
- Brown urine, dysmorphic RBCs, casts, proteinuria

Isolated Hematuria with Benign Sediment
- IgA nephropathy*
- Thin basement membrane
- Alport
- Benign Familial Hematuria
- Henoch Schonlein Purpura*

Hematuria with Active Sediment
- Urinalysis Urine microscopy
- Exclude other causes of red urine
  - Myoglobin (Eg. Rhabdomyolysis)
  - Non-urinary sources of blood (Eg. menstruation, hematochezia)
  - Dyes (Eg. Beets, food coloring)
  - Drugs (Eg. Nitrofurantoin, Rifampin)

C3
- Normal/high C3
  - Antibody mediated (anti-GBM antibodies)
    - Anti GBM/ Goodpastures
    - Pauci-immune (+ANCA)
    - Granulomatosis with polyangiitis
    - Polyarteritis Nodosa
    - Henoch Schonlein Purpura*
    - Hemolytic Uremic Syndrome*
- Low C3
  - Immune Complex mediated
    - Post-infectious glomerulonephritis*
    - Membranoproliferative glomerulonephritis
    - Lupus nephritis

*Indicates Key Condition
This is not an exhaustive list of medical conditions.


**Hypernatremia**

Hypovolemic/Euvolemic → Check clinical volume status → Hypovolemic

- **Salt Excess**
  - Exogenous
    - Abuse/Neglect*
    - Iatrogenic
    - Inappropriate formula preparation
  - Endogenous
    - Hyperaldosteronism

- **Water Deficit**
  - Fluid losses
    - Uosm > 600
      - Abuse/Neglect*
      - Brain Tumor*
      - Hypothalamic dysfunction
  - Reduced intake

- **Renal Loss**
  - Uosm > Posm, Uosm 300-600
    - Osmotic Diuresis
      - Diabetic Ketoacidosis* (Glucosuria)
      - Mannitol
      - Post-obstructive diuresis
      - Polyuric Acute Tubular Necrosis
    - Diabetes Insipidus
      - Uosm < Posm
      - FeNa > 1%
      - U Na < 10
      - Nephrogenic Diabetes Insipidus
      - Central Diabetes Insipidus
  - GI Loss
    - Uosm > 600
      - Gastroenteritis*

- **Insensible Loss**
  - Uosm > 600
    - Burns*
    - Sweat
    - Respiratory losses

*Indicates Key Condition

This is not an exhaustive list of medical conditions.
Pediatric Hypoglycemia

Hypoglycemia

Suspect in any child who is unwell, and with decreased level of consciousness
Neonates <2.6 mmol/L
Beyond neonatal period <4.0 mmol/L

Decreased Substrate
- Prolonged fast (e.g., Malnutrition*, Neglect*, Disordered Eating*)
- Prematurity*
- Small for Gestational Age*

Endocrine
- Hyperinsulinism
- Decreased Counter-regulation
  - Panhypopituitarism
  - Growth hormone deficiency
  - ACTH deficiency
  - Hypothyroid
  - Adrenal insufficiency

Metabolic
- Metabolic Disease*

Increased Demand
- Sepsis*
- Congestive Heart Failure*
- Renal Failure*
- Shock*
- Poisoning/Intoxication* (e.g., Insulin, Sulfonylurea drugs)

⚠️ Potentially acutely life-threatening presentation

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Hyponatremia

Is this TRUE hyponatremia?
Check plasma osmolality

True Hyponatremia

Is ADH appropriately suppressed?
Check urine osmolality

Urine osmolality <100

ADH suppressed

Polydipsia
Decreased osmolar intake
- Abuse/neglect*
- Inappropriate formula
- Water intoxication
- Abuse/neglect*
- Inappropriate formula
- Iatrogenic

Hypovolemic

- Renal (UNa >20, FENa >1%)
  - Osmotic diuresis (Eg. Diabetic Ketoacidosis*)
  - Hypoaldosteronism
  - Diuretics
  - Polyuric Acute Tubular Necrosis
  - Extra renal (UNa<10, FENa <1%)
    - GI losses (gastroenteritis*, pyloric stenosis*)
    - Insensible losses (Cystic Fibrosis*, Burns*)

Hypovolemic

- SIADH
- Endocrinopathies
- Adrenal insufficiency

Euvolemic

- Low intravascular volume (↓EABV)
  - Low UNa esp. <20):
    - Congestive heart failure*
    - Nephrotic syndrome*
    - Nephritis syndrome*
    - Sepsis* with capillary leak

Pseudo-Hyponatremia

- Hyperglycemia
- Hypertriglyceridemia

Urine osmolality >100

ADH present

Why is ADH present?
Check clinical volume status

Euvolemic

- High intravascular volume (↑EABV)
  - UNa >20, FENa >1%:
    - Renal Failure*
**Hypotonic Infant** (Floppy Newborn)

**Hypotonic Infant***

- Detailed history
- Detailed physical exam

**Neurological**

- Upper Motor Neuron
  - Decreased LOC, low to normal strength, normal reflexes

- Lower Motor Neuron
  - Profound weakness, muscle atrophy, fasciculations, absent reflexes

- Brain
  - Chromosomal (Eg. Trisomy 21*), genetic (Eg. Prader Willi)
  - Head injury* or Birth Trauma* (Eg. Hypoxic-Ischemic Encephalopathy, Intracranial Hemorrhage)
  - Intracranial Infection (Eg. Meningitis*, encephalitis*)
  - Increased intracranial pressure*
  - Congenital intracranial structural anomalies
  - Benign Congenital Hypotonia

**Systemic Illness**

- Sepsis*
- Metabolic Disease*
- Hypoglycemia*
- Hypothyroidism

- Weakness distal=>proximal
  - Reduced reflexes
  - May have sensory changes
  - May have autonomic changes

- Weakness includes bulbar reflexes, fatiguable

- Weakness proximal=>distal
  - Reduced reflexes
  - Muscle atrophy

**Anterior Horn Cell**

- Spinal Muscular Atrophy
- Trauma
- Hematoma
- Abscess

**Nerves**

- Hereditary sensory autonomic neuropathy
- Guillain Barre Syndrome

**Neuromuscular Junction**

- Congenital Myasthenia Gravis
- Infantile Botulism
- Drugs

**Muscle**

- Congenital Muscular Dystrophies
- Congenital Myotonic Dystrophies
- Metabolic Disease*

*Indicates Key Condition

This is not an exhaustive list of medical conditions.
Increased Urinary Frequency

Detailed history and physical exam

Increased Urinary Frequency

u/o < 7mL/kg/hr, and u/o appropriate for intake

No polyuria

Urinalysis
Urine Culture

Urine culture positive

Urinary Tract Infection

See “Genitourinary Complaints: Clinical approach to Dysuria”

Urine culture negative

Other

• Urinary obstruction (Eg. Nephrolithiasis)
• Small volume bladder
• Detrusor hyperactivity
• Vulvovaginitis*
• Bladder compression
  • Constipation*
  • Mass
  • Pregnancy

u/o > 7mL/kg/hr, or inappropriately high for intake

Polyuria

Check serum and urine osmolality

Urine Osmolality > Serum Osmolality

Osmotic Diuresis

• Diabetes Mellitus*
• Renal Failure * (high output)
• Iatrogenic (Mannitol, NaCl)

Water Diuresis

Water deprivation test

Hypotonic urine

Diabetes Insipidus

• Central Diabetes Insipidus
• Nephrogenic Diabetes Insipidus

Hypertonic Urine

Primary polydipsia

*Indicates Key Condition

This is not an exhaustive list of medical conditions.
Large for Gestational Age

(Growth > 90th percentile for GA)

Detailed history
Detailed physical exam

Maternal Factors

- Genetic/ethnic predisposition
- Maternal diabetes or hyperinsulinism

Fetal factors

- Prolonged gestation (>41 weeks)
- Genetic disorder (e.g. Sotos syndrome, Beckwith-Wiedemann syndrome)
- Normal variation

MATERNAL COMPLICATIONS

- Prolonged labour
- Operative vaginal delivery
- Caesarean section
- Genital tract lacerations
- Post-partum hemorrhage
- Uterine rupture

FETAL COMPLICATIONS

- Shoulder dystocia
- Birth injury (brachial plexus injury, clavicular fracture)
- Cerebral palsy secondary to hypoxia
- Hypoglycemia
- Polycythemia
- Perinatal asphyxia
- Hyperbilirubinemia
Limp

**Acute**
- Detailed History and Physical exam
- May have history of trauma
  - Usually painful
  - Usually afebrile

**Infectious/Post-infectious**
- Usually febrile
- Systemic symptoms often present

**Rheumatological**
- May be febrile or afebrile
- Systemic symptoms usually present
- Septic Arthritis*
  - Osteomyelitis*
  - Cellulitis*
  - Transient Synovitis*
  - Post-infectious
  - Reactive Arthritis*
  - Rheumatic Fever*

**Malignant**
- May be febrile or afebrile
- Systemic symptoms usually present
- Bone tumour*
  - (Eg. Osteosarcoma, Ewing’s Sarcoma)
- Leukemia*
- Lymphoma*
- Bone Metastasis

**Chronic**
- Limp often noticed at age of walking
- Usually painless
- Developmental Dysplasia of the Hip*
- Cerebral Palsy*
- Leg length inequality
- Talipes equinus
- Other neuromuscular disease

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*Indicates Key Condition

This is not an exhaustive list of medical conditions.
Long PT (INR), Long PTT

Factor Deficiency

- Congenital
  - Factor X
  - Factor V
  - Factor II
  - Fibrinogen

- Acquired
  - Disseminated Intravascular Coagulation
  - Vitamin K Problem
    - Vitamin K deficiency *
    - Vitamin K antagonist (Eg. Coumadin)
  - Liver Disease

Inhibitor

- Heparin

Notes:
- PT more sensitive to Vitamin K deficiency; therefore PT used for monitoring Coumadin therapy (PTT only affected in very severe cases)
- PTT more sensitive to heparin; therefore PTT used for monitoring heparin therapy (PT only affected in very severe cases)

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Long PT (INR), Normal PTT

Sufficient Vitamin K
- Congenital Clotting Factor Deficiency – Extrinsic Factor (Factor VII Deficiency)

Insufficient Vitamin K

Vitamin K Deficiency
- Hemorrhagic Disease of the Newborn
- Antibiotics use
- Poor Nutrition
- Fat Malabsorption

Vitamin K Antagonist
- Coumadin (Warfarin) use

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Lymphadenopathy

- Systemic Lupus Erythematosus
- Juvenile Idiopathic Arthritis*
- Kawasaki Disease*

- Viral (Eg. Viral URTI, EBV, CMV)
- Bacteria (Eg. Pharyngitis*, cervical adenitis*, Tuberculosis)

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Malnutrition

Intake reduced

Height and Head Circumference often preserved initially

Decreased intake

Non-organic causes/contributors
- Neglect*
- Decreased breast milk supply
- Inappropriate formula mixing
- Poverty
- Disturbed Parent-Child Relationship
- Disordered Eating*
- Oral aversion

Organic causes
- Gastroesophageal Reflux/Reflux Disease*
- Neuromuscular disease with poor feeding
- Anatomical issues (e.g., Cleft Lip, etc.)
- Dysphagia

Increased losses

- Vomiting*
- Gastroesophageal Reflux/Reflux Disease*
- Renal Tubular Acidosis
- Malabsorption (e.g, Celiac Disease*, Cystic Fibrosis*, Inflammatory Bowel Disease*, short bowel syndrome, infectious/post-infectious diarrhea)

Failure to Utilize

- Metabolic Disease*
- Congestive Heart Failure*
- Chronic Respiratory Distress (e.g, Cystic Fibrosis*, chronic aspiration)
- Malignancy (e.g, Leukemia*)
- Endocrinopathies (e.g, Hyperthyroidism)

Increased demands

Decreased growth potential

- Familial Short Stature*
- Genetic Syndromes (e.g, Trisomy 21*, Turner Syndrome*)
- Intrauterine insults (e.g, Congenital infections*, Fetal Alcohol Syndrome*)

Malnutrition*

Measure the following:
- Weight for height (<2 yrs) Z-scores
- Body mass index for age (<2 yrs) Z-scores
- Height for age
- Mid Upper Arm Circumference Z-scores

Detailed history including food intake
Careful physical exam
Obtain all growth records

Height and Head Circumference often preserved initially

Height and Head Circumference variable

Height and Head Circumference often preserved initially

Height may be reduced in endocrinopathies

Height usually reduced
Head circumference variable

Primary Indicator

Moderate Malnutrition

Severe Malnutrition

Weight for length <2 yrs.
BMI (>2 yrs.)
-2 to -2.9
≤ -3

Height for age
≤ -3

MUAC
-2 to -2.9
≤ -3

Definition for Malnutrition: One Data Point (AAP, Academy Dietetics and Nutrition)

Primary Indicator

Moderate Malnutrition

Severe Malnutrition

Weight gain velocity (<2 yrs.)
<50% of the norm
<25% of the norm

Weight loss (>2 yrs.)
7.5% BW
>10% BW

Decline in weight for length/BMI
2 z score
3 z scores

Definition for Malnutrition: Two or More Data Points (AAP, Academy Dietetics and Nutrition)

*Indicates Key Condition

This is not an exhaustive list of medical conditions.
Microcytic Anemia

Iron Deficiency*
- Reduced dietary intake (e.g., overconsumption of cow's milk)
- Malabsorption (e.g., Celiac disease*, Inflammatory Bowel Disease*)
- Chronic Blood Loss

Anemia of Chronic Disease
- Chronic inflammation (e.g., Juvenile Idiopathic Arthritis*, Inflammatory Bowel Disease*, Lupus, etc.)

Hemoglobinopathies*

- Hemoglobin A2, Normal Hemoglobin A
- Increased Hemoglobin A2, Increased Hemoglobin F, No Hemoglobin A
- Increased Hemoglobin H, Hemoglobin Inclusions in RBC

β-Thalassemia Minor
β-Thalassemia Major
α-Thalassemia 2-3 digene deletion

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Mouth Disorders (Pediatric)
Murmur In The Newborn (<48 Hours)

Murmur in the Newborn (<48 hrs)
- Detailed history and physical exam
  - Harsh or diastolic murmur
  - Cyanosis or hypoxia
  - Abnormal or absent pulses
  - Upper limb blood pressure >20mmHg above lower limb BP
  - Clinically unwell or unstable
  - Sudden deterioration

Pathological murmur

Yes

Cyanotic Congenital Heart Disease*
- Transposition of the Great Arteries
- Truncus Arteriosus
- Total Anomalous Pulmonary Venous Return
- Tricuspid Atresia
- Tetralogy of Fallot
- Pulmonary Atresia
- Ebstein’s anomaly
- Hypoplastic left heart

Acyanotic Congenital Heart Disease*
- Atrial septal defect
- Ventricular septal defect
- Coarctation of the Aorta
- Aortic stenosis
- Pulmonary stenosis
- Arteriovenous malformation

No

Benign murmur*
- Peripheral Pulmonic Stenosis
- Pulmonary flow murmur

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Murmur In The Newborn Beyond Neonatal Period

**Murmur beyond neonatal period**

- Detailed history and physical exam

  **Normal S2**
  - Early systole, no diastolic component
  - Low intensity
  - Increased intensity with fever, anxiety
  - Changes with position and Valsalva
  - No family history of sudden death

  **Benign**
  - Pulmonary flow murmur
  - Still murmur
  - Venous hum
  - Non-cardiac murmur (Eg. *Anemia*, hyperthyroidism)

  **Exercise intolerance**
  - Syncope with exertion
  - Cyanosis
  - Abnormal S1 or S2
  - Loud or harsh murmur
  - Diastolic, continuous, pansystolic or late systolic
  - Ejection click
  - Displaced apex
  - Palpable heave/thrill
  - Abnormal pulses
  - Symptoms suggestive of congestive heart failure or shock

  **Pathological**

  **Congenital Heart Disease**
  - See Approach to Murmur: Murmur in the Newborn (<48 hrs)

  **Acquired Heart Disease**
  - Rheumatic heart disease
  - Bacterial endocarditis
  - Tricuspid insufficiency
  - Mitral insufficiency
  - Mitral valve prolapse
  - Cardiomyopathy/myocarditis

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
**Neonatal Jaundice**

Approach To Direct Hyperbilirubinemia

- **<20% direct**
  - Indirect (unconjugated) hyperbilirubinemia
  - See “Neonatal Jaundice: Approach to Indirect Hyperbilirubinemia”

- **>20% direct**
  - Direct (conjugated) Hyperbilirubinemia:
    - Direct hyperbilirubinemia is NEVER normal, and requires further workup
    - Hepatic
      - Infectious (TORCH, hepatitis virus, **bacterial sepsis***, UTI* )
      - Genetic (**Cystic fibrosis***, Alagille Syndrome)
      - Metabolic (Inborn errors of metabolism, alpha-1-antitrypsin deficiency)
      - Endocrine (Hypothyroid, hypopituitarism)
      - Iatrogenic (TPN, other drugs)
      - Neoplastic (hepatoblastoma)
    - Post hepatic
      - **Biliary atresia***
      - Other obstructive (choledochal cyst, mass, intestinal obstruction)
Neonatal Jaundice
Approach To Indirect Hyperbilirubinemia

Neonatal Jaundice

Check bilirubin
(If > 2 weeks, check total AND direct)

<20% direct

Indirect (unconjugated)
hyperbilirubinemia

Pre-hepatic

Physiologic*

Onset within first week of life, never in first 24 hours
Clinically well

Pathologic

Onset anytime within first week of life
Red flags: Onset first 24 hrs of life, clinically unwell, risk factors present

>20% direct

Direct (conjugated)
Hyperbilirubinemia

See “Neonatal Jaundice: Approach to Direct Hyperbilirubinemia”

Increased bilirubin production

Decreased bilirubin clearance

Increased enterohepatic circulation

Non-hemolytic
- Cephalohematoma
- Polycythemia

Hemolytic*

Extrinsic
- Immune mediated
- Isoimmunization (ABO, Rh disease)
- Sepsis* (bacteremia, UTI, meningitis, other)

Intrinsic
- Membrane (spherocytosis, elliptocytosis)
- Enzyme (G6PD, pyruvate kinase deficiency)

*Breast milk Jaundice*
*Gilbert’s
*Criglar Najar

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Noisy Breathing
Pediatric Stridor

Stridor in a Child

Present Since Infancy
- No Respiratory Distress
  - Laryngomalacia
- Respiratory Distress
  - Laryngomalacia
  - Laryngeal Web
  - Hemangioma
  - Vocal Cord Dysfunction
  - Subglottic Stenosis

Not Present Since Infancy
- Non-Acute Onset
  - Hemangioma
  - Vocal Cord Dysfunction
  - Subglottic Stenosis
  - Laryngeal Papillomatosis
- Acute Onset
  - Febrile
    - Peritonsillar/Retropharyngeal Abscess*
    - Epiglottitis*
    - Mononucleosis
    - Bacterial Tracheitis*
  - Afebrile
    - Barking Cough
      - Croup
      - Atypical Croup
    - Partially-Treated Bacterial Tracheitis

* Denotes acutely life-threatening causes
Noisy Breathing

Pediatric Wheezing

Wheezing in a Child

CXR Non Specific

Relief With Beta-Agonist
- Asthma*

Positive Sweat Chloride
- Cystic Fibrosis

Wheeze With Feeding
- Aspiration
- GE Reflux
- H-Type Esophageal Fistula

CXR Abnormal

- Pulmonary Sequestration
- Congenital Adenoid Cystic Malformation
- Bronchogenic Cyst
- Neuroblastoma
- Teratoma
- Mediastinal Mass

R/O Endobronchial Disease
- Vascular Compression Syndrome
- Foreign Body Aspiration*
- Endobronchitis
- Structural Anomaly

* Denotes acutely life-threatening causes
Non-Epileptic Paroxysmal Event

- Neonates and Infants
  - Cardiac
    - Arrhythmia*
  - Developmental
    - Sleep Myoclonus
  - Infantile Colic*
  - Gratification disorder (infantile masturbation)
  - Shuddering attacks
  - Gastrointestinal
    - Gastroesophageal Reflux/Reflux Disease* (aka. Sandifer Syndrome)

- Older Infants and Toddlers
  - Cardiac
    - Arrhythmia*
  - Behavioral/Developmental
    - Benign Sleep Myoclonus
    - Breath-holding spells*
    - Gratification disorder (infantile masturbation)
    - Night terrors*
    - Tic disorder
  - Other neurological
    - Benign Paroxysmal Torticollis
    - Benign Paroxysmal Vertigo

- Childhood and Adolescents
  - Cardiac
    - Arrhythmia*
    - Syncope* (vaso-vagal, other)
  - Behavioral/Developmental
    - Daydreaming
    - Panic attack
    - Tic disorder
  - Other neurological
    - Migraine* and migraine variants
    - Sleep issues* (narcolepsy, cataplexy)
    - Transient Ischemic Attack
    - Other movement disorders (e.g., Chorea)

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Normal PT (INR), Long PTT

Bleeding Tendency

Congenital
- Hemophilia*
  - Factor VIII Deficiency (Hemophilia A)
  - Factor IX Deficiency (Hemophilia B)
- Factor XI Deficiency
- von Willebrand’s Disease with a low Factor VIII

Acquired
- Factor VIII Inhibitor
- Heparin
- Other Factors (rare)

No Bleeding Tendency

Congenital (Intrinsic Pathway Factor Deficiency)
- Factor XII
- Prekallikrein (Fletcher Factor)
- High Molecular Weight Kininogen (Fitzgerald Factor)

Acquired
- Antiphospholipid Antibodies (APLA)

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
**Otalgia (Earache)**

- Ear
  - Non-infectious
    - Foreign body
    - Trauma
  - Infectious
    - Otitis Media *
    - Otitis Externa *
  - Referred pain
    - Neurological (neuralgias, *migraine*)
    - Skull (mastoiditis, TMJ)
    - Teeth (*dental disease*, abscesses)
    - Throat (*pharyngitis*, *peritonsillar abscess*, retropharyngeal abscess/cellulitis*, *stomatitis* )
    - Neck (*cervical adenitis*, reactive lymphadenopathy*)
    - Skin and soft tissue (*cellulitis*, *eczema* )

*Indicates Key Condition

This is not an exhaustive list of medical conditions.
Pediatric Cough

Acute

Acute Cough (< 3 weeks)

- Detailed history
  - Respiratory physical exam

**Respiratory**

- **Stridor** on inspiration
  - Increased work of breathing
    - (indraw, nasal flare, head bobbing, paradoxical breathing)
  - Reduced SaO2 and reduced air entry are red flags for impending respiratory failure

**Upper Respiratory**

- Infectious
  - Viral URTI*
  - Sinusitis*
  - Croup*
  - Epiglottitis*
  - Pertussis*
  - Tracheitis*

- Foreign body
  - Anaphylaxis*

**Lower Respiratory**

- Infectious
  - Pneumonia*
  - Bronchiolitis*
  - Asthma*
  - Anaphylaxis*

- Foreign body
  - Anaphylaxis*

**Non-Respiratory**

- Cardiac (E.g. Congestive heart failure*)
- Neurological (E.g. Aspiration)
- Gastrointestinal (E.g. Gastroesophageal reflux*)
- Other (E.g. Habit cough)

*Indicates Key Condition

This is not an exhaustive list of medical conditions.
Pediatric Cough

Chronic Cough (> 3 weeks)

- Detailed history
- Assess growth
- Respiratory physical exam

Respiratory

Stridor on inspiration
Increased work of breathing (indrawing, nasal flare, head bobbing, paradoxical breathing)

Upper Respiratory

- Infectious (E.g. Sinusitis*)
- Mass/tumour*

Wheeze on expiration, increased work of breathing (indrawing, nasal flare, head bobbing, paradoxical breathing)
Crackles, bronchial breath sounds, focal respiratory findings
SaO2 may be reduced

Lower Respiratory

- Infectious (E.g. Atypical pneumonia*)
- Asthma*
- Cystic Fibrosis*
- Foreign body
- Immunodeficiency

Non-Respiratory

Cardiac (E.g. Congestive heart failure*)
Neurological (E.g. Chronic aspiration)
Gastrointestinal (E.g. Gastroesophageal reflux*, tracheoesophageal fistula)

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Pediatric Dyspnea

- Stridor
  - Croup
  - Foreign Body
  - Tracheitis
  - Epiglottitis
  - Laryngospasm

- Wheeze
  - Asthma
  - Bronchiolitis
  - Foreign Body
  - Viral Induced Wheeze

- Crackles
  - Pneumonia
  - Congestive Heart Failure
  - Bronchiolitis
  - Foreign Body

- Decreased Air Entry
  - Pneumonia
  - Asthma
  - Bronchiolitis
  - Foreign Body
  - Pleural Effusion
  - Atelectasis
  - Pneumothorax

- Normal Breath Sounds
  - Pneumonia
  - Foreign Body
  - Heart Disease
  - Diabetic Ketoacidosis
  - Pulmonary Embolism
Pediatric Epilepsies

Infantile
- Benign Focal Epilepsy of Infancy
- West Syndrome

Generalized Epilepsies
- Childhood Absence Epilepsy
- Juvenile Absence Epilepsy
- Juvenile Myoclonic Epilepsy
- Lennox Gastaut Syndrome

Childhood

Focal Epilepsies
- Self-limited epilepsy with centrotemporal spikes
- Remote symptomatic epilepsy

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Pediatric Fractures

**Non-Accidental Trauma (indication of child abuse)**
- **Distal Radius**
  - Torus (junction of metaphysis)
  - Green stick (bone bent at convex side)
  - Complete (spiral, oblique, transverse)
- **Femur # < 1 y.o.**
- **Scapular # Without Traumatize Hx**

**Accidental Trauma**
- **Clavicle Fracture**
- **Tibia Fibular Fracture**
- **Elbow**
  - Supra condylar
  - Lateral supracondylar
- **Dependents Fracture**
  - Supra condylar
  - Lateral supracondylar
- **< 2 y.o.**

**Transverse Fractures <3 y.o.**
- Femur
- Humerus
- Tibia
- Ribs
- Radius
- Skull
- Spine
- Ulna
- Fibula

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Pediatric Infectious Skin Rash

**Paediatric Infectious Skin Rash**

**Bacterial**
- Erythematous, poorly demarcated, non-palpable, blanchable rash
  - Pustules with overlying thick honey-yellow crusts. Occurs in clusters
  - Erythematous sand-paper like rash over trunk, extremities, cheeks. Strawberry tongue. Spares palms and soles. Pastia lines
  - Widespread erythroderma, involving the face, diaper, and intertriginous areas. Desquamation and crusting present. Nikolsky sign.
  - Purpuric, non blanchable rash over full body
    - **Cellulitis***
    - **Impetigo***
    - **Scarlet Fever***
    - **Staph Scaled Skin***
    - **Meningococcemia***

**Viral***
- Erythematous, blanchable macules spreading cephalo-caudally. Koplik spots. URTI symptoms and pharyngitis
  - Bright red, well demarcated rash over cheeks – “slapped-cheek” appearance. May have lacy reticular rash over hands and feet
  - Erythematous, blanchable macules spreading cephalo-caudally. Rash usually starts after fever defervesces
  - Flesh colored, well demarcated papules with umbilicated center
  - Vesicular rash filled with clear fluid, on an erythematous base. Highly pruritic
    - **Measles**
    - **Parvovirus**
    - **Roseola**
    - **Molluscum Contagiosum**
    - **Varicella**

**Other**
- Erythematous papules and vesicles distributed over hands and skin folds. Burrow may be present. Highly pruritic.
  - **Scabies***

*Indicates Key Condition

This is not an exhaustive list of medical conditions.
Pediatric Mood And Anxiety Disorders

Mood or Anxiety Disorder

Mood
- Major Depressive Disorder
- Persistent Depressive Disorder
- Disruptive Mood Dysregulation Disorder*

Bipolar

Anxiety
- Panic Disorder and Agoraphobia
- Specific Phobia
- Social Phobia
- Generalized Anxiety Disorder
- Selective Mutism*
- Separation Anxiety Disorder*

*More commonly or exclusively found in pediatric populations
Pediatric Seizures

Acute Symptomatic Seizures
occurring at time of systemic insult or in close association (<1 week) with documented brain insult

- Metabolic – hypoglycemia, hypo/hypernatremia, hypocalcemia
- Trauma
- Bleed
- Masses
- Drugs/Toxin/Withdrawal
- Autoimmune
- CNS Infection
- Febrile Seizures

Epilepsy
≥ 2 unprovoked seizures, or 1 unprovoked seizure and high (>60%) risk to have further seizures (e.g. abnormal EEG)

Single Unprovoked Seizure
1st seizure + Normal EEG
[10% of population have one]

Remote Symptomatic
- Remote Brain Injury
- Cortical Malformation
- Genetic/Metabolic Syndrome
- Infectious (HIV, parasite)
- Known Epilepsy Gene

Idiopathic/Genetic
- No known cause, presumed genetic predisposition (i.e. no specific gene but twin/family studies suggest genetic link)

Epilepsies can be classified into more than one etiological category, eg. Tuberous Sclerosis = genetic and structural

Some epilepsies can be classified into more specific epilepsy syndromes

⚠️ Potentially acutely life-threatening presentation

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Pediatric Vomiting

Vomiting

- Bilious emesis (green emesis): Red flag*

Evaluate for Surgical/Acute Abdomen:
History and physical exam

Bilious (Surgical/Acute Abdomen)

- Malrotation/Volvulus*
- Intussusception*
- Obstruction (e.g. Intestinal atresia*)

Non-Bilious

Acute

Gastrointestinal Disease
- Appendicitis*
- Obstruction (e.g. Pyloric stenosis*, intestinal atresia*, etc.)
- Intussusception*
- Gastroenteritis*
- Gastroparesis/ileus
- Hepatitis
- Pancreatitis
- Cholecystitis

Other Systemic Disease
- Infection (e.g. Meningitis*, encephalitis*, sepsis*, urinary tract infection*, pneumonia*)
- CNS disease (e.g. Head injury*, concussion*, increased intracranial pressure*, brain tumor*, abusive head trauma*, migraine*)
- Middle ear disease (e.g. Otitis media*)
- Endocrine (e.g. Diabetic ketoacidosis/Diabetes mellitus*)

Chronic

Evaluate for Red Flags:
Bloody emesis, morning emesis, weight loss/failure to thrive, systemic symptoms (fever, unwell, etc.)

Red Flags present

Gastrointestinal Disease
- Inflammatory bowel disease* (e.g. Crohn's Disease)
- Peptic ulcer

Other Systemic Disease
- CNS disease (increased intracranial pressure*, brain tumor*)
- Renal Disease (e.g. Renal failure*)
- Endocrine (e.g. Diabetes mellitus*, Addison's disease, thyroid disease)
- Metabolic disease*

No Red Flags

Gastrointestinal Disease
- Gastroesophageal reflux disease*
- Cyclic Vomiting Syndrome

Other Systemic Disease
- CNS disease (e.g. Head injury*, concussion*, migraine*)
- Respiratory (e.g. Asthma*)
- Middle ear disease (e.g. Otitis media*)
- Drugs/Toxins (e.g. Substance use and abuse*, poisoning/ intoxication*, antibiotics)
- Psychiatric (e.g. Disordered eating*, rumination)
- Endocrine (e.g. Pregnancy*)

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Preterm Infant Complications (<34 Weeks)

Complications Associated with the Extreme Preterm Infant (<34 weeks Gestational Age)

**Neurologic**
- Intraventricular Hemorrhage (IVH)
- Retinopathy of Prematurity (ROP)
- Neurodevelopmental Impairments (NDI)
- Apnea of Prematurity (AOP)

**Respiratory**
- Respiratory Distress Syndrome (RDS)
- Chronic Lung Disease (CLD)
- Pulmonary Hypertension

**Cardiovascular**
- Congenital heart disease* (Eg. Persistent Ductus Arteriosus)

**Gastrointestinal**
- Necrotizing Enterocolitis (NEC)
- Oral Aversion and other feeding difficulties
- TPN cholestasis

**Renal**
- Nephrocalcinosis
- Electrolyte disturbances
- Hypertension

**Hematology**
- Anemia*

**Metabolic**
- Hypoglycemia*
- Metabolic bone disease

**Infectious Diseases**
- Sepsis*

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Preterm Infant Complications (34-36 Weeks)

Complications Associated with the Late Preterm Infant (34-36 weeks Gestational Age)

- Neurologic
  - Apnea of Prematurity (AOP)

- Respiratory
  - Transient Tachypnea of the Newborn

- Gastrointestinal
  - Feeding difficulties

- Hematology
  - Neonatal Jaundice*

- Metabolic
  - Hypoglycemia*
  - Temperature instability

- Infectious Diseases
  - Sepsis*

*Indicates Key Condition

This is not an exhaustive list of medical conditions.
Proteinuria

Persistent Proteinuria

Urine dip negative, but tubular proteins present (Alpha 1 microglobulin). May have Glucosuria, aminoaciduria, acidosis

Tubular Proteinuria

Primary
- Genetic/Metabolic disease* (Eg. Renal Fanconi's, Wilsons disease)
- Drugs
- Heavy metals
- Nutritional

Secondary

Repeat testing

Orthostatic Proteinuria

First morning urine x 3

Transient Proteinuria

- Exercise
- Fever

Glomerular Proteinuria

Urine Microscopy

Active Sediment: RBC cells and casts, WBC casts

See “Edema: Clinical approach to Hematuria”

Benign Sediment

Primary
- Minimal Change Disease
- Focal Segmental Glomerular Sclerosis
- Membranous Nephropathy
- Mesangioproliferative Glomerulonephritis
- Genetic

Secondary
- Infection (Hepatitis virus, HIV, Malaria, Syphilis)
- Drugs (Penicillamin, NSAIDs)
- Immune/Allergic disorders (Bee sting, Food allergies)
- Malignancy (Lymphoma, Leukemia)
- Diabetic nephropathy

*Indicates Key Condition

This is not an exhaustive list of medical conditions.
Pediatric Rash (Eczematous)

Skin Rash

- Pruritic/Scaly/Erythematous lesions. Usually poorly demarcated
  - Eczematous
- Erythematous or violaceous papules & plaques with overlying scale
  - Papulosquamous
- Blisters containing non-purulent fluid
  - Vesiculobullous
- Blisters containing purulent fluid
  - Pustular
- Reactive rash with various morphology
  - Reactive

- Erythematous papules and vesicles (acute) or lichenification (chronic)
  - Atopic Dermatitis* (Eczema)
- Coin shaped (discoid) erythematous plaques. Usually on lower legs
  - Nummular Dermatitis (Discoid Eczema)
- Deep-Seated tapioca-like vesicles on hands/feet/sides of digits.
  - Dyshidrotic Eczema (pompholyx)
- Well-demarcated erythema, papules, vesicles, erosions scaling confined to area of contact
  - Contact Dermatitis
- Yellowish-red plaques with greasy distinct margins on scalp/face/central chest folds
  - Seborrheic Dermatitis*
- Erythematous papules and vesicles distributed over hands and skin folds. Burrow may be present
  - Scabies

Age dependent distribution:
Infants: scalp, face, extensor extremities
Children: flexural areas
Adults: flexural areas/arms/hands/face/nipples

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Rash (Papulosquamous)

Skin Rash

- Pruritic/Scaly/Erythematous lesions. Usually poorly demarcated
  - Eczematous

- Erythematous or violaceous papules & plaques with overlying scale
  - Papulosquamous

- Blisters containing non-purulent fluid
  - Vesiculobullous

- Blisters containing purulent fluid
  - Pustular

- Reactive rash with various morphology
  - Reactive

- Well demarcated plaques, thick silvery scale on elbows & knees. Auspitz sign Koebner's phenomenon
  - Psoriasis

- Purple, pruritic, polygonal, planar (flat-topped) papules on wrists/ankles/genitals
  - Lichen Planus

- Oval, tannish-pink or salmon-coloured patches, plaques with scaling border in Christmas tree pattern on trunk, begins with a large lesion patch (Herald's patch)
  - Pityriasis Rosea

- Annular (Ring-shaped) lesion with elevated scaling, red border, central clearing
  - Tinea (Ring Worm)

- Scarring and/or atrophic red/purple plaques with white adherent scales on sun-exposed area
  - Discoid Lupus Erythematos

*Indicates Key Condition

This is not an exhaustive list of medical conditions.
**Rash (Pustular)**

- **Skin Rash**
  - Pruritic/Scaly/Erythematous lesions. Usually poorly demarcated
  - Erythematous or violaceous papules & plaques with overlying scale
  - Blisters containing non-purulent fluid
  - Blisters containing purulent fluid
  - Reactive rash with various morphology

**Eczematous**
- Erythematous papules and pustules on face
  - Comedones +/- nodules, cysts, scars on face & trunk
  - Acne Vulgaris

**Papulosquamous**
- Pustules centered around hair follicles
  - Folliculitis

**Vesiculobullous**
- Pustules with overlying thick honey-yellow crusts
  - Impetigo

**Pustular**
- “Beefy red” erythematous patches in body folds with satellite pustules at periphery
  - Candidiasis

*Indicates Key Condition

This is not an exhaustive list of medical conditions.
Rash (Reactive)

Skin Rash

- Pruritic/Scaly/Erythematous lesions. Usually poorly demarcated
  - Eczematous
  - Variable pattern and color
    - Ecchymosis: Trauma*, Physical abuse*, Thrombocytopenia (E.g. Immune thrombocytopenia purpura*, leukemia*, etc)
    - Purpura: Meningococcemia *
  - Deep red or purple, non-blanchable markings
    - Urticaria: Allergy/anaphylaxis*, Drug eruption*

- Erythematous or violaceous papules & plaques with overlying scale
  - Papulosquamous
  - Firm, edematous papules & plaques that are transient & itchy. Usually lasts <24hrs
    - Urticaria

- Blisters containing non-purulent fluid
  - Vesiculobullous
  - Tender or painful red nodules on shins
    - Erythema Nodosum: Inflammatory Bowel Disease*, Other autoimmune conditions

- Blisters containing purulent fluid
  - Pustular
  - Target lesions possibly with macules, papules, vesicles &/or bullae on palms soles and mucous membranes
    - Erythema Multiforme: Drug eruption*

- Reactive rash with various morphology
  - Reactive

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Rash (Vesiculobullous)

Skin Rash

- Pruritic/Scaly/Erythematous lesions. Usually poorly demarcated
  - Eczematous
  - Papulosquamous

- Erythematous or violaceous papules & plaques with overlying scale
  - Vesiculobullous
  - Pustular

- Blisters containing non-purulent fluid
  - Reactive rash with various morphology

Inflammatory

- Inflammatory pemphigoids
- Dermatitis herpetiformis
- Bullous systemic lupus erythematosus

Infectious

- Viral*
  - Varicella zoster (chickenpox)
  - Herpes zoster (shingles)
  - Herpes simplex
  - Impetigo* (Bullous form)

Reaction to Agent

- Contact dermatitis
- Drug eruptions*

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
**Respiratory Distress in the Newborn (<48 hrs)**

- **Respiratory**
  - Upper Airway
    - Congenital upper airway obstruction (e.g. Choanal atresia, laryngomalacia)
    - Airway compression (e.g. Congenital neck mass, mediastinal mass)
  - Lower Airway
    - Pneumonia*
    - Transient tachypnea of the newborn
    - Respiratory distress syndrome
    - Pneumothorax
    - Meconium aspiration/meconium pneumonitis
    - Congenital lung anomalies

- **Cardiovascular**
  - Congenital Heart Disease*
    - Cyanotic heart lesions
    - Truncus Arteriosus
    - Total Anomalous Pulmonary Venous Return
    - Tricuspid Atresia
    - Transposition of the Great Arteries
    - Tetralogy of Fallot
    - Hypoplastic Left Heart Syndrome
    - Pulmonary Atresia

- **Neuromuscular**
  - Acyanotic heart lesions
    - Coarctation of the Aorta
    - Critical Aortic Stenosis
    - Large AVSD
  - (May present with irregular breathing rather than respiratory distress)
  - Seizure*
  - Birth trauma* (e.g. Hypoxic brain injury, CNS bleed, birth asphyxia)
  - Congenital CNS malformation
  - Drugs:
    - Narcotics/Sedatives
    - Chest wall deformities
    - Genetic neuromuscular disease (e.g. Congenital myotonic dystrophy, spinal muscular atrophy, congenital myopathies)

- **Other**
  - Sepsis*
  - Hypoglycemia*
  - Metabolic disease*
  - Gastrointestinal (e.g. Diaphragmatic hernia)
  - Hypothermia or hyperthermia
  - Persistent Pulmonary Hypertension

*Indicates Key Condition

This is not an exhaustive list of medical conditions.

⚠️ Potentially acutely life-threatening presentation
Respiratory Distress In The Newborn

Tachypnea

Respiratory Distress

Check Respiratory Rate (RR)

Tachypnea

Respiratory physical exam

No increased work of breathing
Normal SaO2

Tachypnea with no increased work of breathing
- Sepsis* with lactic acidosis
- Diabetic ketoacidosis*
- Metabolic disease*

Upper Airway
(extra-thoracic obstruction present)
- Anaphylaxis*
- Croup*
- Epiglottitis*
- Tracheitis*
- Foreign body*

V/Q Mismatch
- Bronchiolitis*
- Asthma*/Status Asthmaticus*
- Foreign body*
- Pneumonia*
- Atelectasis
- Pleural effusion
- Pneumothorax

Diffusion Problem
- Interstitial lung disease
- Acute respiratory distress syndrome
- Pulmonary Edema

R \to L Shunt
- Congestive Heart Failure*
- Congenital Heart Disease*
- Pulmonary AVM
- Pulmonary Hypertension

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
### Salter Harris Physeal Injury Classification

<table>
<thead>
<tr>
<th>Type</th>
<th>Population</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Younger Children</td>
<td>Separation through the physis</td>
</tr>
<tr>
<td>II</td>
<td>Older Children (75%)</td>
<td>Fracture through a portion of the physis that extends through the metaphyses</td>
</tr>
<tr>
<td>III</td>
<td>Older Children (75%)</td>
<td>Fracture line goes below the physis through the epiphysis, and into the joint</td>
</tr>
<tr>
<td>IV</td>
<td></td>
<td>Fracture Line through the metaphysis, physis and epiphysis</td>
</tr>
<tr>
<td>V</td>
<td></td>
<td>Compression fracture of the growth plate</td>
</tr>
</tbody>
</table>

### Key:
- **S**: Straight through
- **A**: Above
- **L**: Lower
- **T**: Through
- **R**: Crush
School Difficulties

**Environmental**
- Neglect*
- Physical abuse* and Domestic violence*
- Sexual abuse*
- Sleep issues*
- Nutrition and feeding issues* (e.g. malnutrition)
- Socio-economic /cultural /home /environment issues*
- Bullying

**Mental Health**
- Anxiety*
- Depression*
- Behavioural disorders (e.g. Conduct/Oppositional Defiance Disorder)
- Substance use and abuse*

**Neurodevelopmental**
- Intellectual disability/Global delay*
- Specific learning disability*
- Attention Deficit Hyperactivity Disorder*
- Autism Spectrum Disorder*

**Medical**
- Hearing impairment*
- Visual changes*
- Neurologic disease (e.g. tumor*, seizures*, head injury*, neurodegenerative disease)
- Sleep issues* (e.g. Obstructive sleep apnea)
- Hypothyroidism
- Iron deficiency*

---

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Scrotal Mass

Painful

- Sudden Onset
  - Testicular Torsion*
  - Torsion of the Testicular Appendix
  - Trauma
  - Incarcerated Hernia

- Gradual Onset
  - Acute Epididymitis
  - Epididymo-orchitis
  - Trauma (Eg. Hematoma)

Painless

- Trans-illuminates
  - Hydrocele
  - Indirect hernia

- Does Not Trans-illuminates
  - Tumor (Eg. Leukemia*)

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Shock

Defined as inadequate oxygen delivery to meet metabolic demands

Stabilize:
- Airway
- Breathing
- Circulation
- Disability (Glasgow coma scale)
- Dextrose check
- History and physical exam

Cardiogenic Shock
- Congenital Heart Disease *
- Acquired Heart Disease (Eg. Kawasaki Disease * with infarction, cardiomyopathy, myocarditis)
- Arrhythmia

Distributive Shock
- Sepsis *
- Anaphylaxis *
- Burns *
- Neurogenic shock (eg. Trauma *)

Obstructive Shock
- Pulmonary Embolism
- Tension Pneumothorax
- Cardiac Tamponade

Hypovolemic Shock
- Dehydration *
- Vomiting *
- Diarrhea *
- Bleed/Trauma *

Refer to corresponding Clinical Approaches

*Indicates Key Condition
This is not an exhaustive list of medical conditions.

Potential acutely life-threatening presentation
Short Stature

Concerning symptoms:
- Low weight, dysmorphic, delayed puberty

Pathological
- Disproportionate
  - Skeletal Dysplasias (Eg. Achondroplasia)
  - Rickets
- Proportionate
  - Dysmorphic
    - Trisomy 21*
    - Turner Syndrome*
    - Prader-Willi Syndrome
    - Russell-Silver Syndrome
  - Non-Dysmorphic
    - Familial Short Stature*
    - Constitutional Delay*

Height <3rd Percentile
- Detailed History, Physical Exam, and Mid-Parental Target Height

Otherwise well

Non-pathological/Normal variant
- Assess bone age
  - Bone Age = Chronological Age
    - Familial Short Stature*
  - Bone Age < Chronological Age
    - Constitutional Delay*

Weight disproportionately low (<3rd %)
- Psychosocial
  - Nutrition and Feeding issues*
  - Neglect*
  - Disordered Eating*

Chronic Disease
- GI (i.e. Celiac Disease*, IBD*)
- Renal (Eg. Renal failure*)
- Cardiopulmonary (i.e. Cystic Fibrosis*, Congestive Heart Failure*)

Weight appropriate for height
- Iatrogenic
- Endocrinopathy
- Intrauterine Insults
  - Hypothyroidism*
  - Cushing’s Disease
  - Growth Hormone Deficiency
  - Congenital Adrenal Hyperplasia
  - Panhypopituitarism
  - Intrauterine Growth Retardation/Small for Gestational Age*
  - Fetal Alcohol Spectrum Disorder*
Skin Lesion (Primary Skin)

**Primary Skin Lesion**
Initial lesion not altered by trauma, manipulation (rubbing, scratching), complication (infection), or natural regression over time.

- **Flat**
  - Macule (≤ 1 cm diameter)
  - Patch (> 1 cm diameter)

- **Solid**
  - No Deep Component
    - Papule (≤ 1 cm diameter)
    - Plaque (> 1 cm diameter)
  - Deep Component
    - Nodule (1-3 cm diameter)
    - Tumor (> 3 cm diameter)

- **Fluid-Filled OR Semi-Solid-Filled**
  - Cyst

- **Fluid-Filled**
  - Purulent
    - Pustule
  - Non-Purulent Fluid
    - Vesicle (≤ 1 cm diameter)
    - Bulla (> 1 cm diameter)

**Secondary Skin Lesion**
Lesion that develops from trauma, manipulation (rubbing, scratching), complication (infection) of initial lesion, or develops naturally over time.

- **Elevated**
Skin Lesion (Secondary Skin)

Primary Skin Lesion
Initial lesion not altered by trauma, manipulation (rubbing, scratching), complication (infection), or natural regression over time.

Secondary Skin Lesion
Lesion that develops from trauma, manipulation (rubbing, scratching), complication (infection) of initial lesion, or develops naturally over time.

Elevated
- Crust/Scab (dried serum, blood, or pus overlying the lesion)
- Scale (dry, thin or thick flakes of skin overlying the lesion)
- Lichenification (thickened skin with accentuation of normal skin lines)
- Hypertrophic Scar (within boundary of injury)
- Keloid Scar (extend beyond boundary of injury)

Depressed
- Atrophic Scar (fibrotic replacement of tissue at site of injury)
- Ulcer (complete loss of epidermis extending into dermis or deeper; heals with scar)
- Erosion (partial loss of epidermis only; heals without scar)
- Fissure (linear slit-like cleavage of skin)
- Excoriation/Scratch (linear erosion induced by scratching)
Small for Gestational Age

(Growth < 10th percentile for GA)

Detailed pregnancy, and labour/delivery history
Detailed physical exam
Assess pattern of growth (asymmetric vs symmetric IUGR)

Constitutionally Small
Maternal Illness
- Chronic Maternal Disease (Eg. Maternal hypertension, Renal insufficiency, pulmonary disease, chronic anemia, Type 1 Diabetes Mellitus, autoimmune disease, etc.)
- Gestational hypertension
- Anatomical uterine abnormalities

Maternal Lifestyle
- Malnutrition
- Smoking
- Drug use
- Alcohol

Iatrogenic
- Drugs (Eg. Ace inhibitors, phenytoin, etc.)

Fetal
- Congenital infections* (Eg. TORCH infections)

Infection

Genetic
- Chromosomal disorders (Eg. Trisomy 21*)
- Genetic disorders
- Congenital anomalies
- Multiple gestation
- Metabolic disorders

Placental Factors
- Placental insufficiency
- Placental abnormalities (placental abruption, placental infarction, hemangioma, chorioangioma)

Symmetric
- Head circumference, length, and weight proportionally decreased
- Usually occurs early in pregnancy (1st or 2nd trimester)
- Causes: Intrinsic fetal factors (i.e. genetic) or first-trimester insult (Eg. infection)

Asymmetric
- Head circumference is spared relative to decreased weight, length
- Usually occurs later in pregnancy (3rd trimester)
- Causes: Often due to maternal factors. Thought to result from adaptation to an unfavourable environment late in pregnancy

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Pediatric Sore Throat/Sore Mouth

Sore Throat/Sore Mouth

Referred
- Neurological (neuralgias, migraine*)
- Skull (mastoiditis, TMJ)
- Ear (otitis media*, otitis externa*)
- Teeth (dental disease*, abscesses)
- Neck (cervical adenitis*, reactive lymphadenopathy*)
- Skin and soft tissue (cellulitis*, eczema*)

Throat/mouth

Stomatitis (Non-Infectious)
- Canker sores
- Inflammatory (SLE, Crohn’s Disease*, Kawasaki Disease*)
- Drugs* (Steven Johnson, Mucositis)
- Allergy
- Trauma

Infectious

Bacterial
- Pharyngitis* (Group A Streptococcal, other)
- Retropharyngeal abscess/cellulitis*
- Peritonsillar abscess*
- Epiglottitis*

Other
- Viral* (EBV, CMV, HSV, Coxsackie Virus, other viral)
- Fungal (oral thrush*)

*Indicates Key Condition

This is not an exhaustive list of medical conditions.
Sudden Paroxysmal Event

A: Is this a seizure?
Yes

Seizure

B: Is this seizure SYMPTOMATIC of something else?

Yes

Symptomatic

- Drugs
- Infection
  - Meningitis*
  - Encephalitis*
  - Brain abscess
  - Febrile seizure*
- Metabolic
  - Hypoglycaemia*
  - Hyponatremia/Hypernatremia*
  - Hypocalcaemia
  - Hypoxic-ischemic insult
- Structural
  - Brain tumour*, other space occupying lesion
  - Congenital structural anomalies (e.g. Tuberous Sclerosis, Sturge-Weber Syndrome)
  - Abusive head trauma*, other traumatic brain injury
  - Stroke/intracranial bleed

No

Non- Symptomatic

Non-epileptic paroxysmal event

See “Seizures/Paroxysmal Events: Approach to non-epileptic paroxysmal events”

C: If not a symptomatic seizure:

1. What kind of seizure? (See ILAE Classification of Seizure types)
2. What is the age of the child?
3. Are they developmentally normal or abnormal?

***Epilepsy is TWO unprovoked seizures

See “Seizures/Paroxysmal Events: Approach to Pediatric Epilepsies”

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Sudden Unexpected Death In Infancy (SUDI)

**Sudden Unexpected Death in Infancy**

- Must be Reported to Medical Examiner

- **Congenital Anomaly/Disorder**
  - Cardiac Anomaly
  - Cardiac Arrhythmia
  - Neurologic Anomaly
  - Pulmonary Anomaly
  - Metabolic Disorders

- **Infection**
  - Severe Pneumonia
  - Sepsis
  - Gastrointestinal infection

- **Injury**
  - Deliberate (abuse)
  - Accidental*

- **Other**
  - Acute Illness

- **Sudden Infant Death Syndrome (SIDS)**
  - Autopsy negative
  - 80% of SUDI
  - Risk Factors:
    - Prone Sleeping position
    - Tobacco exposure
    - Sharing a Sleeping Surface
    - Prematurity

* SUDI with negative investigations and infant found in prone position or in bed with parent may be called either SIDS or injury (new ideas evolving)

*Indicates Key Condition

This is not an exhaustive list of medical conditions.
Thrombocytopenia

Low Platelet Count

Decreased Production

Decreased Megakaryopoiesis
- Marrow displacement (e.g. Leukemia*, lymphoma*, neuroblastoma*, other tumour*)
- Marrow Failure (Eg. Aplastic Anemia)
- Toxic Damage (e.g. Chemotherapy)

Increased Sequestration
- Splenomegaly
- Thrombus

Increased Destruction

Ineffective Megakaryopoiesis
- B12 Deficiency
- Folate Deficiency
- Drugs

Immune
- Immune Thrombocytopenia Purpura*
- Lupus
- Alloimmune destruction
- Drugs

Non-Immune
- Hemolytic Uremic Syndrome*
- Thrombotic Thrombocytopenia Purpura
- Disseminated Intravascular coagulation
- Infection/sepsis*
- Foreign Surface (e.g. Prosthetic Heart Valve)

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
General Presentations

Fatigue .......................................................... 399
Acute Fever .................................................... 400
Fever of Unknown Origin / Chronic Fever.. 401
Hypothermia .................................................... 402
Sore Throat / Rhinorrhea ................................. 403
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Fatigue

Exclude Sleep Disturbance/Lifestyle Issues/Pregnancy

Organic Etiologies

Endocrine/Metabolic
- Anemia
- Malignancy

Neoplastic/Hematologic
- Endocarditis
- Tuberculosis
- Epstein-Barr Virus
- Hepatitis
- HIV

Infectious
- Anemia
- Malignancy

Chronic Disease
- Hypnotics
- Anti-hypertensives
- Anti-Depressants
- Drug Abuse (e.g. Alcohol)
- Drug Withdrawal

Pharmacologic
- Anxiety
- Somatization Disorder
- Malnutrition/Drug Addiction

Psychogenic
- Chronic Fatigue Syndrome

Idiopathic

Exclude Sleep Disturbance/Lifestyle Issues/Pregnancy

No Organic Etiologies

Endocrine
- Hypo/Hyperthyroidism
- Diabetes
- Pituitary Insufficiency
- Adrenal Insufficiency

Metabolic
- Renal Failure
- Liver Failure
- Hypercalcemia

Autoimmune/Inflammatory
- Rheumatoid Arthritis
- Celiac Disease
- SLE
- Polymyalgia Rheumatica

Cardio-pulmonary
- Congestive Heart Failure
- Chronic Obstructive Pulmonary Disease

Neurologic
- Depression
- Multiple Sclerosis
- Stroke
- Parkinson’s
- Myasthenia Gravis
Acute Fever

Fever (acute onset)

Infectious

Viral
- Rhinovirus
- Influenza Virus
- Parainfluenza Virus
- Adenovirus
- Enterovirus
- Coronavirus
- HIV

Bacterial
- Fungal
- Protozoa (e.g., malaria)
- Other parasites

Other

Inflammatory
- PE
- Thrombophlebitis
- DVT
- Pancreatitis

Iatrogenic
- Transfusion reaction
- Malignant Hyperthermia
- Neuroleptic malignant syndrome

Endocrine
- Thyroid storm
- Acute Adrenal Insufficiency

Other
- Heat stroke
- Sickle Cell disease
- Drug fever
- MI

Bacteremia
- Intermittent Bacteremia
- Continuous Bacteremia

Septic Shock

Acute Organ Specific Infection
- Upper Respiratory Tract Infection
- Urinary Tract Infection
- Pneumonia
- Pyelonephritis
- Meningitis
- Skin Infection

Abscess
- Head and neck
- Thoracic
- Abdominal
- Pelvic
- Extremity
Fever of Unknown Origin / Chronic Fever

Fever of unknown origin/chronic fever

- Infection
  - Organ Specific Infection
    - Infectious endocarditis
    - Osteomyelitis
    - Occult abscess
    - Sinusitis
    - Cholangitis
    - UTI
    - Meningitis
  - Non-organ specific
    - Brucellosis
    - Q-fever
    - Salmonellosis
    - Yersinia
    - Tularemia
    - Septic Phlebitis
    - Rheumatic fever
    - Lyme disease
    - TB
    - Whipple’s disease
- Neoplasm
  - NHL
  - Hodgkin’s lymphoma
  - Leukemia
  - Solid tumors
- Autoimmune
  - SLE
  - RA
  - Polyarteritis nodosum
  - Giant cell arteritis
  - Sarcoidosis
- Other
  - Drug fever
  - Factitious fever
  - Trauma Non-infectious hepatitis
  - Recurrent PE

- Bacterial
- Viral
  - HIV
  - EBV
  - CMV
  - Viral hepatitis
  - Enterovirus
- Other
  - Fungal
  - Protozoa (eg. malaria)
  - other parasites
Hypothermia

- Environmental
  - Immersion
  - Non-Immersion

- Acute Illness

- Body Heat Loss
  - Drugs/Toxins
  - Iatrogenic
  - Burns

- Lack of Body Heat Generation
  - Hypothyroidism
  - Adrenal Insufficiency
  - Hypoglycemia
  - Malnutrition

- Improper Thermoregulation
  - Cerebrovascular Accident
  - Central Nervous System Trauma
  - Multiple Sclerosis
  - Drugs/Toxins

- Other
  - Trauma
  - Sepsis
  - Vascular Insufficiency
  - Uremia
Sore Throat / Rhinorrhea

Common viral pathogens:
Rhinovirus, Coronavirus, Influenza virus, Parainfluenza Virus, Adenovirus, Herpes Simplex Virus,
Enterovirus (Coxsackie, Echo), Epstein Barr Virus, Cytomegalovirus, HIV
Most common bacterial pathogen:
Group A Beta Hemolytic Streptococcus pyogenes (GABHS)

Predominantly Rhinorrhea

- Acute
  - Acute Viral Sinusitis
  - Acute Bacterial Sinusitis
  - Acute Head Cold Syndrome

- Chronic
  - Allergic/Vasomotor/Drug Rhinitis
  - Nasal Polyposis
  - Chronic Sinusitis
  - Nasopharyngeal Cancer

Predominantly Sore Throat

- Acute
  - GERD
  - Environmental
  - Trauma
  - Foreign Body
  - Neoplasm

- Chronic
  - Streptococcal Tonsillopharyngitis
  - Peritonsillar Abscess
  - Ludwig’s Angina

Viral

- Acute viral Pharyngitis
- Acute Influenza
- Acute Viral Laryngotracheitis
- Acute Viral Tracheobronchitis
- Acute Infectious Mononucleosis
- Herpangina
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<tr>
<th>Year</th>
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<tbody>
<tr>
<td>2019-20</td>
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## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>AAA</td>
<td>Abdominal Aortic Aneurysm</td>
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<tr>
<td>ACE</td>
<td>Angiotensin-Converting Enzyme</td>
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<td>ACTH</td>
<td>Adrenocorticotropic Hormone</td>
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<td>ADPKD</td>
<td>Autosomal Dominant Polycystic Kidney Disease</td>
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<td>ADH</td>
<td>Antidiuretic Hormone</td>
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<td>AIN</td>
<td>Acute Interstitial Nephritis</td>
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<tr>
<td>ALS</td>
<td>Amyotrophic Lateral Sclerosis</td>
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<td>ARB</td>
<td>Angiotensin Receptor Blocker</td>
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<td>ARF</td>
<td>Acute Renal Failure</td>
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<td>ARPKD</td>
<td>Autosomal Recessive Polycystic Kidney Disease</td>
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<td>BPH</td>
<td>Benign Prostatic Hypertrophy</td>
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<td>CCD</td>
<td>Cortical Collecting Duct</td>
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<td>CHF</td>
<td>Congestive Heart Failure</td>
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<tr>
<td>CIN</td>
<td>Chronic Interstitial Nephritis</td>
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<td>CLL</td>
<td>Chronic Lymphocytic Leukemia</td>
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<td>CNS</td>
<td>Central Nervous System</td>
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<td>COPD</td>
<td>Chronic Obstructive Pulmonary Disease</td>
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<tr>
<td>CRF</td>
<td>Chronic Renal Failure</td>
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<tr>
<td>CRH</td>
<td>Corticotrophic Releasing Hormone</td>
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<td>CT</td>
<td>Computed Tomography</td>
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<td>DCIS</td>
<td>Ductal Carcinoma In Situ</td>
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<td>DHEA</td>
<td>Dehydroepiandosterone</td>
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<td>DHEA-S</td>
<td>Dehydroepiandosterone Sulfate</td>
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<tr>
<td>DIC</td>
<td>Disseminated Intravascular Coagulation</td>
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<td>DKA</td>
<td>Diabetic Ketoacidosis</td>
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<td>DRE</td>
<td>Digital Rectal Exam</td>
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<td>DVT</td>
<td>Deep Vein Thrombosis</td>
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<td>EABV</td>
<td>Effective Arterial Blood Volume</td>
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<td>ECF</td>
<td>Extracellular Fluid</td>
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<tr>
<td>ENaC</td>
<td>Epithelial Sodium Channel</td>
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<tr>
<td>FEV1</td>
<td>Forced Expiratory Volume in One Second</td>
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<td>FJN</td>
<td>Familial Juvenile Nephronophthisis</td>
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<tr>
<td>FSGS</td>
<td>Focal Segmental Glomerulosclerosis</td>
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<td>FSH</td>
<td>Follicle Stimulating Hormone</td>
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<tr>
<td>FVC</td>
<td>Forced Vital Capacity</td>
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<td>GBM</td>
<td>Glomerular Basement Membrane</td>
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<td>GERD</td>
<td>Gastrointestinal Esophageal Reflux Disease</td>
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<tr>
<td>GFR</td>
<td>Glomerular Filtration Rate</td>
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<td>GHRH</td>
<td>Growth Hormone Releasing Hormone</td>
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<tr>
<td>GH</td>
<td>Growth Hormone</td>
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<tr>
<td>GI</td>
<td>Gastrointestinal</td>
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<tr>
<td>GN</td>
<td>Glomerulonephritis</td>
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<td>GnRH</td>
<td>Gonadotropin Releasing Hormone</td>
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<td>GPA</td>
<td>Granulomatosis with Polyangiitis</td>
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<td>GRA</td>
<td>Glucocorticoid</td>
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<td>GTN</td>
<td>Gestational Trophoblastic Neoplasm</td>
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<td>H+</td>
<td>Hydrogen</td>
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<tr>
<td>HCG</td>
<td>Human Chorionic Gonadotropin</td>
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<td>Abbreviation</td>
<td>Full Form</td>
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<tr>
<td>HDL</td>
<td>High Density Lipoprotein</td>
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<td>HELLP</td>
<td>Hemolysis, Elevated Liver Enzymes, Low Platelets</td>
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<td>HIV</td>
<td>Human Immunodeficiency Virus</td>
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<td>HPL-1a</td>
<td>Human Peripheral Lung Epithelial Cell Line 1a</td>
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<td>HRT</td>
<td>Hormone Replacement Therapy</td>
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<td>Henoch-Schönlein Purpura</td>
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<td>HSV</td>
<td>Herpes Simplex Virus</td>
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<td>HUS</td>
<td>Hemolytic-Uremic Syndrome</td>
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<td>IBD</td>
<td>Irritable Bowel Disease</td>
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<tr>
<td>IBS</td>
<td>Irritable Bowel Syndrome</td>
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<td>ICP</td>
<td>Increased Intracranial Pressure</td>
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<td>ICU</td>
<td>Intensive Care Unit</td>
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<tr>
<td>IGF</td>
<td>Insulin-like Growth Factor</td>
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<td>INR</td>
<td>International Normalized Ratio</td>
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<tr>
<td>ITP</td>
<td>Idiopathic Thrombocytopenic Purpura</td>
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<td>IUGR</td>
<td>Intrauterine Growth Restriction</td>
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<tr>
<td>IV</td>
<td>Intravenous</td>
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<td>IVP</td>
<td>Intravenous Pyelogram</td>
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<td>JVP</td>
<td>Jugular Venous Pyelogram</td>
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<td>K+</td>
<td>Potassium</td>
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<td>KUB</td>
<td>Kidney, Ureter, Bladder</td>
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<td>LCIS</td>
<td>Lobular Carcinoma In Situ</td>
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<tr>
<td>LDL</td>
<td>Low Density Lipoprotein</td>
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<tr>
<td>LGA</td>
<td>Large for Gestational Age</td>
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<tr>
<td>LH</td>
<td>Luteinizing Hormone</td>
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<tr>
<td>LLN</td>
<td>Lower Limit of Normal</td>
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<td>LOC</td>
<td>Level of Consciousness</td>
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<td>LPL</td>
<td>Lipoprotein Lipase</td>
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<td>MCD</td>
<td>Minimal Change Disease</td>
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<td>MCH</td>
<td>Mean Corpuscular Hemoglobin</td>
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<td>MCHC</td>
<td>Mean Corpuscular Hemoglobin Concentration</td>
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<tr>
<td>MCV</td>
<td>Mean Corpuscular Volume</td>
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<tr>
<td>MEN</td>
<td>Multiple Endocrine Neoplasia</td>
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<tr>
<td>MI</td>
<td>Myocardial Infarction</td>
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<tr>
<td>MPA</td>
<td>Microscopic Polyangiitis</td>
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<td>MPGN</td>
<td>Membranoproliferative Glomerulonephritis</td>
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<td>MS</td>
<td>Multiple Sclerosis</td>
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<td>MSK</td>
<td>Musculoskeletal</td>
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<td>Na+</td>
<td>Sodium</td>
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<td>NSAIDs</td>
<td>Non-Steroidal Anti-Inflammatories</td>
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<td>OCP</td>
<td>Oral Contraceptive Pill</td>
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<td>OSM</td>
<td>Osmolality</td>
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<td>PE</td>
<td>Pulmonary Embolism</td>
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<td>PID</td>
<td>Pelvic Inflammatory Disease</td>
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<td>PMN</td>
<td>Polymorphic Neutrophils</td>
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<td>POSM</td>
<td>Plasma Osmolality</td>
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<tr>
<td>PPROM</td>
<td>Preterm Premature Rupture of Membranes</td>
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<tr>
<td>PROM</td>
<td>Premature Rupture of Membranes</td>
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<td>PT</td>
<td>Prothrombin Time</td>
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<td>Parathyroid Hormone</td>
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<td>PTT</td>
<td>Partial Thromboplastin Time</td>
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<td>PUD</td>
<td>Peptic Ulcer Disease</td>
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<tr>
<td>PUJ</td>
<td>Pelviureteric Junction</td>
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<tr>
<td>RAPD</td>
<td>Right Afferent Pupillary Defect</td>
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</tbody>
</table>
RAS  Renal Artery Stenosis
RBC  Red Blood Cell
RTA  Renal Tubular Acidosis
SGA  Small for Gestational Age
SLE  Systemic Lupus Erythematosus
TORCH  Toxoplasmosis, Other (Hepatitis B, Syphilis, Varicella-Zoster virus, HIV, Parvovirus B19), Rubella, Cytomegalovirus, Herpes Simplex Virus
TSH  Thyroid Stimulating Hormone
TSHR  Thyroid Stimulating Hormone Receptor
TTKG  Transtubular Potassium Gradient
TTP  Thrombotic Thrombocytopenic Purpura
UTI  Urinary Tract Infection
US  Ultrasound
VACTERL  Vertebral Anomalies, Anal Atresia, Cardiovascular Anomalies, Tracheoesophageal Fistula, Esophageal Atresia, Renal Anomalies, Limb Anomalies
VSD  Ventricular Septal Defect
VUJ  Vesicoureteral Junction
Notes
Superficially resembling flowcharts, schemes are a way to ease the memorization of differential diagnoses by breaking large lists into sets of smaller, conceptually-intuitive information packets. Using the Medical Council of Canada’s Clinical Presentation List, Blackbook organizes the most common medical presentations of patients into diagnostic schemes. As a tool for medical students, residents, allied health trainees, and health care educators, medical presentation schemes will ease the learning of the volume of medical diagnoses, and will facilitate recall when needed.

Based on the medical presentation schemes used in the University of Calgary Medical curriculum, Blackbook is a joint production of the students and the Cumming School of Medicine at the University of Calgary.