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This material is for educational purposes only.

It is not to be used to make medical decisions. Medical decisions should be made only with the guidance of a licensed medical professional.

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Blackbook: Approaches to Medical Presentations

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A Message from the Editors

Welcome to the Blackbook, an ongoing project organizing medical presentations into schemes. 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 across North America find Blackbook to be a useful tool in their learning.

Blackbook continues to evolve and improve with each new version. This fourteenth edition has overhauled the entirety of the pediatrics section with 84 new schemes that incorporate the most up-to-date evidence and clinical practices! Furthermore, Blackbook continues to integrate with Calgary Cards, an online study aid using patient case centered multiple choice questions, facilitating the direct translation of scheme learning into clinical scenario practice.

We continue to strive to make Blackbook a leading study resource. Please email blackbk@ucalgary.ca with any feedback, corrections, or ideas for new schemes.

Thank you and happy learning! Bryan Ma and Hannah Yaphe
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
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**Abnormal Rhythm**

**Types of Arrhythmia**

- **Bradyarrhythmia (<60 bpm)**
  - Sinus Bradycardia
  - Sick Sinus Syndrome
  - SA Block
  - AV Block (1st/2nd/3rd 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

**Narrow QRS (<120 msec) SVT**

- 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

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

- 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 (2)

Causes of Arrhythmia

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

Cardiac

Non-Cardiac

Structural
- Valve disease
- Cardiomyopathy

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

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

Cardiovascular

Pulmonary/Mediastinal

Other

Vascular

• Pulmonary Embolism* (chest pain often not present)
• Pulmonary Hypertension

Chest Wall/Pleura

• Pneumothorax*
• Pleural Effusion
• Pleuritis/Serositis

Parenchymal

• Pneumonia with pleurisy*
• Tuberculosis*
• Neoplasm*
• Sarcoidosis

* Denotes acutely life-threatening causes
Chest Discomfort

Other

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
Hypertension

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

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

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

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 >95thile), but the approach is the same.
Hypertension in Pregnancy

**Hypertension in Pregnancy**

DBP ≥ 90 mmHg, based on two measurements

---

**Pre-existing Hypertension**

Before Pregnancy OR <20 weeks gestational age

- No Proteinuria
  - Chronic Hypertension
    - Primary
    - Secondary

- Proteinuria (≥0.3 g/24 hr urine) OR one or more Adverse Conditions*
  - Pre-existing Hypertension with Pre-Eclampsia

**Gestational Hypertension**

Previously normotensive, >20 weeks gestational age

- No Proteinuria
  - Gestational Hypertension
    - Pre-existing Hypertension with Pre-Eclampsia

- Proteinuria (≥0.3 g/24 hr urine) OR one or more Adverse Conditions*
  - Gestational Hypertension with Pre-Eclampsia

---

**Pre-Eclampsia + Seizures/Coma**

- Eclampsia

---

**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 <100 x 10^9/L
- Serum albumin <20 g/L

**Fetal**

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

---

*SOGC, 2008

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

Valvular Disease (Preserved Diastolic/Systolic Function)

- Mitral Stenosis
- Mitral Regurgitation
- Aortic Stenosis
- Aortic Regurgitation

Myocardial

Systolic Dysfunction (Reduced Ejection Fraction)

- Impaired Contractility
- Increased Afterload

Diastolic Dysfunction (Preserved Ejection Fraction)

- Impaired Diastolic Filling

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

Coronary Artery Disease

- Myocardial Infarction
- Transient Myocardial Ischemia

Chronic Volume Overload

- Mitral Regurgitation
- Aortic Regurgitation

Dilated Cardiomyopathies

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

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

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

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

Coronary Artery Disease

- Chronic Volume Overload

Chronic Volume Overload

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- Chronic Volume Overload

Chronic Volume Overload

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

Ejection Fraction = \frac{SV}{EDV} = \frac{EDV - ESV}{EDV}
Isolated Right-Sided 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
  - Bronchiectasis

- Vasculature
  - Pulmonary Embolism
  - Primary Pulmonary Arterial Hypertension
  - Pulmonary Veno-Occlusive Disease

Rule out Left-Sided Heart Failure (Most Common)

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)
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)
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

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

Cold Extremities

High JVP

Low JVP
Syncope

Rule out Seizure

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

Cardiac
- CO = SV x HR
- MI
- DCM
- Mitral/Aortic Stenosis
- HCM (LVOT)
- Blood Loss/Hypotension
- Mitral Stenosis
- Cardiac Tamponade
- Constrictive Pericarditis

Respiratory
- Pulmonary Embolism
- Hypoxia
- Hypercapnia

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

Stroke Volume
- Contractility
- Afterload
- Preload

Heart Rate/Rhythm
- Tachyarrhythmia
- Bradyarrhythmia
- VT/VFib
- AFib/AFlutter
- AVNRT/AVRT
- Sick Sinus Syndrome (SA Node)
- 2nd/3rd degree AV Block
- Pacemaker Malfunction
- Tachy-Brady Syndrome
Systolic Murmur
Benign & Stenotic

- Benign/Flow/Hyperdynamic
  - Pregnancy
  - Fever
  - Anemia

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

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

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

* Mitral Regurgitation /

S1 S2

* Mitral Valve Prolapse (OS –

S1 OS S2

Systolic Murmur

Cardiovascular
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)
Respiratory

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Pulmonary Function Tests

Interpretation

Pulmonary Function Tests
Interpretation

FEV₁/FVC ≥ LLN

FVC ≥ LLN

TLC ≤ LLN

Restriction

DL,CO ≥ LLN

Normal

Pulmonary Hypertension, Anemia, Carboxyhemoglobinemia

DL,CO ≥ LLN

Chest Wall or Neuromuscular Disorders

Interstitial Lung Disease

TLC ≥ LLN

Obstruction

DL,CO ≥ LLN

Asthma or Non-Emphysematous COPD

Mixed Defect

DL,CO ≥ LLN

Emphysematous COPD

LLN: Lower limit of Normal

**Acid-Base Disorder**

### Respiratory

- **Elevated Anion Gap**
  - pH < 7.35
  - Acidemia
  - Metabolic Acidosis
    - Chronic
    - Hypoventilation present for hours to days
  - Normal Anion Gap
    - pH 7.35-7.45
    - Normal pH
    - Respiratory Acidosis
      - Acute
      - Hypoventilation present for minutes to hours
  - Elevated Anion Gap
    - pH > 7.45
    - Alkalemia
    - Metabolic Alkalosis
      - Chronic
      - Hyperventilation present for hours to days
    - Normal Anion Gap
      - Acute
      - Hyperventilation present for minutes to hours

### Mixed Acid-Base Disorder

**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
Chest Discomfort
Cardiovascular

- Cardiovascular
  - Ischemic
    - Myocardial Infarction*
    - Stable/Unstable Angina*
  - Non-Ischemic
    - Pericarditis
    - Myocarditis
    - Aortic Dissection*

* Potentially acutely life-threatening
Chest Discomfort

Cardiovascular

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

Processes that can affect the Pleura
- Pneumonia*
- Pulmonary Embolism*
- Malignancy
- Sarcoidosis
- Acute Chest Syndrome

*Potentially acutely life-threatening
Chest Discomfort

Other

Chest Discomfort

Cardiovascular

Pulmonary/Mediastinal

Other

Gastrointestinal
- GERD
- 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

Respiratory

25
Chest Trauma Complications

Chest Trauma

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

Chronic Cough ( > 3 wks )

Normal Chest X-Ray

Normal Spirometry

Obstructive Disease
(FEV1/FVC <75%)

- Asthma
- COPD

Upper Airway

- Post-Nasal Drip / Rhinosinusitis
- Neuromuscular Swallowing Disorder
- Thyroiditis
- Mediastinal Mass
- Elongated Uvula

Lower Airway

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

Cough & Dyspnea & Fever

Abnormal Chest X-Ray

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

Other

- ACE Inhibitor
Cough, Dyspnea & Fever

* Potentially acutely life-threatening
Dyspnea

Acute

- Myocardial Infarction*
- Cardiac Tamponade*
- CHF

Pleural
- Pneumothorax (Tension*)

Parenchymal
- Pneumonia

Vascular
- Pulmonary Embolism*

Lower Airway (Wheeze)
- Asthma*
- AECOPD
- CHF
- ARDS

Upper Airway (Stridor)
- Aspiration*
- Anaphylaxis*

* Denotes acutely life-threatening causes
Dyspnea Chronic

Cardiac

Dyspnea

Acute
Presents in minutes to hours

Cardiac

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*

Other

Arrhythmia
• Atrial Fibrillation
• Bradyarrhythmia
• Tachyarrhythmia

* Potentially acutely life-threatening
Dyspnea Chronic
Pulmonary / Other

- 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)

- Alveoli
  - Pneumonia

- Interstitium
  - Interstitial Pulmonary Fibrosis
  - Hypersensitivity Pneumonitis
  - CHF
  - Sarcoidosis

- Pump
  - Chest Wall
  - Neuromuscular
  - Pleura

- Vessels
  - Pulmonary Embolism*
  - Pulmonary Hypertension
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

Diffuse Abnormality
- CHF
- Bronchiectasis
- Pulmonary Vasculitis

Infection
- Bacterial
- Viral
- Tuberculosis
- Fungal

Malignancy

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

Vascular
- Pulmonary Embolism
- Arteriovenous Malformation
Alveolar-Arterial Gradient = \( P_{A}O_2 - P_aO_2 \)
\[ P_{A}O_2 = F\text{O}_2 (P_b-PH_2O)-(P_aCO_2/0.8) \]
*In Calgary, \( P_b = 660\text{mmHg}, \) sea level \( P_b = 760\text{mmHg} \)

---

**Hypoxemia**

High AA Gradient

- **Right-to-Left Shunt**
  - Airway Disease (Asthma, COPD)
  - Vascular (PE*)
  - Parenchymal Disease

- **Ventilation/Perfusion Mismatch**
  - Interstitial lung disease
  - Pulmonary Arterial Hypertension

- **Diffusion Limitation**
  - Ventricular Septal Defect**
  - Atrial Septal Defect
  - Arteriovenous Malformation
  - Severe Pneumonia
  - Atelectasis

Intracardiac

Pulmonary

---

Normal AA Gradient

- **Low Inspired \( \text{PO}_2 \)**
  - High Altitude

- **Hypoventilation**
  - Increased \( \text{PCO}_2 \)

- Central
  - Drugs*
  - Coma
  - Hypothyroidism

- Peripheral
  - Obesity Hypoventilation Syndrome
  - Neuromuscular Weakness
  - Pleural Abnormalities
  - Chest Wall Abnormalities

---

* 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.
Respiratory Granulomatosis with polyangiitis (GPA)/microscopic polyangiitis (MPA)

Lung Nodule

Single Round Lesion < 3cm In Diameter

New Nodule

Multiple Nodules

Solitary Nodule

Nodule on CXR > 2 Years Without a Change in Size

- Scar
- Granuloma
- Arteriovenous Malformation

Malignancy

- Primary lung cancer
- Metastases (“cannonball lesions”; Eg. 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

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

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

Posterior
- Neurogenic Tumour
- Esophageal Lesion
- Diaphragmatic Hernia

* Potentially acutely life-threatening
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

*Potentially acutely life-threatening

**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
Pulmonary Hypertension

- Pulmonary Arterial Hypertension
  - Idiopathic
  - Associated with:
    - Connective Tissue Disease
    - Portal Hypertension
    - Congenital Heart Disease
    - HIV

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

- Lung Disease and/or Hypoxemia
  - COPD
  - Interstitial Lung Disease
  - Sleep-Disordered Breathing

- Chronic Thromboembolic Disease

- Miscellaneous
  - Hematologic Disorders
  - Metabolic Disorders
Hematologic

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Hematologic
Overall Approach to Anemia

Anemia

Blood Loss

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

- Any combination of:
  - Decreased Reticulocytes
  - MCV, MCH, MCHC, Serum Iron, Ferritin
  - Increased TIBC, Hypochromic RBCs

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
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
  - Multiple Myeloma

- RBCs in Rouleaux Formation
  - Myelodysplastic Syndromes

- Dysplastic
  - Myelodysplastic Syndromes

- Macrocytosis Target Cells Normal WBCs
  - Normal Liver Function Tests
  - Rule out B12 and Folate Deficiency
  - Liver Disease

- 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
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
  - **Normal Reticulocytosis**

**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
- **Acquired**
  - Drugs (e.g. ASA)
  - Renal Disease

**Vascular System**
- **Congenital**
  - Connective Tissue Disorders
  - Hereditary II Telangiectasia
- **Acquired**
  - Steroids
  - Vasculitis

**Coagulation Proteins**
Approach to Bleeding / Bruising

Coagulation Proteins

Bleeding/Brusing

Platelets

Vascular System

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 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 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

Hematologic
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)
Approach to Splenomegaly

Evidence of portal hypertension or coagulopathy?

- Infectious
  - Bacterial
  - Viral (EBV)
  - Parasitic
  - Fungal

- Congestive
  - Cirrhosis
  - Thrombus (e.g., Hepatic, Portal, Splenic)

- Infiltrative

- Inflammatory
  - Systemic Lupus Erythematosus
  - Sarcoidosis
  - Felty's Disease
  - Serum Sickness

- 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

Neutropenia or Neutrophil Dysfunction
- Aphthous Ulceration
- Perirectal Infection
- Abscess Formation
- Soft Tissue and Visceral Infection
- Periodontal Disease

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*
Hematologic

Neoplastic

Reactive

Systemic Inflammatory
- Systemic Lupus Erythematosus
- Sarcoidosis
- Rheumatoid Arthritis
- Pseudotumor

Infectious
- EBV
- CMV
- HIV
- Tuberculosis
- Hepatitis

Other
- Acne
- Allergy
- Insect Bites
- Young age

Leukemia

Monoclonal Lymphocytes on Biopsy

Reed-Sternberg Cells on Biopsy

History of Bleeding, Infection, Fatigue
- Acute Lymphoblastic Leukemia (Pancytopenia, WBC differential includes Blasts)

Asymptomatic, Age > 50
- Chronic Lymphocytic Leukemia (CBC with Lymphocytes)
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>
</table>
| Anterior
  - Infection (e.g. Mononucleosis, Toxoplasmosis)
  - Posterior
  - TB
  - Lymphoma
  - Kikuchi Disease
  - Head/Neck Malignancy | Thoracic Malignancy (Breast, Mediastinum, Lungs, Esophagus)
  - Abdominal Malignancy (Virchow’s Node) | Infection (Arm, Thoracic Wall, Breast)
  - Cancer (in absence of infection in upper extremity) | Infection (Forearm/Hand)
  - Lymphoma
  - Sarcoidosis
  - Tularaemia
  - Secondary Syphilis | Leg Infection
  - Sexually Transmitted Infection
  - Cancer |
Hematologic

Neutrophilia

Increased Neutrophils

- Reactive (Orderly WBC differential)
  - Infection
    - Bacterial
    - Abscess
    - Viral
  - Medications
    - Corticosteroids
    - Lithium
    - Epinephrine
  - Cancer
    - Solid Tumour (e.g. Lung, Bladder, Colon)
  - Other
    - Inflammation
    - Tissue necrosis
    - Physical stimuli
    - Emotional stimuli
    - Metabolic disorders
    - Asplenia

- Neoplastic (Disorderly WBC differential)
  - Myeloproliferative Disorder
    - Chronic myelogenous leukemia
    - Polycythemia vera
  - Acute Leukemia (pancytopenia, blast cells)
Neutropenia
Decreased Neutrophils Only

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

- Medications
  - Anticonvulsants
  - Antibiotics
  - Antithyroid
  - Antihypertensive
  - Antirheumatic
  - Antistroke
  - Antipsychotic
  - Antineoplastic

- Viral Infection
  - Epstein-Barr Virus
  - Cytomegalovirus
  - Childhood viruses
  - HIV
  - Influenza
  - COVID-19
Neutropenia

Bicytopenia / Pancytopenia

- Decreased Production
  - Isolated Neutrophil Decrease
  - Bicytopenia/Pancytopenia (Neutrophils and Other Cell Lines Decreased)
  - Decreased Production
    - Marrow Infiltration
      - Hematologic and non-hematologic malignancies
      - Infection
      - Primary Myelofibrosis
    - Stem cell damage or suppression
      - Chemotherapy
      - Radiation
      - Drugs
      - Toxins
      - Aplastic Anemia
      - Myelodysplasia
    - Nutritional deficiency
      - B12/folate/combined deficiencies
  - Sequestration
    - Splenomegaly
Polycythemia

Polycythemia (Erythrocytosis)

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

True
Elevated RBC Mass

JAK-2 Negative
Elevated Erythropoietin
Reactive
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%

Erythropoietin Secreting Tumor
O₂ Saturation ≥ 90%
Abnormal Abdominal Ultrasound

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)

Suspected DVT

Calculate Clinical Probability Score

Low: ≤ 2 Points

Negative D-Dimer

STOP

Positive D-Dimer

STOP

Positive Leg U/S

TREAT

Negative Leg U/S

STOP

High: > 2 Points

Negative Leg U/S

TREAT

Positive Leg U/S

TREAT

Negative Leg U/S at 1 Week

STOP

Positive Leg U/S at 1 Week

STOP

Negative Venogram

TREAT

Positive Venogram

TREAT

---

**Well's Criteria for DVT**

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

Hematologic

60
Suspected Pulmonary Embolism (PE)

Suspected PE

Calculate Clinical Probability Score

High: > 4 Points

CT-PA or Compression U/S

Negative CT-PE

Non-Diagnostic

Positive CT-PA

TREAT

Low Clinical Suspicion

STOP

Positive

TREAT

• Repeat U/S in 1 Week

Negative

Low: ≤ 4 Points

Negative D-Dimer

Positive D-Dimer

STOP

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

Immune

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

Non-Immune

Autoimmune
- ITP
- SLE
- CLL
- APLA

Alloimmune
- anti-HLA antibodies

Drugs
- Quinidine
- HIT
- Others
Thrombocytosis

Thrombocytosis

Reactive

- Artifact (redo CBC)

Spurious

- Essential thrombocytosis
  - Polycythemia Vera
  - Chronic Myelogenous Leukemia
  - Primary Myelofibrosis

Autonomous

Infectious
- Acute or Chronic

Inflammatory
- IBD
- Rheumatic disorders
- Celiac disease

Tissue Damage
- Post-op surgery
- Trauma
- Burns

Non malignant hematologic conditions
- Rebound effect following treatment of ITP
- Rebound effect following ETOH induced thrombocytopenia

Other
- Post-splenectomy or hyposplenic states
- Non-hematologic malignancy
- Iron deficiency anemia
Hemolysis

Extravascular
Spleen and RES-mediated hemolysis

Extrinsic to RBC

Immune-Mediated

- Warm AIHA
- Cold AIHA
- Alloimmune delayed HTR
- Drug-induced AIHA

Intravascular
Hemolysis within circulation

Intracellular to RBC

Membrane Defects

- Hereditary sph erocytosis
- Hereditary elliptocytosis

RBC Enzyme Defects

- G6PD deficiency
- PK deficiency

Infections

- Malaria
- Babesiosis
- C. perfringens

Complement-Mediated

- Cold AIHA
- PCH
- PNH
- Drug-induced immune-complex hemolytic anemia
- Acute HTR

Mechanical Shearing

- MAHA (TTP, DIC, HUS)
- Prosthetic heart valves
- Atriovenous malformations

Abnormal Hgb & Hgb Defects

- Thalassemia
- Sickle cell
- Unstable Hgb
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Abdominal Distention

- Ascites
- Bowel Dilatation
- Other Causes

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

**Acute Colonic**

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

**Toxic Megacolon**
- Inflammatory
- Infectious
- Ischemic

**Paralytic Ileus**
- Peritonitis
- Post-surgical
- Hypothyroidism

**Chronic Intestinal**
- Scleroderma
- Familial Myopathy

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

Ascites

Bowel Dilatation

Other Causes

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

- Ascites
- Bowel Dilatation
- Other Causes

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

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

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

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

Exclude pregnancy/hernia/abdominal wall mass

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

Neoplastic
- Gastrointestinal Tumours (e.g. Colonic, Gastric, Pancreatic)
- Gynecologic Tumors (e.g. Ovarian, Uterine)
- Lymphoma/Sarcoma

Other Causes

Abdominal Mass

Feces

Pulsatile
- Vascular (Abdominal Aortic Aneurysm)

Pseudoneoplastic
- Pancreatic Pseudocyst
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)

Localized

Non-Peritonitic
  • Gastroenteritis
  • Irritable Bowel Syndrome
  • Constipation
  • Metabolic Disease (e.g. Diabetic Ketoacidosis)
  • Mesenteric Ischemia
  • Mesenteric Thrombus
  • Sickle Cell Anemia
  • Musculoskeletal
  • Trauma
  • Peptic Ulcer Disease
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
- Cholecystitis
- Perforated Ulcer
- Pancreatitis
- Splenic Rupture

Epigastric
- Peptic Ulcer Disease
- Gastritis
- Esophageal Rupture
- Biliary Colic

Left Upper Quadrant
- Splenic Infarct
- Splenic Abscess
- Splenic Rupture

Bowel
- Appendicitis
- Diverticulitis
- Incarcerated Hernia

Lower Quadrant
Non-Peritoneal
- Irritable Bowel Syndrome
- Psoas Abscess
- Urinary Tract Infection
- Ureteric Colic

Pelvic/Adrenal
- Ectopic Pregnancy
- Ovarian Torsion
- Pelvic Inflammatory Disease
- Salpingitis

Localized
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

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

Cramping/Fleeting

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

Post-Prandial

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/Epi gastric? 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/Epigastric? 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

External Lesion
- Other
  - Malignancy
  - Solitary Rectal Ulcer
- Dermatologic
  - Dermatitis
  - Psoriasis
- Anorectal Disease
  - Fissure
  - Fistula/Abscess (Crohn's)
  - Hemorrhoid
Acute Diarrhea

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

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

- 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
  - *Crohn’s Ileitis*
  - *Crohn’s Colitis*

Inflammatory

- Non-Bloody
  - *Ulcerative Colitis*
  - *Crohn’s Colitis*

Dietary

- Bloody
  - *Bacterial (e.g. E. coli, C. difficile, Salmonella, Campylobacter, Shigella*)
  - Parasitic (e.g. *E. histolytica*)

**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

Chronic Diarrhea

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

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

Malabsorptive

Primary Malabsorption
• Celiac Disease
• Mucosal Disease
• Ileal Crohn’s Disease

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

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

Motility

Motility

• Irritable Bowel Syndrome
• Hyperthyroid

Inflammatory

Inflammatory

• Inflammatory Bowel Disease
• Radiation Colitis
• Ischemic Colitis

Small Bowel
Large Volume/Watery

Secretory

Secretory

• Villous Adenoma
• Colon Cancer
• Microscopic Colitis

Primary Malabsorption

Secondary Malabsorption

Pancreatic Insufficiency

Gastrointestinal
81
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

Irritable Bowel

Secondary Causes
Constipation (Adult)

Secondary Causes

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

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

- **Severe Idiopathic**

- **Secondary Causes**
  - **Non-Neurogenic**
  - **Metabolic**
    - Hypothyroidism
    - Hypokalemia
    - Hypercalcemia
  - **Colorectal Disease**
    - Colon Cancer
    - Colonic Stricture
      (Inflammatory Bowel Disease and Diverticular Disease)
Gastrointestinal

Constipation (Pediatric)

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

Neonate/Infant

- Dietary/Functional
  - Insufficient Volume/Bulk

- Neurologic
  - Hirschsprung’s Disease
  - Imperforate Anus
  - Anal Atresia
  - Intestinal Stenosis
  - Intestinal Atresia

Older Child

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

- Anatomic
  - Bowel Obstruction
  - Pseudo-obstruction

- Neurologic
  - Hirschsprung’s Disease
  - Spinal Cord Lesions
  - 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

Functional

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

Motor Disorder
Solids and/or Liquids

Mechanical Obstruction
Solids only

Intermittent Symptoms
• Esophageal Spasm

Progressive Symptoms
• Scleroderma
• Achalasia
• Diabetic Neuropathy

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**
Hepatomegaly

Rule out concurrent splenomegaly and jaundice

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

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

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

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
Jaundice

Pre-Hepatic
Unconjugated Hyperbilirubinemia

Hepatic
Conjugated Hyperbilirubinemia

- Hepatocellular
- Cholestatic
- Dubin Johnson

See Elevated Liver Enzymes scheme

Post-Hepatic
Usually has Duct Dilatation on Ultrasound

Increased Production
- Hemolysis
- Ineffective Erythropoiesis
- Hematoma

Decreased Hepatic Uptake
- Sepsis
- Drugs (e.g. 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
- Proliferative
  - Cystadenoma
- Infectious
  - Hydatid Cyst

Solid
- Benign
  - Cystadenocarcinoma
- Malignant
  - Proliferative
    - Hemangioma
    - Focal Nodular Hyperplasia
    - Adenoma
  - Infectious
    - Abscess
- Primary Malignancy
  - Hepatocellular Carcinoma
  - Cholangiocarcinoma
- Secondary Malignancy
  - Metastases (e.g. Lung, Colon, Breast)
Mouth Disorders (Adult & Elderly)

Consider oral manifestations of systemic disease

- Teeth
  - Ulcerating
    - Gastrointestinal
      - • Crohn’s Disease
      - • Ulcerative Colitis
      - • NSAIDs
    - Other
      - • Canker Sore
      - • Cold Sore
      - • Anemia
      - • Langerhan’s Cell Histiocytosis
      - • Wegener’s Disease
      - • Sarcoïdosis
      - • Drug Induced
      - • Sexually Transmitted Infection
  - Mucous Membrane
    - Non-Ulcerating
      - Lighter (White)
        - • Gingivitis
        - • Kawasaki Disease (Strawberry Tongue)
        - • Other Gum Disease
        - • Mucocele
        - • Allergic Reaction
      - Darker (Red)
        - • Chronic Liver Disease
        - • Sjögren’s Syndrome
        - • Acromegaly
        - • Amyloidosis
        - • Psoriasis
        - • Gingival Hyperplasia
        - • Dry Mouth
      - No Colour Change
        - • Leukoplakia
        - • Squamous Cell Carcinoma
      - Non-Neoplastic
        - • Candidiasis
        - • Lichen Planus
        - • Anemia
      - Neoplastic
        - • Leukoplakia
        - • Squamous Cell Carcinoma
Nausea & Vomiting
Gastrointestinal Disease

Nausea and Vomiting

Gastrointestinal Disease

Other Systemic Disease

Upper Gastrointestinal

Hepatobiliary

Lower Gastrointestinal

Acute

Chronic

Acute

Chronic

• Infectious Gastroenteritis
• Gastric/Duodenal Obstruction
• Gastric Volvulus

• Infectious Gastroenteritis
• Small/Large Bowel Obstruction
• Acute Appendicitis
• Mesenteric Ischemia
• Acute Diverticulitis

• Gastroesophageal Reflux Disease
• Peptic Ulcer Disease
• Gastroparesis

• Acute Hepatitis
• Acute Cholecystitis
• Cholelithiasis
• Choledocholithiasis
• Acute Pancreatitis

• Inflammatory Bowel Disease
• Colonic Neoplasm
Nausea & Vomiting
Other Systemic Disease

Gastrointestinal Disease

Endocrine/Metabolic
- Pregnancy
- Diabetes/ DKA
- Uremia
- Hypercalcemia
- Addison’s Disease
- Thyroid Disease

Other
- Sepsis (e.g. 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
Stool Incontinence

Intact Pelvic Floor

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

Affected Pelvic Floor

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

- Congenital Anorectal Malformation

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

- 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)
Upper Gastronintestinal 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?

Mallory Weiss Tear

Tumors

Esophagitis/Gastritis

• Benign
• Malignancy
Lower Gastrointestinal Bleed

Occult (Stool + Occult blood and/or iron deficiency anemia)
- Colorectal cancer
- Angiodysplasia (colon or small bowel)
- Occult UGI bleeding (ulcer, esophagitis, gastritis, cancer)
- Other: small bowel tumors, asymptomatic IBD

Overt Bleeding

In Patient
- RULE OUT BRISK Upper GI bleed, Diverticular bleed,
- Acute colitis (ischemia, infectious, inflammatory),
- Small bowel source (e.g. Meckel's, tumor),
- Angiodysplasia

Out Patient
- Perianal Disease (most common)
- Inflammatory Bowel Disease
- Colorectal Cancer
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

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Acute Kidney Injury

Acute increase in creatinine by at least 50%

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

Renal Hypoperfusion
• Hepatorenal syndromes
• Drugs
• Emboli

Systemic Hypotension
• Shock

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

Tubular
(Thrombocytopenia and schistocytosis on CBC)

Vascular

TTP/HUS

Glomerular
(RBC casts, dysmorphic RBCs)

Interstitial
(Sterile pyuria, eosinophilia)

Rapidly Progressive Glomerulonephritis

Acute Interstitial Nephritis

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

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

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

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

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

• Benign Prostatic Hyperplasia
• Constipation
• Prostate Cancer
• Urolithiasis

• Urinalysis and CBC
• Urinalysis

• Benign Prostatic Hyperplasia
• Constipation
• Prostate Cancer
• Urolithiasis

101
Chronic Kidney Disease

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

Pre-Renal
(Evidence of Renovascular disease)

- Atheroemboli
- Renal artery stenosis
- Drugs
- Chronic hypoperfusion

Renal
(Abnormal urinalysis: proteinuria/pyuria)

- Atherosclerosis

Glomerular
(Proteinuria)

- Diabetes
- Hypertension

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

- Reflux nephropathy
- Benign prostatic hyperplasia
- Constipation
- Prostate cancer

Tubular
(Family history, ultrasound)

- Polycystic kidney disease
- Medullary cystic disease
- Nephronophthisis

Vascular
(Other small vessel disease)

- Atherosclerosis

Interstitial
(Sterile pyuria, WBC casts, eosinophiluria)

- Drugs (NSAIDs, analgesics)
- Infections (chronic pyelonephritis)
- Immune (sarcoid, Sjögren)
- Multiple myeloma
- Hyperoxaluria
- Hypercalcemia
- Hyperphosphatemia
**Dysuria**

- **Pyuria**
  - Leukocytes on Dipstick/Microscopy
  - **Bacteriuria & Hematuria**
    - Dipstick positive for nitrites (if infected with enterobacteria).
    - **Upper Urinary Tract Infection/Pyelonephritis**
      - WBC Casts
  - **No Bacteriuria & No Hematuria**
    - Dipstick negative for nitrites.
    - **Lower Urinary Tract Infection/Cystitis**
      - WBC Clumps
  - **Urethritis**
    - **Candida**
    - **Herpes Simplex Virus**
  - **Vaginitis**
    - **Candida**
    - **Gardnerella**
    - **Neoplasm**
  - **Non-Pathogenic**
    - **Gonococcal**
    - **Non-Gonococcal (e.g. Chlamydia, Trichomonas)**
    - **Estrogen deficiency**
    - **Interstitial cystitis**
    - **Radiation cystitis**

- **No Pyuria**
  - No Leukocytes on Dipstick/Microscopy
Generalized Edema

Increased blood pressure

**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

Signs of left ventricular failure

Low serum albumin due to loss or impaired synthesis

Severely ill (e.g. in ICU)
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)

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)

Glomerular
(Dysmorphic RBCs and/or RBC casts)

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 Intake**
  - (IV potassium with reduced excretion)
- **Transcellular Shift**
  - Appropriate renal excretion
    - (GFR, TTKG, distal flow adequate)
- **Increased Release**
  - Increased Serum Osmoles, Increased Urate, Phosphate, Creatinine Kinase
    - Non-Anion Gap Metabolic Acidosis
    - Hyperosmolarity
    - Cell Lysis (e.g. Tumor Lysis Syndrome, rhabdomyolysis)
- **Decreased Entry**
  - Decreased Na⁺-H⁺ Exchanger
  - Decreased Na⁺-K⁺-ATPase
    - Insulin Deficiency/Resistance
    - β₂ antagonism
    - α₁ agonism
    - Digoxin

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

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

**Decreased Glomerular Filtration Rate**
Increased Creatinine
- Chronic renal failure
- AKI

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

Exclude pseudohyperkalemia

Leukocytosis, thrombocytosis, hemolysis

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

Serum Potassium <3.5 mmol/L

Increased Loss

Decreased intake
(rare cause in isolation)

Transcellular shift

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

Renal Loss
Urine loss >20mmol/d

High distal [K]
TTKG > 4

EABV contracted

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

High distal flow
TTKG < 4

• Polyuria

Normal or expanded EABV

Volume Status Assessment

GI loss
Urine loss <20mmol/d

• Diarrhea
• Vomiting
• NG suction
• Laxatives

Low renin
Low aldosterone

• Licorice intake
• Liddle’s syndrome

High renin
High aldosterone

• Renal artery stenosis

Low renin
High aldosterone

• Hyperaldosteronism

Low renin
Low aldosterone

Renal artery stenosis
**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 Volume**
<3L/24 hours

**Low Urine Osmolality**
< 300 mmol/kg
- Diabetes Insipidus

**Non-renal losses**

**Hypodipsia**
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

Artifactual

Normal Posm
280-295 mmol/kg
- Hypertriglyceridemia
- Paraproteinemia

High Posm
>295 mmol/kg
- Hyperglycemia*
- Mannitol

Impaired H20 Excretion
- Reduced GFR
- Diuretics

Hyper-osmolar urine
Uosm > 100 mmol/kg
ADH expression

Hypo-osmolar plasma
Posm < 280 mmol/kg

Intact H20 Excretion

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

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

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

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

Hypovolemia
- True hypovolemia
- Hypo-osmolar plasma
- Hyperglycemia*
- Mannitol

Hypo-osmolar urine
Uosm < 100 mmol/kg
ADH suppression
- Primary polydipsia
- Insufficient osmole intake

Hormonal changes
- Hypothyroidism
- Adrenal insufficiency
- Pregnancy

*serum sodium correction in hyperglycemia:
\[ [Na^+]_{corrected} = [Na^+] + (0.3 \times ([glucose] - 5)) \]
Hypertension

BP > 140/90 (>130/80 for DM)

Hypertensive urgency or emergency (any visit)
Hypertension with end-organ damage or DM (visit 2)
Diagnosis based on repeat clinic visits, Ambulatory blood pressure monitor, Self/Home pressure monitoring (visit 3+)

Essential (Primary) Hypertension

Secondary Hypertension

Cardiac Output (Volume dependent)

Renal Parenchymal Diseases
- Glomerulonephritis
- Nephritic syndrome
- AKI/CKD

Mineralocorticoid Excess
- Conn’s syndrome
- NSAIDs
- Licorice
- Liddle’s syndrome
- Bilateral RAS

Vasoconstrictors
- Sympathetic nervous system (ie. cocaine, pheochromocytoma)
- Steroids (Cushing’s, exogenous steroids)
- Renin-Angiotensin stimulation (OCP)
- Alcohol abuse/ withdrawal

Systemic Vascular Resistance (Vasoconstrictive)

Anatomic Causes
- Aortic coarctation
- Unilateral RAS

Metabolic Causes
- Hyperthyroidism
- Hypercalcemia
- Pheochromocytoma

Consider secondary HTN
- Onset <20yo, >50yo
- No FHx
- Hypertensive urgency
- Refractory hypertension (multi-drug resistance)
Increased Urinary Frequency

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

Intrinsic to Urinary Tract

Urinary Tract Infection
(See Dysuria scheme)

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

Extrinsic to Urinary Tract

Small volume bladder

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

Vulvovaginitis
Bladder compression/Pregnancy
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

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

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

Soft Stones
Struvite Stones
10% of stones

• Urinary tract infection

Cysteine Stones
Non Calcium containing, but opaque
• Cystinuria

Uric Acid Stones
• Hyperuricosuria
• High protein intake

Radiolucent
Non-calcium
10% of stones

Anatomical problem
• Medullary sponge kidney

Renal
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

Uosm unchanged or increased by <50%
Unresponsive Kidney

- Nephrogenic Diabetes Insipidus
Proteinuria

Persistent Proteinuria

>150 mg/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 (e.g., Amyloidosis)

Transient Proteinuria
- Exercise
- Fever
- UTI

Excluded on history/with repeat testing

Orthostatic Proteinuria
- Tall adolescents
Renal Mass

Solid

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

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

Cystic
Renal Mass

Cystic

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

Abscess
Fever and leukocytosis
Positive Gallium scan

• Renal Cell Carcinoma
Scrotal Mass

- Painful
  - Sudden Onset
    - Testicular Torsion
    - Torsion of the Testicular Appendix
    - Trauma
    - Incarcerated Hernia
  - Gradual Onset
    - If with Dysuria see Dysuria scheme
    - Acute Epididymitis
    - Epididymo-orchitis

- Painless
  - Trans-illuminates
    - Tumor
      - Solid = Tumor until proven otherwise
      - Germ cell
        - Seminoma, Teratoma, Mixed
      - Non-germ cell
  - Does Not Trans-illuminates
    - Varicocele
      - Soft/"Bag of Worms"
Suspected Acid-Base Disturbance

Suspected Acid-Base Disorder

Acidemia (pH < 7.35)

- Metabolic Acidosis
  - (HCO₃⁻ < 24mmol/L)
  - CO₂ : HCO₃⁻ 12:10

- Respiratory Acidosis
  - (pCO₂ > 40 mmHg)
  - CO₂ : HCO₃⁻ 10:1

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

Non-Anion Gap
- Renal
- Gastrointestinal (diarrhea)

Normal pH

Metabolic Alkalosis
- (HCO₃⁻ > 28mmol/L)
- CO₂ : HCO₃⁻ 7:10

Acute Metabolic Alkalosis
- CO₂ : HCO₃⁻ 10:1

Chronic Metabolic Alkalosis
- CO₂ : HCO₃⁻ 10:3

Alkalemia (pH > 7.45)

Respiratory Alkalosis
- (pCO₂ < 35 mmHg)
- CO₂ : HCO₃⁻ 10:2

- Acute Respiratory Alkalosis
- CO₂ : HCO₃⁻ 10:2

- Chronic Respiratory Alkalosis
- CO₂ : HCO₃⁻ 10:4

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

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 < 0 Mixed Anion Gap Acidosis + Non-Anion Gap Acidosis
- ΔAnion Gap > 0 Mixed Anion Gap Acidosis + Metabolic Alkalosis

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

- Excess acid addition
- Elevated serum creatinine

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

- Salicylate poisoning
- Lactic acidosis
- Ketosis
- Toxic alcohol ingestion
- Other ingestion

Normal Anion Gap (≤12) (loss of HCO3)

- Decreased NH₃ production and anion secretion
- • AKI/CKD

- • Shock
- • Drugs
- • Inborn errors
- • Diabetic ketoacidosis
- • Starvation/alcoholic ketosis
- • Ethylene/Propylene glycol
- • Methanol
- • Paraldehyde, Iron, Isoniazid, Toluene, Cyanide

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

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
Metabolic Acidosis

Normal 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 (>14)
(Acid Gain)

Normal Anion Gap (≤14)
(Loss of Bicarbonate)

History of diarrhea?

Gastrointestinal Tract Loss
(Negative urine net charge)
• Diarrhea
• Fistula

Renal Loss

Direct Loss
Negative U net charge
High FE\textsubscript{HCO3}
• RTA Type II
• Carbonic anhydrase inhibitor

Indirect Loss
Positive U net charge

Principal Cell Problem
Low TTKG
• RTA Type IV

\(\text{TTKG} = \frac{K_{\text{Urine}} \times \text{Osm}_{\text{Serum}}}{(K_{\text{Serum}} \times \text{Osm}_{\text{Urine}})}\)
Urine net charge = \(U_{\text{Na}} + U_{\text{K}} - U_{\text{Cl}}\)

\(\alpha\)-Intercalated Cell Problem
High TTKG
• RTA Type I
Metabolic Alkalosis

Sustained Metabolic Alkalosis

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

Transient

- IV Bicarbonate
- Acute correction of hypercapnia

Volume Status Assessment
Urinary Incontinence

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

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

Established
Not easily reversible cause
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
- Carcinoma (until proven otherwise)
- Bladder stone
- Thrombus (frank hematuria)

Outflow Tract
- BPH
- Prostate cancer
- Urethral stricture
- Posterior Urethral valves

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

Bladder
Endocrinology

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Abnormal Lipid Profile

Combined & Decreased HDL

Abnormal Serum Lipid Profile

- Increased LDL
- Increased Triglycerides
- Increased Cholesterol and Triglycerides
- Decreased HDL

Genetic Causes
- Familial Combined Hyperlipidemia
- Familial Dysbetalipoproteinemia

Secondary Causes
- Nephrotic Syndrome
- Drugs
- Diabetes
- Hypothyroidism
- Apo-A1 Deficiency/Variant
- Tangier Disease
- LCAT Deficiency
  Primary Hypoalphalipoproteinemia
- Sedentary Lifestyle
- Smoking
- Androgens

Physical signs:
- Hypertriglyceridemia: eruptive xanthoma, lipemia retinialis
- 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
  - Familial Hypercholesterolemia
  - Familial Defective ApoB-100
  - LDLr deficiency
- Secondary Causes
  - Hypothyroid
  - Obstructive Liver Disease
  - Nephrotic Syndrome

Increased Triglycerides
- Genetic Causes
  - Familial Hypertriglyceridemia
  - Familial LPL Deficiency
  - Apo-CII Deficiency
- Secondary Causes
  - Diabetes
  - Alcohol
  - Increased Estrogen (e.g. Pregnancy, Hormone Replacement Therapy, Oral Contraceptive)

Increased Cholesterol and Triglycerides
- Genetic Causes
- Secondary Causes

Decreased HDL

Physical signs:
- Hypertriglyceridemia: eruptive xanthoma, lipemia retinalis
- Increased LDL: 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
- Increased Free T4
  - Thyrotoxicosis

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

*Refer to Hyperthyroidism (1) on page 150
**Refer to Hyperthyroidism (2) on page 151
Adrenal Mass

Benign

Benign Adrenal Mass

Most common neoplasm is Benign Non-Functioning Adenoma

Signs of Hormone Excess

Hyperplasia

- Often Bilateral
- Congenital Adrenal Hyperplasia
- ACTH Dependent
- ACTH Independent
- Macronodular Hyperplasia

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

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

Other

- Cyst
- Pseudocyst
- Hematoma
- Infection (TB, Fungal)
- Amyloidosis

Androgen Excess

- Adrenogenital Syndrome (High Plasma E2 + Clinical Picture)

Estrogen Releasing Adenoma

- Positive Dexamethasone Suppression Test

Aldosterone Releasing Adenoma (High Aldosterone: Renin Ratio)

Pheochromocytoma

(Paroxysmal Hypertension, Headache, Diaphoresis, Palpitations, Anxiety)

Non-functioning Adenoma

Lipoma

Myelolipoma

Ganglioneuroma

High DHEAS

Normal DHEAS

- Androgen Releasing Adenoma

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

Normal DHEAS

- Non-functioning Adenoma

- Lipoma

- Myelolipoma

- Ganglioneuroma

Other

- Cyst
- Pseudocyst
- Hematoma
- Infection (TB, Fungal)
- Amyloidosis
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

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

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

No Signs of Hormone Excess

Normal DHEAS

• Other Source (e.g. Polycystic Ovarian Syndrome, Congenital Adrenal Hyperplasia)

High DHEAS

• Androgen Releasing Carcinoma (e.g. Adrenocortical Carcinoma)

Pheochromocytoma
Paroxysmal Hypertension, Headache, Diaphoresis, Palpitations, Anxiety

Silent/Non-Functioning Mass

Positive 24-Hour Metanephrines + Nor-Metanephrines

Androgen Releasing Carcinoma (e.g. Adrenocortical Carcinoma)

Normal DHEAS

• Other Source (e.g. Polycystic Ovarian Syndrome, Congenital Adrenal Hyperplasia)

High DHEAS
• Androgen Releasing Carcinoma (e.g. Adrenocortical Carcinoma)

Positive 24-Hour Metanephrines + Nor-Metanephrines

Pheochromocytoma
Paroxysmal Hypertension, Headache, Diaphoresis, Palpitations, Anxiety

Silent/Non-Functioning Mass

Positive 24-Hour Metanephrines + Nor-Metanephrines

Pheochromocytoma
Paroxysmal Hypertension, Headache, Diaphoresis, Palpitations, Anxiety

Silent/Non-Functioning Mass

Positive 24-Hour Metanephrines + Nor-Metanephrines

Pheochromocytoma
Paroxysmal Hypertension, Headache, Diaphoresis, Palpitations, Anxiety

Silent/Non-Functioning Mass
Amenorrhea

Rule Out Pregnancy

Low/Normal FSH

Bleed With Progestin Challenge
- Polycystic Ovarian Syndrome

Hypothalamic-Pituitary Axis

No Bleed With Progestin Challenge
- Hypothyroidism
- Hyperthyroidism
- 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

- Normal TSH/ Prolactin
  - Idiopathic

- 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

- Autonomous Production
  - Renal Cancer or Failure
  - Lactotroph Adenoma
  - Bronchogenic Tumor
  - Contraceptive Pill/Patch/Ring

- High Prolactin + High TSH
  - Primary Hypothyroidism

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

Increased LH & Decreased Testosterone
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

Androgen Excess
Normally With Menstrual Irregularity

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

Malignancy

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

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 Hypocalciuric 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**

**Low Phosphate**

- Normal Creatinine
  - Low/Normal PTH
    - Hypoparathyroidism (e.g. Acquired, Autoimmune, Idiopathic, Congenital, Infiltrative)
    - Activating Mutation in Calcium Sensing Receptor (CaSR)
    - Hypomagnesemia
  - High PTH
    - PTH Resistance (Pseudohypoparathyroldism)
    - Calcium Complexing
    - (Citrate Infusion, Pancreatitis)

- High Creatinine
  - Low PTH
    - Hypoparathyroidism with Chronic Kidney Disease
  - High PTH
    - Secondary Hyperparathyroidism
    - Rhabdomyolysis
    - Phosphate Poisoning

---

**Corrected total serum calcium concentration (mmol/L) =**

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

Low Phosphate

High Phosphate

Low/Normal PTH

• Severe Malnutrition with Hypomagnesemia

High PTH

• 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 (eg. anti-convulsants)
  - 25-OH D not very low
    - Chronic Renal Failure
    - Severe hyperphosphatemia (eg. 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

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**

- **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
Hyperphosphatemia

Hyperphosphatemia

(> 1.46 mmol/L)

Transcellular Shift

• Rhabdomyolysis
• Tumor Lysis
• Metabolic or Respiratory Acidosis
• Insulin Deficiency

Decreased Excretion

FE_{PO4} < 20%

• Renal Disease
• Hypoparathyroidism
• Pseudo-hypoparathyroidism
• Acromegaly
• Bisphosphonate Therapy

Increased Intake/Absorption

Normally in Context of Impaired Renal Function

• Hypervitaminosis D
• Phosphate Supplementation
• Phosphate Containing Enemas/Laxatives

Pseudo-hyperphosphatemia

• Multiple Myeloma
• Hyperbilirubinemia
• Hemolysis
• Hyperlipidemia
• Tumor Lysis
Hypophosphatemia

Hypophosphatemia (< 0.8 mmol/L)

**Transcellular Shift**
- Recovery From DKA
- Refeeding Syndrome
- Acute Respiratory Alkalosis
- Hypokalemia
- Hypomagnesemia
- Burns

**Increased Excretion**
- GI
- Renal
  - Fe<sub>Po4</sub> > 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

**Dietary deficiency**
- Small bowel diarrhea
- Enteric Fistula

**Malabsorption**
- Anorexia
- Chronic Alcoholism

**GI**
- Small bowel diarrhea
- Enteric Fistula

**Renal**
- Fe<sub>Po4</sub> > 5%

**Transcellular Shift**
- Recovery From DKA
- Refeeding Syndrome
- Acute Respiratory Alkalosis
- Hypokalemia
- Hypomagnesemia
- Burns

**Increased Excretion**
- GI
- Renal
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**Decreased Intake**
- Dietary deficiency
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  - Chronic Alcoholism
- Malabsorption
  - Aluminum/Magnesium Containing Antacids
  - Inflammatory Bowel Disease
  - Steatorrhea
  - Chronic Diarrhea
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
- Thyroid Hormone Resistance

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

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

Infiltrative Disease
- Fibrous Thyroiditis
- Hemosiderosis

Congenital Thyroid Agenesis/Degenesis
- Severe Iodine Deficiency

Medications
- Thionamides
- Lithium
- Amiodarone
- Interferon

Central Hypothyroidism
- Hashimoto's Thyroiditis
Hyperuricemia

Primary

Over-production
- Increased turnover of nucleotides

Under-excretion
- Lower uric acid clearance
- Starvation

Secondary

Over-production

Under-excretion

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

Hemolytic Anemia
- See hemolysis scheme

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

Endocrine
- Hyperparathyroidism
- Diabetic acidosis

Renal
- Chronic renal failure
- Sarcoidosis
- Hypercalcemia

Drug-Induced
- Antiuricosuric drugs
- ACE inhibitors
- Cyclosporine
- Diuretics
- Organic acids
- Ethambutol
- Alcohol
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
- 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
- Hyperthyroidism
- Chronic Pain

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

Physiological
- Hypo-testosteronism
- Prolactinemia
- Hyperthyroidism
- Hyperthyroidism

Pathological

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

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

Other
- Hypertension
- Dyspareunia
- Dialysis

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

Disease

Pelvis
- Dialysis

Other
- Hypertension
- Dyspareunia
- Dialysis

Endocrinology
Sellar / Pituitary Mass

- **Adenoma**
  - Primarily Anterior Pituitary
  - Secreting
    - Prolactin
    - GH
    - ACTH
    - TSH
    - LH/FSH
    - Mixed
  - Non-Functioning
    - Oncocytoma
    - Null Cell Adenoma

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

- **Non-Adenomatous**
  - Vascular
    - Aneurysm
    - Infarction
  - Hamartoma

- **Inflammatory**
  - Infectious
  - Autoimmune
  - Giant Cell Granuloma
  - Langerhan’s Cell
  - Histiocytosis
  - Sarcoidosis

- **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

No Dysmorphic Features

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

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

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

Normal Variant

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
- No Obese BMI
- Early Puberty Onset
- Precocious Puberty
  - Adrenal Tumor
  - Ovarian Tumor
  - Testotoxicosis
  - Congenital Adrenal Hyperplasia

Accelerated Growth (BA>CA)

- Obese BMI
  - Exogenous Obesity
- Normal Puberty Onset
  - GH Excess
  - Hyperthyroidism

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)

Constitutional

- Constitutional Tall Stature (Early Bloomer)
Weight Gain / Obesity

Energy Related (Primary)

Increased Intake
- Sedentary Lifestyle
- Smoking Cessation

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

Secondary

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

Genetic

Dietary
- Progressive
- Polyphagia
- High-Fat Diet

Social/Behavioural
- Socioeconomic
- Ethnicity
- Psychological

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

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Altered Level of Consciousness

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

No Metabolic Abnormality
- Postictal
- Concussion
- Meningitis
- Encephalitis

Focal
- Trauma
- Stroke
- Tumor
- Hemorrhage
- See Imaging Section

Non-Focal
- Refer to Blood Work and Imaging Sections

Metabolic Abnormality
- Hypoxia
- Hypercapnea
- Hyper/HypoNa
- Hyper/HypoCa
- Hyper/HypoK
- Sepsis

No Metabolic Abnormality
- Postictal
- Concussion
- Meningitis
- Encephalitis

Structural Abnormality
- Epidural Hemorrhage
- Subdural Hemorrhage
- Intracranial Hemorrhage
- Ischemia
- Tumor

Non-Structural
- Post-Ictal
- Concussion
- Encephalitis
**Altered Level of Consciousness**

GCS ≤ 7

**Brain Involvement**

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

**Diffuse Lesions**
- Hemorrhage
- Traumatic
- Ischemia/Infarction
- Neoplastic Abscess
- Herniation
- Brain stem Lesion

**Vascular**
- Hypertensive encephalopathy
- Vasculitis
- TTP
- DIC
- Hypoxemia
- Multiple emboli

**Infection**
- Meningitis
- Encephalitis
- Trauma/Concussion
- Post-ictal

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

**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

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

**Fluent**
- Grammatically correct, but nonsensical, tangential.
- Phonemic & semantic paraphasias
  - Wernicke’s Aphasia
  - Conduction Aphasia
  - Transcortical Sensory Aphasia

**Non-Fluent**
- Agrammatic, hesitant, but substantive communication
  - Impaired Comprehension
  - Intact Comprehension
  - Impaired Comprehension
  - Intact Comprehension

**Impaired Repetition**

**Intact Repetition**
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

Aphasia

Aphasia

Neurologic
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
    - Myelopathic
    - Spondyloarthropathies or Osteoarthritis

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

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

Subcortical Dementia

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

- Early Exapyramidal 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

Decline in Instrumental Activities of Daily Living

- Amnestic Mild Cognitive Impairment
- Non-Amnestic Mild Cognitive Impairment

Affecting Multiple Domains

- Depression
- Delirium

• Depression
• Delirium

• Amnestic Mild Cognitive Impairment
• Non-Amnestic Mild Cognitive Impairment

• Fronto-temporal Dementia
• Vascular Dementia
• Alzheimer’s Dementia
• Dementia with Lewy Bodies
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

Falls in the Elderly

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

Extrinsic Factors

Musculo-skeletal
- Arthritis

Drugs
- Polypharmacy – esp. >4 medications
- Psychotropics

Environment
- Rugs
- Stairs
- Lighting

Neurologic
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
- Spastic
  - Vascular
  - Infection
  - Toxic
  - Nutrition
  - Metabolic
  - Inflammation
  - Neoplasm
  - Degenerative
- Cataclysmic Deficiency
  - Catalytic Deficiency
    - (Childhood)

See Movement Disorder schemes
Headache

Primary

Usually episodic

No pattern

Unilateral

• Migraine (Throbbing/Pulsating)

Bilateral

• Tension/Stress Headache (Tightening, Band-Like, Dull)

Secondary

Usually constant

Other

• Primary Cough Headache
• Primary Exertional Headache
• Primary Stabbing Headache

In Clusters

Autonomic Cephalgias

Last for minutes to hours.
Separated by hours.
Sudden onset.

• Cluster Headache (Orbital, Sharp, Autonomic Dysfunction)
• Hemicranial Continua

Other

Last for seconds, separated by minutes to hours

• Trigeminal Neuralgia (Shooting, stabbing)

Other

In Clusters

Sudden onset.
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)
Mechanisms of Pain

Pain

Nociceptive
Tissue Damage

Mixed
Nociceptive/Neuropathic

Neuropathic
Burning, shooting, gnawing, aching, lancinating

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

Somatic

Central Nervous System

Peripheral Nervous System

• Post-Herpetic Neuralgia
• Neuroma
• Neuropathy

Deep
Less well-localized, dull, longer duration

Superficial
Well-localized, sharp, short duration

Deafferentation
Loss of sensory input

Sympathetic
• Complex regional pain syndrome

• Post-stroke
• Spinal injury
Movement Disorder

Hyperkinetic

Examples listed not exhaustive for all causes

- Tourette’s Syndrome
- Attention Deficit Hyperactivity Disorder
- Obsessive Compulsive Disorder
- Generalized dystonia
- Writer’s cramp
- Blepharospasm
- Cervical Dystonia

Tics

Dystonia

Stereotypies

Myoclonus

• Epilepsy
• Toxic/metabolic

Chorea

• Huntington’s Disease

Bradykinetic

Tremor

Athetosis

Ballism
Movement Disorder

Tremor

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

Hyperkinetic

Tremor

Drug-Induced Parkinsonism

Parkinson’s Disease (TRAP)

Hyperkinetic

- Resting Tremor
- Cogwheel Rigidity
- Akinesia/Bradykinesia
- Postural Instability

Tremor

- Neuroleptics
- Haloperidol
- Metoclopramide
- Prochlorperazine
- Amiodarone
- Verapamil

Progressive Supranuclear Palsy

- Vertical Gaze Palsy
- Axial rigidity > limb rigidity
- +/- Tremor
- Bradykinesia
- Falling backwards

Multiple System Atrophy

- 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
• Syring

Sensory Changes

No Objective Weakness

• Cardio-pulmonary disease
• Anemia
• Chronic Infection
• Malignancy
• Depression
• Deconditioning
• Arthritis
• Fibromyalgia
• Endocrine Disease

No Sensory Changes

Motor Neuron and Motor Neuropathy
Atrophy, Fasciculations, Hyperreflexia

Neuromuscular Junction
Fatigability, Variability, Oculomotor

Myopathy
Proximal muscle involvement, elevated CK

• Lead toxicity
• Progressive muscular atrophy
• Hodgkin’s lymphoma
• Polio
• Multifocal Motor Neuropathy
• Spinal Muscular Atrophy

• Myasthenia Gravis
• Lambert-Eaton Myasthenic Syndrome
• Botulism
• Congenital

• Polymyositis
• Duchenne Muscular Dystrophy
• Statin Toxicity
• Dermatomyositis
• Viral infection

See Peripheral Weakness: Sensory Changes scheme
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

Mono-neuropathy

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

Compression
- Carpal Tunnel
- Ulnar
- Peroneal
- Radial

Other
- Trauma
- Tumor
- Ischemia

Mononeuritis Multiplex
- Vasculitis
- Diabetes

Plexopathy
- Brachial neuritis
- Diabetes
- Tumor

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

Unprovoked Recurrence
Epileptic Seizure

Focal Seizure ¹

Non-Dyscognitive ¹
Features of
• Aura
• Motor
• Autonomic

Dyscognitive ²

Evolving to Bilateral Convulsive Seizure ³, ⁴

Unclassified

Generalized

Non-Convulsive
• Absence
• Atonic

Convulsive
• Myoclonic
• Clonic
• Tonic
• Tonic-Clonic

provoked Recurrence
Non-epileptic organic seizure/other

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.
Spell / Seizure

Secondary Organic

Unprovoked Recurrence (Primary)
Epileptic Seizure

Unprovoked Recurrence (Primary)

Other

Febrile

• Sepsis
• Encephalitis
• Meningitis

Infection

• Hypoglycemia
• Hyperglycemia
• Hypocalcemia
• Hyponatremia
• Uremia
• Alcohol/drug

Metabolic

Vascular

• Intracerebral hemorrhage
• Subarachnoid hemorrhage
• Subdural hemorrhage

• Dementia

Degenerative

Structural

• Congenital abnormality
• Neoplasm
• Arteriovenous malformation

• Eclampsia

Pregnancy

Secondary Organic

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

Neurologic
Spell / Seizure

Other

Spell/Seizure

Unprovoked Recurrence (Primary)
Epileptic Seizure

Unprovoked Recurrence (Primary)
Epileptic Seizure

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

Other

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

Cardiovascular
• Syncope

Secondary Organic

Psychogenic
• Panic Disorder
• Conversion Disorder
• Pseudoseizures
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

Ischemia

Subarachnoid Hemorrhage
Stroke

Ischemia

Stroke

Intracerebral Hemorrhage

Thrombosis
Atherosclerosis, Arterial Dissection, Fibromuscular Dysplasia

Large Vessel

Small Vessel

• Lacunar

Unknown

Heart

• Left Ventricle
• Left Atrium
• Valvular
• Atrial fibrillation
• Bacterial endocarditis
• Myocardial infarction

Ascending Aorta

Systemic Hypoperfusion

Pump Failure

Cardiac Output Reduction

• Cardiac arrest
• Arrhythmias

• Myocardial infarction
• Pulmonary embolus
• Pericardial effusion
• Shock

Subarachnoid Hemorrhage
Stroke

Subarachnoid Hemorrhage

Intracerebral Hemorrhage

Ischemia

Subarachnoid Hemorrhage

Vessel Disease
- Aneurysm
- Vascular Malformation

Other
- Bleeding Diathesis
- Trauma
- Drug Use
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/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
Vertigo

Vertigo/Dizziness

True 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

Infection
• Meningitis
• Cerebellar/Brainstem Abscess

Trauma
• Cerebellar Contusion

Space-Occupying 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
• Labyrinthitis/Vestibular Neuronitis
• Menière’s Disease
• Acoustic Neuroma
• Ototoxicity (usually imbalance and oscillopsia)
• Otitis Media
• Temporal Bone Fracture
Obstetrical & Gynecological

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Obstetrical

Intrapartum Abnormal Fetal HR Tracing

Variability & Decelarations

Abnormal Fetal Heart Rate Tracing

Abnormal Variability

Baseline Abnormality

Decelarations

Minimal/Absent Variability

≥ 5 bpm

• Fetal sleep
• Prematurity
• Medications (analgesia, sedatives)
• Hypoxic acidemia
• Congenital anomalies

Marked Variability

≥ 25 bpm

• Mild hypoxia

Sinusoidal Pattern

• Severe fetal anemia (Hgb < 70)
• Tissue hypoxia in fetal brain stem

Absent Accelerations

• Hypoxic acidemia
• Fetal abnormality

Early decelarations

• Fetal head compression (mirror contractions)

Variable decelarations

• Cord compression
• Fetal acidemia if complicated variable decelarations

Late decelarations

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

Prolonged decelaration

• 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

See Bleeding in Pregnancy Scheme

Non Pregnant

Gynecologic

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

Non-Gynecologic
- Medical (e.g. coagulopathy, liver disease, renal disease)
- Drugs
Acute Pelvic Pain

Gynecologic

Pregnant

Non-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

**Obstetrical Emergencies
Chronic Pelvic Pain

> 6 months in duration

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

Non-Gynecologic

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
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

Congenital Outflow Tract Anomalies

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

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
Amenorrhea

Secondary

Primary
No onset of menarche by age 16

Secondary
Absence of menses for more than 3 cycles or 6 months in women who were previously menstruating

Rule out pregnancy (β-hCG)

Ovarian

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)

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)

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

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

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

Not Bleeding from the Os

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

Second / Third Trimester

Not Bleeding from the Os

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)

β-hCG not doubled in 72h

Ectopic pregnancy or failed pregnancy

No IUP on Transvaginal U/S

No Ectopic Pregnancy on U/S

β-hCG > 1500

Ectopic likely
Bleeding in Pregnancy

2nd & 3rd Trimester

Bleeding in Pregnancy

Hemodynamically Unstable – Do ABCDEs

< 20 Weeks

Second / Third Trimester

Do NOT perform digital examination until the placental location is known

Bleeding from the Os

Not Bleeding from the Os

Painful

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

Painless

- Placenta previa
- Vasa previa

Cervical polyp/Ectropion
Cervical/Vaginal neoplasm
Vaginal laceration
Infection
Breast Disorders

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

Breast Mass
- Malignant
  - Invasive
    - Ductal carcinoma
    - Lobular carcinoma
    - Tubular carcinoma
    - Medullary carcinoma
    - Papillary carcinoma
    - Mucinous carcinoma
  - Non-Invasive

- Benign
  - Solid
    - Fibroadenoma
  - Cystic
    - Gross cyst
    - Galactocele
    - Fibrocystic

Gynecomastia
- Physiologic
  - Newborn
  - Adolescence
  - Aging
- Pathologic
  - Drugs
  - Decreased testosterone
  - Increased estrogen
  - Idiopathic
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
- Decreased Uteroplacental Flow
  - Gestational hypertension/pre-eclampsia
  - Renal insufficiency
  - Diabetes mellitus
  - Autoimmune disorders

**Fetal Factors**
- Multiple Gestation
- Placental Abruption
- Maternal Lifestyle
  - Malnutrition
  - Smoking
  - Alcohol
  - Drugs

**Placental Factors**
- Chromosomal Abnormalities
  - Trisomy 13, 18, 21
  - Turner syndrome, 45X
- Placental Malformations
- Confined Placental Mosaicism (Rare)
- Placental Ischemia/Infarction
  - Placenta previa
  - Chronic insufficiency
- Placental Abruption
  - Vasa previa
- Maternal Hypoxemia
  - Pulmonary diseases
  - Chronic anemia
  - High altitude
- Iatrogenic
  - Folic acid antagonists
  - Anticonvulsants
Growth Discrepancy

Large for Gestational Age

Small for Gestational Age

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%)
  - 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
  - Decreased FSH
    - Hypothalamic
      - Hypopituitarism
        - Hypothyroidism
        - Hyperprolactinemia
        - Tumors (e.g. Prolactinoma)
        - Premature ovarian failure
        - Premenopausal changes
        - Turner’s syndrome
    - Hypothalamic
      - Excessive exercise
      - Stress/psychosis
      - Systemic disease
  - Normal FSH
    - Polycystic ovarian syndrome
    - Obesity
  - Increased FSH
    - Ovary
      - Ovulation confirmation: mid-luteal serum progesterone
      - Ovarian reserve: Day 3 FSH +/- Estradiol
      - Premature ovarian failure
      - Premenopausal changes
      - Turner’s syndrome

- Unexplained (15%)

- Female (50%)
Infertility (Male)

Failure to conceive following > 1 year of unprotected sexual intercourse

Male (35%)

Sperm Production
(Non-obstructive azoospermia)
Low testosterone

Pre-Testicular
(Hypogonadotrophic hypogonadism)
Low FSH/LH

• Kallmann syndrome
• Suppression of gonadotropins (e.g. hyperprolactinemia, hypothyroidism, drugs, tumor, infection, trauma)
• Anabolic steroids

Sperm Motility
Abnormal semen analysis

• Antibodies from infection

Testicular
(Sperm production problem)
High FSH/LH

• Genetic abnormality (e.g. Klinefelter’s)
• Cryptorchidism
• Varicocele
• Mumps orchitis
• Radiation, Infection, drugs, trauma, torsion

Sperm Transport

• Vasectomy
• Cystic fibrosis gene mutation
• Post-infectious obstruction
• Ejaculatory duct cysts (e.g. prostate)
• Kartagener syndrome

Unexplained (15%)

Sexual Dysfunction

Female (50%)

See Sexual Dysfunction Scheme

Pre-Testicular (Hypogonadotrophic hypogonadism)
Low FSH/LH

Testicular (Sperm production problem)
High FSH/LH

Sexual Dysfunction

See Sexual Dysfunction Scheme

Pre-Testicular (Hypogonadotrophic hypogonadism)
Low FSH/LH

Testicular (Sperm production problem)
High FSH/LH

Sexual Dysfunction

• Vasectomy
• Cystic fibrosis gene mutation
• Post-infectious obstruction
• Ejaculatory duct cysts (e.g. prostate)
• Kartagener syndrome

Sperm Transport

• Antibodies from infection

Sperm Motility
Abnormal semen analysis

Sperm Production
(Non-obstructive azoospermia)
Low testosterone

Male (35%)

Unexplained (15%)

Female (50%)

Sexual Dysfunction

See Sexual Dysfunction Scheme

Pre-Testicular (Hypogonadotrophic hypogonadism)
Low FSH/LH

Testicular (Sperm production problem)
High FSH/LH

• Genetic abnormality (e.g. Klinefelter’s)
• Cryptorchidism
• Varicocele
• Mumps orchitis
• Radiation, Infection, drugs, trauma, torsion
Intrapartum Factors that May Affect Fetal Oxygenation

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

Non-Gynecologic

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

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

Pregnant

Uterus
- Intrauterine pregnancy

Fallopian Tube
- Tubal ectopic pregnancy

Ovary
- Ovarian ectopic pregnancy

See Ovarian Mass scheme
Ovarian Mass

**Benign Neoplasms**
- Polycystic ovary
- Endometrioid cyst

**Epithelial**
- Serous cystadenoma
- Mucinous cystadenoma

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

**Sex Cord Stromal**
- Fibroma
- Thecoma
- Granulosa cell tumor

**Hyperplastic**
- Follicular cyst
- Corpus lutein cyst
- Theca lutein cyst

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

**Malignant Neoplasms**
- Serous cystadenocarcinoma
- Mucinous cystadenocarcinoma
- Endometrioid
- Clear Cell

**Epithelial**
- Dysgerminoma
- Immature teratoma
- Yolk Sac

**Germ Cell**
- Granulosa cell tumor
- Sertoli Cell
- Sertoli - Leydig

**Sex Cord Stromal**
- Krukenberg tumor
  (gastrointestinal metastasis)
- Breast

**Metastases**
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
• Enterocoele
• Rectocoele (posterior prolapse)
Post-Partum Fever

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

Post Partum Fever (Puerperal)

< 6 Weeks Post-partum

Infectious

Non-Infectious

Respiratory
- Atelectasis
- PE

Uterine

Thrombotic
- DVT
- Septic Pelvic Thrombophlebitis

Respiratory
- Pneumonia

Uterine
- Endometritis
- Retained Products of Conception

Breasts
- Mastitis
- Abcess

Urinary
- UTI
- Pyelonephritis

Wound
- Cesarean Incision
- Vaginal Laceration
- Episiotomy
- Abscess/Hematoma
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

---

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- Anti-coagulation agents (e.g. heparin)
- Pre-existing coagulopathy (e.g. von Willebrand’s disease, Hemophilia A)
Vaginal Discharge

Infectious

Sexually Transmitted Infection
- Chlamydia trachomatis
- Neisseria gonorrhoeae

Toxic Shock Syndrome

Inflammatory

Systemic
- Crohn’s disease
- Collagen vascular disease
- Dermatologic

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

Neoplastic
- Endometrium
- Cervix
- Vulva
- Vagina

Vulvovaginitis
- Vulvovaginal candidiasis
- Bacterial vaginosis
- Trichomonas vaginalis
Dermatologic

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Burns

Physical Agents
  - Thermal Burn
  - Cold Burn
  - Electrical Burn
  - Sun Burn

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

Parkland formula for fluid resuscitation:
- 4cc x Weight (kg) x %TBSA burn
Dermatoses in Pregnancy

Physiologic Changes

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

Pigmented

- Melasma
- Linea Nigra

Abdomen

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

Hormone induced

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

Skin

- Chadwick’s sign (bluish discoloration of cervix/vagina/vulva)

Mucous Membranes
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)

Pruritic
- Pemphigoid gestationis
- Pruritic urticarial plaques & papules of pregnancy (PUPPP)

Primary Skin Lesion
Disorders of Pigmentation

Hyperpigmentation

Disorder of Pigmentation

Hypopigmentation

Hyperpigmentation

Diffuse

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

Localized
Discrete Areas

Acquired

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

Congenital

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

Hypopigmentation

Disorder of Pigmentation

Hypopigmentation

Localized

Congenital

• Tuberous sclerosis (white “ash leaf” macules)

Acquired

Scale

• Tinea versicolor (can also be hyperpigmented)
• Pityriasis alba

Hyperpigmentation

Diffuse

Congenital

Generalized hypopigmentation of hair, eyes, skin

Acquired

• Vitiligo

Phenylketonuria
• Albinism
• Piebaldism

• Vitiligo

Post-Infammatory hypopigmentation
Genital Lesion

Elevated

Vesicles
- Herpes simplex

Papules/Plaques

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

Non-Infected

Depressed

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

Excoriations
- Scabies
- Pubic lice

Non-Infectious

Inflamed/Non-Infectious

- Squamous cell carcinoma (can be in situ)
- Melanoma

- Lichen planus
- Psoriasis
Hair Loss (Alopecia)

Diffuse

Hair Loss

Localized (focal)

Diffuse

Scarring
Irreversible - biopsy required

Non-Scarring
Reversible

Pattern
Androgenetic alopecia

Anagen Effluvium
Chemotherapy
Loose anagen syndrome

Discrete Patches
Alopecia totalis (all scalp and facial hair)
Alopecia universalis (all body hair)

Telogen Effluvium

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
  - 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

- Diffuse
  - Non-Scarring
    - Reversible
    - 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.

Secondary Skin Lesion
Lesion that develops from trauma, manipulation (rubbing, scratching), complication (infection) of initial lesion, or develops naturally over time

Flat

• Macule (≤ 1 cm diameter)
• Patch (> 1 cm diameter)

Solid

Fluid-Filled OR Semi-Solid-Filled

• Cyst

No Deep Component

• Papule (≤ 1 cm diameter)
• Plaque (> 1 cm diameter)

Firm/Edematous

• Wheals/Hives

Deep Component

• Nodule (1-3 cm diameter)
• Tumor (> 3 cm diameter)

Transient/Itchy

Fluid-Filled

Purulent

• Pustule

Non-Purulent Fluid

• Vesicle (≤ 1 cm diameter)
• Bulla (> 1 cm diameter)
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

- **Erosions/Ulcers/Blisters**
  - **Primary Dermatologic Diseases**
    - Aphthous Stomatitis (recurring, 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

- **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
- Psoriasis
- Alopecia Areata

Pitting
- Psoriasis
- Onychomycosis
- Onychogryphosis

Thickening
- Psoriasis
- Onychomycosis

Onycholysis
- Psoriasis
- Onychomycosis

Nail Fold Abnormality

Inflammation
- Erythema, Swelling, Pain

Telangiectasia
- SLE
- Scleroderma
- Dermatomyositis

Brown/Black Linear Streak
- Junctional/Melanocytic Nevus
- Malignant Melanoma Under Nails
- Drug-Induced

Proximal & Lateral
- Acute Trauma/Infection
- Acute Paronychia

Lateral Only
- Ingrown Nail

Chronic
- Chronic Paronychia

Inflammation

Pitting

White/Yellow-Brown
- Onychomycosis

Green
- Pseudomonas infection

Oil Drop Sign
- Psoriasis

Fungal Culture
- Psoriasis
- Onychomycosis
- Onychogryphosis

Nail Disorders

Primary Dermatologic Disease
Nail Disorders
Systemic Disease

Nail Disorder

- Primary Dermatologic Disease
- Systemic Disease

Nail Plate Abnormality
- Koilonychia
  - Spoon-Shaped
  - Iron deficiency anemia

Nail Fold Abnormality
- 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)

Nail Bed Abnormality
- Clubbing
- Red Discoloration
  - Splinter hemorrhages (dark red, thin lines, usually painful)
  - Bacterial endocarditis
  - Trauma

- White Discoloration
- Blue Discoloration

- 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

- Medications
- Wilson’s disease
- Silver poisoning
- Cyanosis
Nail Disorders
Systemic Disease - Clubbing

Nail Disorder

Primary Dermatologic Disease

Systemic Disease

Nail Plate Abnormality

Nail Fold Abnormality

Nail Bed Abnormality

Koilonychia
Spoons-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

Pruritus

Primary Skin Lesion

No Primary skin Lesion

Primary Abnormal Finding

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 Throbocytopenia
- 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

**Age dependent distribution:**
- Infants: scalp, face, extensor extremities
- Children: flexural areas
- Adults: flexural areas/hands/face/nipples

- **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/face/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
Skin Rash

**Papulosquamous**

- **Eczematous**
  - Pruritic/Scaly/Erythematous lesions
  - Usually poorly demarcated

- **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 (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

- **Acneform**
  - Erythematous papules and pustules on face

- **Infectious**

- **Acne Vulgaris**
  - Comedones +/- nodules, cysts, scars on face & trunk

- **Comedones Absent**

- **Folliculitis**
  - 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

- **Acne Rosacea**
  - Telangiectasia, episodic flushing after sunlight, alcohol, hot or spicy food & drinks

- **Perioral Dermatitis**
  - Perioral, periorbital & nasolabial distribution, sparing vermilion 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)
  - **Reaction to Agent**
    - 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**
  - Coumadin
  - Heparin
  - Bleomycin

- **Metabolic**
  - Sickle cell anemia
  - Thalassemia

- **Protozoan**
  - Cryoglobulinemia

- **Other**
  - Leishmaniasis

- **Viral**
  - Herpes simplex

- **Bacterial**
  - Tuberculosis
  - Syphilis
  - Chlamydia trachomatis
  - Klebsiella granulomatis

- **Fungal**
  - Histoplasmosis
  - Coccidiodomycosis
  - Cryptococcosis
Skin Ulcer by Location

Genitals

Skin Ulcer

- Oral
- Head/Neck
- Trunk/Sacral Region
- Genitals
- Lower Legs/Feet

Painful
- Herpes simplex
- *Haemophilus ducreyi* (chancroid)
- Behçet’s syndrome
- Pemphigus vulgaris
- Lichen sclerosis
- Erosive lichen planus

Painless
- Primary syphilis (chancre)
- Granuloma inguinale
- Lymphogranuloma venereum
Skin Ulcer by Location

Head & Neck

Skin Ulcer

- Oral
  - Neoplastic
    - Squamous cell carcinoma
    - Basal cell carcinoma
    - Melanoma
  - Metabolic
    - Pyoderma gangrenosum
  - Vascular
    - Wegner’s granulomatosis
    - Radiation
  - Other

- Head/Neck
- Trunk/Sacral Region
- Genitals
- Lower Legs/Feet
Skin Ulcer by Location

Lower Legs / Feet

Skin Ulcer

Oral
- Physical
  - Pressure
  - Trauma
  - Radiation

Head/Neck
- Vascular
  - Arterial insufficiency
  - Vascular insufficiency
  - Vasculitis

Trunk/Sacral Region
- Neurological
  - Diabetic neuropathy
  - Tabes dorsalis (syphilis)

Genitals
- Metabolic
  - Pyoderma gangrenosum
  - Diabetic dermopathy
  - Necrobiosis lipoidica

Lower Legs/Feet
- Neoplastic
  - Squamous cell carcinoma
  - Basal cell carcinoma
  - Melanoma

- Other

Dermatologic
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

- Head/Neck

- Trunk/Sacral Region

- Genitals

- Lower Legs/Feet
Skin Ulcer by Location

**Trunk / Sacral Region**

- 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

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## Acute Joint Pain

### Vitamin CD

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<td>Trauma</td>
<td>- Multiple injury sites, Open Fracture, Infectious joint pain</td>
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<td>Autoimmune</td>
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<tr>
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<td>- See pathologic fractures</td>
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<td>Iatrogenic</td>
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<td>Neoplastic</td>
<td>- See Tumour</td>
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<tr>
<td>Congenital</td>
<td>- Scoliosis, Talipes Equinovarus, Meta tarsus adductus, Bow leg, Knock-Knee’d</td>
</tr>
<tr>
<td>Degenerative</td>
<td>- Degenerative Disc Disease, Osteoarthritis, Osteoporosis</td>
</tr>
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Chronic Joint Pain

Chronic/Degenerative Change

Peri-Articular
- Bursa
  - Aseptic Bursitis
- Epiphysitis/Apophysis
  - Slipped Epiphysis
  - Apophysitis (Osgood-Schlatter Disease)
- Tendon
  - Enthesitis
  - Tendinopathy
  - Tendon Rupture
  - Impingement
  - Tenosynovitis
  - Ganglion Cyst
- Bone
  - Stress Fracture
  - Charcot Joint

Articular Cartilage
- Osteoarthritis
- Chondromalacia

Joint Capsule
- Baker Cyst
- Ganglion Cyst
- Adhesive Capsulitis

Synovium
- Monoarthritis
- Polyarthritis

Intra-Articular
- Muscle
  - Delayed Onset Muscle Soreness
  - Fibromyalgia
  - Myositis Ossificans
- Skin/Fascia
  - Fascitis (e.g., Myofascial Pain, Illiotibial Band Friction, Plantar Fasciitis
- Bone
  - Stress Fracture
  - Charcot Joint
  - Pathologic Fracture
  - Periostitis
  - Epicondylitis
Bone Lesion

Bone Lesion on X-ray

Rule Out Osteomyelitis & Secondary Metastases

Non-aggressive

Aggressive

Exostotic

Narrow, <1mm margin
Reactive bone formation

Broad or Indistinct Margin
&/or Soft Tissue Invasion

Multiple Lytic Lesions

• Osteochondroma

Asymptomatic &/or Non-
Active Bone Scan

• Unicameral Bone Cysts
• Aneurysmal Bone Cysts
• Non-ossifying Fibroma

Symptomatic &/or Active
Bone Scan

• Enchondroma (can calcify
&/or turn malignant)
• Giant Cell Tumor (“Soap
Bubble” appearance)

Benign

No Bone Mineralization

• Osteoid Osteoma (“Nidus”
appearance)

Malignant

Bone Mineralization,
Constitutional Symptoms,
Codman’s Triangle, Excessive
Scalloping & Destruction of
cortical Bone

• Unicameral Bone Cysts
• Aneurysmal Bone Cysts
• Non-ossifying Fibroma

Inflammatory Appearance

• Osteoid Osteoma (“Nidus”
appearance)
• Osteoblastoma (may be
malignant or sclerotic in
appearance)

Not Inflammatory Appearance

• Chondroblastoma
• Chondromyxoid Fibroma

• Multiple Myeloma

• Osteosarcoma (Codman’s
Triangle)
• Chondrosarcoma (“Popcorn”
appearance)
• Ewing’s Sarcoma
Always check neurological and vascular status one joint below the injury

Deformity/Limp

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-Calve-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

Musculoskeletal
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

Peri-Articular
- Cellulitis
- Necrotizing Fasciitis
- Septic Bursitis
- Abscess
- Osteomyelitis
- Lymphadenitis
- Warts

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)**

**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
  - Ankylosing Spondylitis
  - Enteropathic (e.g. Inflammatory Bowel Disease)
  - Psoriatic Arthritis

- Insidious Onset
Vascular Joint Pain

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

Vascular Joint Pain

Constant Pain (Ischemia)
Acute Onset
Increased Pain with Activity (Claudication)
Cold Extremity or Hyperemia
Pathologic/Fragility 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

Paget’s Disease
Skull/Spine/Pelvis
Positive Alkaline Phosphatase

Renal Osteodystrophy
Secondary to Chronic Renal Failure

Osteomalacia/Rickets
Diffuse Pain/Proximal Muscle Weakness

Primary
• Post-Menopausal
• Elderly

Secondary
• Gastrointestinal Disease
• Bone Marrow Disorder
• Endocrinopathy
• Malignancy
• Drugs (e.g. corticosteroids)
• Rheumatoid Disease
• Renal Disease
• Poor Nutrition
• Immobilization

• 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

Periarticular

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
Fracture Healing

**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

**Delayed Union (3 – 6 months)**
- Tobacco / nicotine
- NSAIDS
- Ca²⁺ / Vitamin D deficiency

**Non-Union (after 6 months)**

**Malunion**

- Septic (R/O First)
- Aseptic

**Functional**
- Small deviations from normal axis

**Non Functional**
- Inadequate immobilization/reduction
- Misalignment before casting
- Premature cast removal

**Hypertrophic** (adequate blood flow)
- Mechanical failure
- Excessive motion
- Excessive bone gap

**Atrophic** (inadequate blood flow)
- Tobacco / nicotine
- NSAIDS
- Medications
- Allergies
- Biologic Failure

**Remodelling**
Osteoporosis

BMD Testing

T-Scores:
Normal \( > -1 \)
-2.49 < Osteopenia \( < -1 \)
Osteoporosis \( \leq -2.5 \)

**Age \( > 50 \) years**
- All men and women \( \geq 65 \)
- 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
Metastatic - Most common tumour in adults

- Breast
- Prostate
- Thyroid
- Lung
- Renal

Primary

Benign
- Osteochondroma
- Osteoid osteoma
- Chondroblastoma
- Fibroblastoma
- 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
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<th>Action</th>
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<td>Shoulder</td>
<td>Abduction</td>
<td>C5</td>
<td>Axillary Nerve</td>
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<tr>
<td></td>
<td>Adduction</td>
<td>C6-C8</td>
<td>Thoracodorsal Nerve</td>
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<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>
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<tr>
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<td>Abduction</td>
<td>T1</td>
<td>Ulnar Nerve</td>
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<tr>
<td>Hip</td>
<td>Flexion</td>
<td>L2</td>
<td>Nerve to Psoas</td>
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<tr>
<td></td>
<td>Extension</td>
<td>S1</td>
<td>Inferior Gluteal Nerve</td>
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<tr>
<td></td>
<td>Abduction</td>
<td>L5</td>
<td>Superior Gluteal Nerve</td>
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<td>L5</td>
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<td></td>
<td>Plantarflexion</td>
<td>S1</td>
<td>Tibial Nerve</td>
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N.B. There is considerable overlap between myotomes for some actions. The myotomes listed are the dominant segments involved.
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<th>Sensory</th>
<th>Motor</th>
<th>Reflex</th>
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<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>
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<tr>
<td>C6</td>
<td>Dorsal Thumb</td>
<td>Wrist Extension</td>
<td>Brachioradialis Reflex</td>
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<tr>
<td>C7</td>
<td>Dorsal Middle Finger</td>
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<td>Triceps Reflex</td>
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<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>
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<td>T7-12</td>
<td>See Dermatomes</td>
<td>Abdominal Muscles</td>
<td>Abdominal Reflex</td>
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<td>L2</td>
<td>Anterior Medial Thigh</td>
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<td>L3</td>
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<td>Knee Extension</td>
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<td>Ankle Dorsiflexion</td>
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<td>Hamstring Reflex</td>
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<tr>
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<tr>
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<td>Perianal Region</td>
<td>Anal Sphincter</td>
<td>None</td>
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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.
Psychiatric

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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

Associated with Recurrent Anxious Thoughts

Recurrent, Unexpected Panic Attacks

Panic Disorder

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

Specific Trigger (e.g. water, heights, animals, etc.)

Separation From Attachment Figure

Using Public Transportation, Open Spaces, Enclosed Spaces, Being in a Line, Crowd, or Outside the Home

Public Setting Where a Negative Evaluation May Occur

Specific Phobia
Separation Anxiety Disorder

Agoraphobia
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

Intrusive/Inappropriate/ Distressing Thoughts With Repetitive Behaviour Meant to Neutralize Anxiety

*Obsessive Compulsive Disorder

Specific Wories

Excessive Worry or Fear About Social Situations

Social Anxiety Disorder (Social Phobia)

Associated with Recurrent Anxious Thoughts

(*) 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

* Not considered an anxiety disorder according to DSM-V

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

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

Obsessive Compulsive Disorder

Preoccupation with Perceived Physical Appearance

Body Dysmorphic Disorder

Hair Pulling

Trichotillomania

Excoration Disorder

Skin Picking

Hoarding Disorder

Difficulty Discarding Possessions

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

Mood Disorders

Depressed Mood

Rule out depressed or elevated mood disorder due to substances and/or general medical condition

Depressed or Elevated Mood

Elevated Mood +/- Depressed Mood

Depressed Mood Only

2 week period, depressed mood nearly everyday

- Major Depressive Disorder

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

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

Prevalence = 5%
Hospitalized patients

Depressed mood in context of personal loss < 2 months

- Bereavement

None of:
1) Suicidal ideation
2) Psychosis (except hallucinations of deceased)
3) Guilt (except deceased)

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

Prescriptions:
- Corticosteroids
- Antihypertensives
- Antipsychotics
- Oral contraceptives

Prevalence = 3% over lifetime

Psychiatric
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

**Somatoform Disorders**

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

**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

**Pain; psychological factors important**
- Pain Disorder

**Multiple symptoms; long history**
- Somatization Disorder

**Neurologic**
- Conversion Disorder
  - Must have symptoms affecting movement or sensation (non-anatomic and unexplainable)

**Criteria**
- 4 pain sx
- 2 GI sx
- 1 sexual sx
- 1 pseudo-neuro sx

**One or more symptoms for at least six months**
- Undifferentiated Somatoform Disorder

---

**SOMATOFORM DISORDERS**

Factitious Disorder
- Pain Disorder
- Body Dysmorphic Disorder

Pain Disorder

Illness Anxiety Disorder

Conversion Disorder
- Undifferentiated Somatoform Disorder

Somatization Disorder

Neurologic
- Conversion Disorder

Criteria
- 4 pain sx
- 2 GI sx
- 1 sexual sx
- 1 pseudo-neuro sx
Otolaryngologic

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Hearing Loss

Conductive

Hearing Loss

Otoscopy, Tuning Fork, Confirm with Audiogram

Conductive Hearing Loss

Sensorineural Hearing Loss

Normal Otoscopy

Abnormal Otoscopy

Middle Ear

* Otosclerosis
* Congenital (Ossicular Chain Malformation)
* Eustachian Tube Dysfunction

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

Sensorineural

Otologyngologic

280
Hoarseness

Acute

Hoarseness

If Hoarseness persists > 3 months, Refer to ENT

Acute
< 3 weeks

Constant

Infectious
• Viral Laryngitis
• Fungal Laryngitis (Monilia)
• Bacterial Laryngitis
• Bacterial Tracheitis

Inflamatory
• Acute Nonspecific Laryngitis (GERD, Smoking, Allergies, Vocal Abuse)
• Inhaled Steroids

Trauma
• External Laryngeal Trauma
• Iatrogenic
  - Endoscopy
  - Endotracheal intubation

Non-Acute
> 3 weeks

Variable

Inflamatory
• Voice Overuse

Hyperfunction
• Muscle Tension Dysphonia
Hoarseness

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

Non-Acute

> 3 weeks

Variable

• Functional

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**
- Otitis Externa
- Osteomyelitis of Temporal Bone
- Herpes Simplex
- Zoster (Ramsay Hung Syndrome if Facial Nerve Paralysis)
- Furunculosis

**Referred**
- 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
  - Mastoid
    - Mastoiditis

**Abnormal Tympanic Membrane**
- Acute Otitis Media
  - Barotrauma
  - Traumatic Perforation

**Auricle**
- Cellulitis/Perichondritis
  - Trauma (Frostbite, Auricular Hematoma)
  - Autoimmune (Relapsing Polychondritis)

**Periauricular**
- 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

Subjective (90%)

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

Objective Pulsatile or Rhythmic (10%)

Muscular
- Myoclonus of Stapedius/Tensor Tympani/Palatal Muscles
- Degenerative Disease of the Head and Neck
- Eustachian Tube Dysfunction

Objective
Tinnitus

Subjective

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

Somatic

• TMJ
• Bruxism
• Whiplash
• Skull Fracture
• Closed Head Injury

Objective
Heard by others (Rare)

Subjective
Heard only by patient (Common)
Ophthalmologic

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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
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

Clinical Pearl:
• Patients with bilateral acute vision loss should have a CT.

Unilateral

Bilateral

Complete/ Partial Homonymous Hemianopia
• Infarct
• Intracranial Hemorrhage
• Tumor

Other
• Migraine
• Systemic Hypoperfusion
Acute Vision Loss

Unilateral

Bilateral

Painful

Cornea

• Keratopathy

No Abnormalities of the Optic Nerve

• Acute Angle Closure Glaucoma (fixed dilated pupil)

Abnormalities of the Optic Nerve

• Temporal Arteritis
• Demyelination
• MS
• Idiopathic
• Glaucoma

Retina

• Retinal Detachment
• Retinal Artery Occlusion
• Retinal Vein Occlusion
• Ischemic Optic Neuropathy

Transient Ischemic Attack

Vitreous

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

Perform slit-lamp exam to localize: Left → Right on Scheme

**Cornea**
- Keratoconus
- Stromal Scaring
- Neovascularization
- Edema
- Pterygium

**Lens**
- Obscure Red Reflex, Poor fundus Visibility
- Cataract (Nuclear, Subcapsular, Cortical)

**Macula**
- Drusen or Edema
- Age Related Macular Degeneration (Wet, Dry)
- Diabetic Retinopathy (Background, Pre-Proliferative, Proliferative)
- Retinitis Pigmentosa (Decreased night vision, loss of peripheral vision)
- Systemic inflammatory conditions

**Retina**
- Cotton wool spots, Micro-aneurysms, Hemorrhage and Macular Edema

**Optic Nerve**
- Pallor, Papilledema, Irregular Disc Large Cup:Disc
- Glaucoma (Open-Angle)

**Optic Track**
- Optic Nerve Compression
- Pituitary Lesion
- Meningioma
- Craniopharyngioma

**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 Anisometria (Unequal Refractive Error)
  - Hyperopia
  - Astigmatism

- **Strabismic**
  - Abnormal Binocular Interaction

**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

Binocular

Neuronal (Non-Comitant)
- Myasthenia Gravis

Extraocular Muscle Restriction/Entrapment
- Orbital Inflammation
- Orbital Tumor
- Orbital Floor Fracture

Strictly Horizontal (Cranial Nerve VI problem)
- Cannot Abduct
- Ischemia
- Diabetes Mellitus
- Aneurysm
- Tumor
- Trauma

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
- Ischemia
- Diabetes Mellitus
- Aneurysm
- Trauma
- Subdural Hemorrhage
- Hyperthyroidism

Refractive Error
- Cataract/Lens Dislocation
- Functional
- Corneal Distortion/Scarring
- Vitreous Abnormalities

Myasthenia Gravis

Orbital Inflammation
- Orbital Tumor
- Orbital Floor Fracture

Ischemia
- Diabetes Mellitus
- Aneurysm
- Trauma
- Subdural Hemorrhage
- Hyperthyroidism

Orbital Tumor

Orbital Floor Fracture

Ischemia
- Diabetes Mellitus
- Aneurysm
- Trauma
- Subdural Hemorrhage
- Hyperthyroidism

Grave’s Ophthalmopathy

Cranial Nerve III
- Eye depressed, abducted, ptosis, large/unreactive pupil

Cranial Nerve IV
- Eye cannot depress when looking medially

Grave’s Ophthalmopathy
- Ischemia
- Diabetes Mellitus
- Aneurysm
- Trauma
- Subdural Hemorrhage
- Hyperthyroidism

Clinical Pearls:
- Diplopia is almost always binocular.
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- 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.
Pupillary Abnormalities

Isocoria

**Pupillary Abnormality**

- **Equal (Isocoria)**
  - Relative Afferent Pupil Defect
    - Optic Neuritis
    - Ischemic Optic Neuropathies
    - Optic Nerve Tumor
    - Retinal detachment
    - Traumatic/Compressive Optic Neuropathy
  - Bilateral Impairment
    - Dilated Pupils (Mydriasis)
    - Constricted Pupils (Miotic)
      - Syphilis (light-near dissociation)
      - Pharmacologic (e.g., Opioids, Alcohol)
  - 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.

- Pathological
  - Impaired Constriction
    - Parasympathetic dysfunction
    - Anisocoria greater in light
    - Large pupil abnormal
  - Impaired Dilation
    - Sympathetic dysfunction/Horner’s Syndrome: miosis, anhydrosis, ptosis
    - Anisocoria greater in dark
    - Small pupil abnormal

- Physiological
  - Anisocoria equal in light and dark, 10% cocaine: pupils dilate symmetrically
  - Simple Anisocoria (<0.5mm)

- Preganglionic
  - Ptosis, ophthalmoplegia
  - Constriction with 0.1% pilocarpine
  - Oculomotor Nerve/Fascicle
  - (Other CN III Findings)

- Postganglionic
  - Constriction with 0.1% pilocarpine
  - (Adie’s) Pupil
  - (Ciliary Ganglion Lesion)

- Neuromuscular Junction
  - No constriction with 0.1% pilocarpine
  - Pharmacologic
  - Factitious

- Preganglionic
  - No dilation with 0.125% adrenaline
  - Idiopathic
  - Trauma
  - Tumor (Lung, Breast, Thyroid)

- Postganglionic
  - Dilation with 0.125% adrenaline
  - Cluster Headache
  - Carotid Dissection
  - Trauma
  - Idiopathic
**Red Eye**

**Atraumatic**

- **Lids/Orbit/ Lacrimal System**
  - Blepharitis
  - Stye/ Chalazion
  - Dacrocystitis
  - Pre-septal cellulitis
  - Orbital Cellulitis

- **Ocular Surface**
  - Subconjunctival Hemorrhage
  - Conjunctivitis
  - Corneal Abrasion/ Erosion
  - Keratitis/Corneal Ulcer
  - HSV Keratitis

- **Intermediate Layers**
  - Episcleritis
  - Scleritis
  - Uveitis
  - Iritis

- **Intraocular**
  - Acute Angle Closure Glaucoma
  - Endophthalmitis

**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
  - Orbital Rim/Mid-facial Fracture
  - Orbital Floor Fracture
  - Orbital Apex Injury/Retrobulbar Fracture**

** Urgent lateral canthotomy

- 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

Strabismus

Rule Out Amblyopia

Phoria
- Latent deviation
- Symmetrical corneal light reflex,
- Negative cover test positive
  cover/uncover test
- Esophoria (eye moves medial → centre
  when uncovered)
- Exophoria (eye moves lateral → centre
  when uncovered)

Tropia
- Manifest deviation
- Asymmetrical light reflex,
- Positive cover test

Non-Paretic
- Comitant
  Angle of misalignment unchanged with direction of
  gaze

Paretic
- Non-comitant
  Angle of misalignment changes with direction of
gaze

Horizontal (eso/exotropia)
- CN VI problem
  (eye cannot abduct)

Horizontal and/or vertical
(Eso/exotropia, hyper/hypotopia, mixed)
- CN III Problem (eye is
  depressed and abducted, ptosis,
  large/unreactive pupil)
- CN IV Problem (eye
  cannot depress when looking
  medially)

Clinical Pearl:
- Strabismus is most often seen
  in pediatrics.
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)
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### Historical Editors

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</table>
Developmental Delay

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

Delay in 2 or more domains

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”

Developmental Delay
Loss of milestones

- Metabolic disease*
- Malignancy (Eg. Brain tumor*)
- Neurodegenerative disease

Delay in single domain

Motor Delay (Gross Motor and/or Fine Motor)*

- Cerebral Palsy*
- Developmental Coordination Disorder
- Benign Congenital Hypotonia
- Neuromuscular disorder

Speech/Language Delay*

- Hearing impairment*
- Isolated speech delay
- Selective Mutism
- Mechanical (e.g. dental, cleft palate)

Social Delay

- Autism Spectrum Disorder* (Note that can often present with an associated speech delay as well)
- Genetic disease
School Difficulties

Environmental
- Neglect*
- Physical abuse* and Domestic violence*
- Sexual abuse*
- Sleep issues*
- Nutrition and feeding issues* (Eg. malnutrition)
- Socio-economic/cultural/home/environment issues*
- Bullying

Mental Health
- Anxiety*
- Depression*
- Behavioural disorders (Eg. 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 (Eg. tumor*, seizures*, head injury*, neurodegenerative disease)
- Sleep issues* (Eg. Obstructive sleep apnea)
- Hypothyroidism
- Iron deficiency*
Small for Gestational Age

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 (E.g. 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 (E.g. Ace inhibitors, phenytoin, etc.)

Fetal
- Congenital infections* (E.g. TORCH infections)

Infection

Genetic
- Chromosomal disorders (E.g. Trisomy 21*)
- Genetic disorders
- Congenital anomalies
- Multiple gestation
- Metabolic disorders

Placental Factors
- Placental insufficiency
- Placental abnormalities (placental abruption, placental infarction, hemangioma, chorioangioma)

<table>
<thead>
<tr>
<th>Symmetric</th>
<th>Asymmetric</th>
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<tbody>
<tr>
<td>Head circumference, length, and weight proportionally decreased.</td>
<td>Head circumference is spared relative to decreased weight, length.</td>
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<tr>
<td>Usually occurs early in pregnancy (1st or 2nd trimester).</td>
<td>Usually occurs later in pregnancy (3rd trimester).</td>
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<tr>
<td>Causes: Intrinsic fetal factors (i.e. genetic) or first trimester insult (e.g. infection).</td>
<td>Causes: Often due to maternal factors. Thought to result from adaptation to an unfavourable environment late in pregnancy.</td>
</tr>
</tbody>
</table>

*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
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
Failure to Thrive

Adequate Calorie Consumption

- Increased Losses
  - Vomiting
  - Gastroesophageal Reflux
  - Renal Tubular Acidosis

- Malabsorption
  - Pancreatic Insufficiency (Cystic Fibrosis)
  - Celiac Disease
  - Liver Disease

- Increased Demands
  - Congestive Heart Failure
  - Chronic Respiratory Failure

- Failure to Utilize
  - Metabolic Disorders
  - Syndromes
Failure to Thrive

Inadequate Calorie Consumption

- Organic Illness
  - Chronic Renal Failure
  - Esophagitis
  - Congenital Heart Defect
  - Structural Dystrophies

- Protein-Energy Malnutrition
  - Kwashiokor (inadequate protein intake)
  - Marasmus (inadequate protein and energy intake)

- Psychosocial Illness
  - Oral Aversion
  - Neglect
  - Poverty
  - Disturbed Parent-Child Relationship
Hypotonic Infant (Floppy Newborn)

Hypotonic Infant*

Detailed history
Detailed physical exam

**Neurological**

**Upper Motor Neuron**
- Decreased LOC, low to normal strength, normal 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

**Anterior Horn Cell**
- Spinal Muscular Atrophy
- Trauma
- Hematoma
- Abscess

**Lower Motor Neuron**
- Profound weakness
- Muscle atrophy
- Fasciculations
- Absent reflexes

**Nerves**
- Hereditary sensory autonomic neuropathy
- Guillain Barre Syndrome

**Systemic Illness**
- Sepsis*
- **Metabolic Disease***
- Hypoglycemia*
- Hypothyroidism

**Weakness distal>proximal**
- Reduced reflexes
- May have sensory changes
- May have autonomic changes

**Neuromuscular Junction**
- Weakness includes bulbar reflexes
- Fatiguable

**Muscle**
- Weakness proximal>distal
- Reduced reflexes
- Muscle atrophy

*Indicates Key Condition

This is not an exhaustive list of medical conditions.
Acute Abdominal Pain

Acute Abdominal Pain (< 72 hours)
Evaluate for Surgical/Acute Abdomen:
- History and physical exam
- Labs
- Imaging (X-ray, ultrasound)

Focal

Generalized
- Metabolic (Eg. Diabetic Ketoacidosis*)
- Henoch Schonlein Purpura*
- Sickle cell disease
- Gastroenteritis*
- Functional*

Upper Abdominal Pain

Biliary/Hepatic
- Biliary Colic
- Cholecystitis
- Choledocholithiasis
- Hepatitis

Other
- Referred pain (Eg. Pneumonia*)
- Musculoskeletal injury

Upper GI tract
- Gastroesophageal reflux/gastroesophageal reflux disease*
- Malrotation/Volvulus*
- Gastroenteritis*
- Peptic Ulcer

Pancreatic
- Pancreatits

Periumbilical/ Lower Abdominal Pain

GI tract
- Acute Abdomen*
- Appendicitis*
- Intussusception*
- Malrotation/Volvulus*
- Incarcerated Hernia
- Obstruction
- Constipation*
- Gastroenteritis*

Genitourina
- Pregnancy*/Ectopic pregnancy
- Ovarian/Testicular Torsion*
- Dysmenorrhea
- Sexually transmitted Infections* (Eg. Pelvic Inflammatory Disease)
- Urinary tract infection*
- Renal Colic

Spleen
- Splenic rupture
- Acute splenic enlargement (Eg. Infectious, sequestration)

Other
- Functional*
- Musculoskeletal injury
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 Pancreatitis
- Gastritis/Duodenitis Ulcer

Diffuse/Lower Abdominal Pain
- Gastroesophageal reflux/Gastroesophageal reflux disease*

- Celiac Disease*
- Lactose Intolerance/Dietary
- Constipation*
- Functional*/Irritable Bowel Syndrome
- Inflammatory Bowel Disease*
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 (Eg. Intestinal atresia*)
  - Non-Bilious

- Acute
  - Gastrointestinal Disease
    - Appendicitis*
    - Obstruction (Eg. Pyloric stenosis*, intestinal atresia*, etc.)
    - Intussusception*
    - Gastroenteritis*
    - Gastroparesis/ileus
    - Hepatitis
    - Pancreatitis
    - Cholecystitis
  - Other Systemic Disease
    - Infection (Eg. Meningitis*, encephalitis*, sepsis*, urinary tract infection*, pneumonia*)
    - CNS disease (Eg. Head injury*, concussion*, increased intracranial pressure*, brain tumor*, abusive head trauma*, migraine*)
    - Middle ear disease (Eg. Otitis media*)
    - Endocrine (Eg. 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* (Eg. Crohn's Disease)
      - Peptic ulcer
    - Other Systemic Disease
      - CNS disease (Increased intracranial pressure*, brain tumor*)
      - Renal Disease (Eg. Renal failure*)
      - Endocrine (Eg. Diabetes mellitus*, Addison’s disease, thyroid disease)
      - Metabolic disease*
  - No Red Flags
    - Gastrointestinal Disease
      - Gastroesophageal reflux disease*
    - Other Systemic Disease
      - Metabolic disease*
      - CNS disease (Eg. Head injury*, concussion*, migraine*)
      - Respiratory (Eg. Asthma*)
      - Middle ear disease (Eg. Otitis media*)
      - Drugs/Toxins (Eg. Substance use and abuse*, poisoning/intoxication*, antibiotics)
      - Psychiatric (Eg. Disordered eating*, rumination)
      - Endocrine (Eg. Pregnancy*)
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*

  - Pathologic

  Onset anytime within first week of life
  Red flags: Onset first 24 hrs of life, clinically unwell,
  risk factors present

  Onset within first week of life, never in first 24 hours
  Clinically well

  **Increased bilirubin production**

  - 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)

- >20% direct

  **Direct (conjugated) Hyperbilirubinemia**

  See “Neonatal Jaundice: Approach to Direct Hyperbilirubinemia”

- Increased enterohepatic circulation

  - GI obstruction
  - Breast feeding jaundice/dehydration*
Neonatal Jaundice

Approach To Direct Hyperbilirubinemia

- Check bilirubin (if > 2 weeks, check total AND direct)

- <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)
Diarrhea (Pediatric)

Pediatric Diarrhea

History and physical exam

Acute (< 2 weeks)

Dietary
- High sugar load
- Lactose intolerance

Infectious
- Viral (Gastroenteritis*)
- Bacteria (E.g., E. coli, Salmonella, Yersinia, Campylobacter, Shigella)
- Parasitic (E.g., 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 (E.g., 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
Constipation (Pediatric)


- Neonate/Infant
  - Dietary/Functional
    - Insufficient intake/ Nutrition and feeding issues*
  - Anatomic
    - Intestinal Atresia*
    - Cystic Fibrosis*
    - Imperforate Anus
    - Anal Atresia
    - Intestinal Stenosis
  - Systemic Disease
    - Hypothyroidism

- Older Child
  - Dietary/Functional
    - Insufficient intake/ Nutrition and feeding issues *
    - Withholding
    - Painful (e.g. Fissures)
    - Drugs (Narcotics, Psychotropics)
  - Neurologic
    - Hirschsprung’s Disease
    - Guillain-Barré Syndrome
    - Neglect*/Physical abuse*/Sexual Abuse*
  - Systemic Disease
    - Celiac disease*
    - Hypothyroidism
  - Anatomic
    - Bowel Obstruction
    - Pseudo-obstruction
Mouth Disorders (Pediatric)

- Teeth
  - Teething
- Mucous Membranes
  - Non-Painful
- Painful
  - Gastrointestinal
    - Crohn's Disease
    - Ulcerative Colitis
  - Other
    - Gum Disease (e.g. Gingivitis)
    - Hand, Foot and Mouth Disease (Coxsackie Virus)
    - Streptococcal Throat Infection
    - Canker Sore
    - Herpes Simplex Virus
    - Inflamed Papillae (e.g. Burn)
  - Non-Inflammatory
    - Impetigo
    - Mucocele
    - Candidiasis
  - Inflammation
    - Allergic Reaction
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
  - Other
    - Anemia
    - Shock
    - Hypothermia
    - Hypoglycemia

- Maternal Related
  - Drugs (Ex. SSRI)
  - Diabetes Mellitus
  - Gestational Hypertension
Cyanosis in the Newborn

Cyanosis (<48 hrs)

SaO2 low
Cyanosis of mouth, tongue, face, core

Central Cyanosis

Apply oxygen
Chest x-ray

No improvement of SaO2
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

Detailed pregnancy and delivery history
Detailed physical exam
check SaO2

Peripheral Cyanosis

Acrocyanosis (often normal in otherwise healthy newborns)

Otherwise appears well
SaO2 normal
Cyanosis of hands, feet, perioral

Respiratory
(May not necessarily be cyanotic)

Upper Airway
- Congenital upper airway obstruction (Eg. Atresia, laryngomalacia)
- Airway compression (Eg. Congenital neck mass, mediastinal mass)

Lower Airway
- Pneumonia*
- Pneumothorax
- Meconium aspiration/meconium pneumonitis
- Congenital lung anomalies

Other

Variable response to supplemental O2

• Sepsis*
• Hematologic (Eg. Anemia*, Hemoglobinopathies*, Polycythemia
• Metabolic disease *
• Persistent Pulmonary Hypertension
• Disordered control of breathing (Eg. Seizure*, birth trauma* causing intracranial injury, peripartum maternal narcotics

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Limp

Detailed History and Physical exam

Acute
May have history of trauma
Usually painful
Usually afibrile

MSK/Traumatic
- Trauma/injury* (Eg. Physical abuse*, fracture, sprain, overuse injuries, etc)
- Slipped Capital Femoral Epiphysis*
- Legg-Calve-Perthes* (ie. Avascular Necrosis)
- Growing pains*

Infectious/Post-infectious
Usually febrile
Usually painful
Systemic symptoms often present

- Septic Arthritis*
- Osteomyelitis *
- Cellulitis*
- Transient Synovitis*
- Post-infectious
  Reactive Arthritis*
- Rheumatic Fever*

Rheumatological
May be febrile or afibrile
Usually painful
Systemic symptoms usually present

- Juvenile Idiopathic Arthritis*
- Inflammatory Bowel Disease*
- Systemic Lupus Erythematosus
- Drug reaction

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

May be febrile or afibrile
Usually painful
Systemic symptoms usually present

Malignant
- Bone tumour* (Eg. Osteosarcoma, Ewing’s Sarcoma)
- Leukemia*
- Lymphoma*
- Bone Metastasis

*Indicates Key Condition

This is not an exhaustive list of medical conditions.
Respiratory Distress In The Newborn

Respiratory Distress in the Newborn (<48 hrs)

Detailed pregnancy and delivery history
Detailed physical exam

Respiratory
- Upper Airway
  - Congenital upper airway obstruction (Eg. Choanal atresia, laryngomalacia)
  - Airway compression (Eg. 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
  - Trisuspid Atresia
  - Transposition of the Great Arteries
  - Tetralogy of Fallot
  - Hypoplastic Left Heart Syndrome
  - Pulmonary Atresia

Neuromuscular
- (May present with irregular breathing rather than respiratory distress)
  - Seizure*
  - Birth trauma* (Eg. Hypoxic brain injury, CNS bleed, birth asphyxia)
  - Congenital CNS malformation
  - Drugs: Narcotics/Sedatives
  - Chest wall deformities
  - Genetic neuromuscular disease (Eg. Congenital myotonic dystrophy, spinal muscular atrophy, congenital myopathies)

Other
- Sepsis*
- Hypoglycemia*
- Metabolic disease *
- Gastrointestinal (Eg. Diaphragmatic hernia)
- Hypothermia or hyperthermia
- Persistent Pulmonary Hypertension

*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
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
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
Pediatric Cough

Acute

**Acute Cough (< 3 weeks)**

Detailed history
Respiratory physical exam

**Respiratory**

- **Stridor** on inspiration
  - Increased work of breathing (indrawing, nasal flare, head bobbing, paradoxical breathing)
  - Reduced SaO2 and reduced air entry are red flags for impending respiratory failure

- **Wheeze** on expiration, asymmetric breath sounds,
  - Increased work of breathing (indrawing, nasal flare, head bobbing, paradoxical breathing)
  - Crackles, bronchial breath sounds, focal respiratory findings
  - SaO2 reduced

**Upper Respiratory**

- Infectious
  - Viral URTI*
  - Sinusitis*
  - Croup*
  - Epiglottitis*
  - Pertussis*
  - Tracheitis*

- Foreign body
  - Anaphylaxis*

**Lower Respiratory**

- Infectious
  - Pneumonia*
  - Bronchiolitis*
  - Asthma*
  - Anaphylaxis*
  - Foreign body

**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 Respiratory Distress In The Newborn

Tachypnea

Respiratory Distress

Check Respiratory Rate (RR)

Tachypnea

Respiratory physical exam

Normal RR, irregular RR or Bradypnea

See "Respiratory distress: Approach to Normal RR, irregular RR or Bradypnea"

Upper Airway
(extra-thoracic obstruction present)

No increased work of breathing
Normal SaO2

Tachypnea with no increased work of breathing

Stridor on inspiration
Increased work of breathing (indrawing, nasal flare, head bobbing, paradoxical breathing)
Reduced SaO2 and reduced air entry are red flags for impending respiratory failure

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 → L Shunt

- Congestive Heart Failure*
- Congenital Heart Disease*
- Pulmonary AVM
- Pulmonary Hypertension

*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.
**Pediatric Fractures**

- **Non-Accidental Trauma (indications of child abuse)**
  - Distal Radius
    - Torus (junction of metaphysis)
    - Green stick (bone bent at convex side)
    - Complete (spiral, oblique, transverse)
  - Clavicle Fracture
    - *Supra condylar* (by 2 y.o.)
    - Lateral supracondylar
  - Tibia Fibular Fracture
  - Elbow
  - Toddlers Fracture
- **Accidental Trauma**
  - 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.
# 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>

S  Straight through  
A  Above  
L  Lower  
T  Through  
R  Crush
**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)
- > 6 Month Continence Prior
  - 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**
- 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.
Apparent Life Threatening Event

Based on History from Parent
(Extent of investigations based on initial examination)

- Acute Illness
- Witnessed Choking Spell
- Injury
  - Non-Accidental
  - Unnoticed
  - Factitious by Proxy
- Apnea
  - Periodic Breathing
  - Apnea of Infancy

- Cardiac
  - Congenital Heart Disease
  - Arrhythmia
  - Cardiomyopathy
  - Myocarditis
- Metabolic
  - Inborn Errors of Metabolism
  - Reye’s Syndrome
  - Electrolyte Disturbances
- Neurologic
  - Seizure
  - Malignancy
  - Neuromuscular Disorders
  - Central Apnea
- Respiratory
  - Anatomical Foreign Body Aspiration
  - Breath-holding spell (age-dependent)
- Infectious
  - Pneumonia
  - Sepsis
  - Upper Respiratory Tract Infection
  - Empyema
  - Urinary Tract Infection
- Gastrointestinal
  - Gastroesophageal Reflux
  - Volvulus
  - Gastroenteritis
  - Incarcerated Hernia

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Sudden Paroxysmal Event

A: Is this a seizure?
Clues: Non suppressible, decreased LOC, rhythmic movements, eye deviation, post-ictal, incontinence

Yes → Seizure

B: Is this seizure SYMPTOMATIC of something else?

Yes → Symptomatic

Drugs
• Meningitis*
• Encephalitis*
• Brain abscess
• Febrile seizure*

Infection

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

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 non-epileptic paroxysmal events”

Non-epileptic paroxysmal event

See “Seizures/Paroxysmal Events: Approach to Pediatric Epilepsies”

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Non-Epileptic Paroxysmal Event

**Neonates and Infants**
- Cardiac
  - Arrhythmia*
  - Developmental
    - In 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 (Eg. Chorea)

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Pediatric Epilepsies

Infantile
- Benign Focal Epilepsy of Infancy
- West Syndrome

Childhood

Generalized Epilepsies
- Childhood Absence Epilepsy
- Juvenile Absence Epilepsy
- Juvenile Myoclonic Epilepsy
- Lennox Gastaut Syndrome

Focal Epilepsies
- Self-limited epilepsy with centrotemporal spikes
- Remote symptomatic epilepsy

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
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, E.g. Tuberous Sclerosis = genetic and structural

Some epilepsies can be classified into more specific epilepsy syndromes

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Febrile Seizures

Simple Febrile Seizures
1. Generalized
2. < 15 min
3. 1 seizure in 24 hours

- No investigations for seizure
- 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

- ~1/3 risk of having future febrile seizure
- Slightly increased risk of epilepsy (4-6%)
- 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

*If < 6 mo, not a febrile seizure -> LP
* If neuro deficits or lethargic on exam need to rule out CNS infection -> CT, LP

*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
Abdominal Mass

Abdominal Mass

Ultrasound Mass

Tumor
- Liver: Hepatoblastoma, hepatocellular carcinoma, adenoma
- Kidney: Wilms tumor*, Renal cell carcinoma
- Muscle: Rhabdomyosarcoma
- Bowel: Lymphoma
- Adrenal: Neuroblastoma*
- Genitourinary: Germ cell Tumor

No Tumor

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.
Shock

Defined as inadequate oxygen delivery to meet metabolic demands

Stabilize:
A- Airway
B- Breathing
C- Circulation
D- Disability (Glasgow coma scale)
D- 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*

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
**Hypoglycemia**

**Decreased Substrate**
- Prolonged fast (Eg. 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* (Eg. Insulin, Sulfonylurea drugs)

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
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/intoxicaton* (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

Often no preceding prodrome.
May have signs or symptoms suggestive of toxicidrome.
Usually no focal findings on neurological exam.

Obtain urine drug screen, gas, osmolality, electrolytes

Perform CBC, blood cultures, Lumbar puncture +/- head imaging

Obtain urine drug screen, gas, osmolality, electrolytes, consider ammonia and lactate

Obtain urine drug screen, gas, osmolality, electrolytes, consider ammonia and lactate

Obtain STAT head imaging

Consider ancillary testing depending of history (Eg. Bloodwork, EEG, EKG, etc.)
**Bleeding/Bruising**

- Detailed history and physical exam
  - Rule out purpura
  - Consider Non-accidental Injury

- Check CBC, INR and PTT

- History of mucosal bleeding
  - Petechiae and bruising on exam
  - Low platelets
  - Normal INR, normal PTT

  **Platelets**

- Thrombocytopenia
  - See Bleed and Bruising: Approach to Thrombocytopenia

- Disordered Platelet Function
  - Congenital disorders of platelet function
  - Drugs (e.g., Ibuprofen, aspirin)

- Vascular System
  - Normal platelets
  - Normal INR, normal PTT

- Disorders of Coagulation
  - May have history of prolonged bleed, hemorrhage, positive family history
  - Normal platelets
  - Increased INR and/or PTT

  **See Bleed and Bruising: Approach to Disorders of Coagulation**

*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 (e.g. Aplastic Anemia)
    - Toxic Damage (e.g. Chemotherapy)
  - Ineffective Megakaryopoiesis
    - B12 Deficiency
    - Folate Deficiency
    - Drugs
- Increased Sequestration
  - Splenomegaly
  - Thrombus
- Increased Destruction
  - 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.
Long PT (INR), Long PTT

Factor Deficiency

Congenital
- Factor X
- Factor V
- Factor II
- Fibrinogen

Acquired

Inhibitor
- Heparin

Disseminated Intravascular Coagulation

Vitamin K Problem
- Vitamin K deficiency *
- Vitamin K antagonist (Eg. Coumadin)

Liver Disease

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

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Dehydration

**Dehydration***

- History and Physical exam
- Clinical assessment of dehydration severity

**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.
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*)

Euvolemic

- SIADH
- Endocrinopathies
- Adrenal insufficiency

Hypovolemic

Low intravascular volume (↓EABV)

- Congestive heart failure*
- Nephrotic syndrome*
- Nephritis syndrome*
- Sepsis* with capillary leak

High intravascular volume (↑EABV)

- Renal Failure*
Hypernatremia

Hyponatremia

Hypervolemic/Euvolemic

Salt Excess

Exogenous
Abuse/Neglect*
Iatrogenic
Inappropriate formula preparation

Endogenous
Hyperaldosteronism

Check clinical volume status

Hypovolemic

Water Deficit

Fluid losses

Reduced intake

Uosm >600
Abuse/Neglect*
Brain Tumour*
Hypothalamic dysfunction

Renal Loss

Osmotic Diuresis

Uosm > Posm, Uosm 300-600

Diabetic Ketoacidosis* (Glucoisuria)
Mannitol
Post-obstructive diuresis
Polyuric Acute Tubular Necrosis

GI Loss

Glucose Insipidus

Uosm < Posm
FeNa > 1%
U Na < 10

Nephrogenic Diabetes Insipidus
Central Diabetes Insipidus

Gastroenteritis*

Insensible Loss

Uosm >600

Burns*
Sweat
Respiratory losses

*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.
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)

- Detailed History and Physical Exam

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

Detailed History and Physical Exam

Clinical features and investigations not suggestive of infection
Often acute onset

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

Clinical features and investigations not suggestive of infection
Often fever > 5 days

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.
Failure to Thrive

**Failure to Thrive**

- Weight <3%ile OR
  - Weight falls over TWO major percentile lines, OR
  - Body mass index-for-age or weight-for-length < 3%ile

**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 (Eg. Cleft lip, etc.)
  - Dysphagia

**Intake Normal or High**

- **Height and Head Circumference often preserved initially**

**Increased Losses**

- **Vomiting**
- Gastroesophageal Reflux/Reflux Disease*
- Renal Tubular Acidosis
- Malabsorption (Eg. 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 (Eg. Cystic Fibrosis*, chronic aspiration)
- Malignancy (Eg. Leukemia*)
- Endocrinopathies (Eg. Hyperthyroidism)

**Height usually reduced**

- Head circumference variable

**Decreased growth potential**

- **Familial Short Stature**
- Genetic Syndromes (Eg. Trisomy 21*, Turner Syndrome*)
- Intrathecal insults (Eg. Congenital infections*, Fetal Alcohol Syndrome*)

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
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

Yes
- Pathological murmur
  - 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)

Pathological

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

Congenital Heart Disease*
- Rheumatic heart disease
- Bacterial endocarditis
- Tricuspid insufficiency
- Mitral insufficiency
- Mitral valve prolapse
- Cardiomyopathy/myocarditis

Acquired Heart Disease

See Approach to Murmur: Murmur in the Newborn (<48 hrs)

*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.
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.
Anemia By Mechanism

Anemia

Detailed history and Physical exam

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

Acute bleed

Chronic bleed

Hemolysis*/Increased RBC Destruction
- Increased Unconjugated Bilirubin, decreased haptoglobin, increased LDH, Spherocytes on Smear

Consumption/Sequestration
- Normocytic, normochromic RBCs
- Increased reticulocytes

- Hypersplenism/
  - Splenomegaly
  - Thrombus

Congenital
- Hemoglobinopathies*
- Thalassemia*
- RBC Membrane Disorder
- RBC Metabolism Disorder

Acquired
- Immune
- Non-Immune

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Anemia By MCV

- Low Mean Corpuscular Volume for age
  - Iron Deficiency*
  - Thalassemia*
  - Lead Poisoning
  - Anemia of Chronic Disease
  - Sideroblastic anemia
  - Anemia of Chronic Disease (Eg, Juvenile idiopathic arthritis*, IBD*, Chronic Infection, etc.)

- Normal Mean Corpuscular Volume for age
  - 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)

- High Mean Corpuscular Volume for age
  - B12 Deficiency
  - Folate Deficiency
  - Drugs
  - Reticulocytosis
  - Liver Disease
  - Hypothyroidism

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Microcytic Anemia

- Ferritin decreased, serum iron decreased, TIBC increased
  - Fe/TIBC <18%
  - MCV/RBC >13
  - Iron Deficiency*
    - Reduced dietary intake (over consumption of cow’s milk)
    - Malabsorption (Eg. Celiac disease*, Inflammatory Bowel Disease*)
    - Chronic Blood Loss

- Ferritin normal/increased, serum iron decreased, TIBC normal/decreased
  - Fe/TIBC >18%
  - Anemia of Chronic Disease
    - Chronic inflammation (Eg. Juvenile Idiopathic Arthritis*, Inflammatory Bowel Disease*, Lupus, etc.)

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

 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

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
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 erythodermia, involving the face, diaper, and intertriginous areas. Desquamation and crusting present. Nikolsky sign.
  - Purpuric, non blanchable rash over full body

- **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

- **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.
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)
      - Firm/Edematous
    - Deep Component
      - Nodule (1-3 cm diameter)
      - Tumor (> 3 cm diameter)
      - Transient/Itchy
      - Wheals/Hives
  - 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

*Indicates Key Condition

This is not an exhaustive list of medical conditions.
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)

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
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

Atopic Dermatitis* (Eczema)
- Erythematous papules and vesicles (acute) or lichenification (chronic)

Nummular Dermatitis
- Coin shaped (discoid) erythematous plaques. Usually on lower legs

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

Seborrheic Dermatitis*
- Yellowish-red plaques with greasy distinct margins on scalp/face/central chest folds

Scabies
- Erythematous papules and vesicles distributed over hands and skin folds. Burrow may be present

Age dependent distribution:
- Infants: scalp, face, extensor extremities
- Children: flexural areas
- Adults: flexural areas/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
  - Papulosquamous

- Erythematous or violaceous papules & plaques with overlying scale
  - Vesiculobullous
  - Pustular

- Blisters containing non-purulent fluid
  - Reactive rash with various morphology

- Blisters containing purulent fluid

- Reactive

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/genitals

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

Discoid Lupus Erythematosus
- Scarring and/or atrophic red/purple plaques with white adherent scales on sun-exposed area

*Indicates Key Condition

This is not an exhaustive list of medical conditions.
Rash (Vesiculobullous)

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
Papulosquamous
Vesiculobullous
Pustular
Reactive

Inflammatory
- Inflammatory pemphigoid
- 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.
Rash (Pustular)

**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

### 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.
Proteinuria

Persistent Proteinuria
- Urine dip negative, but tubular proteins present (Alpha 1 microglobulin). May have Glucosuria, aminoaciduria, acidosis

- Tubular Proteinuria
  - Primary
  - Secondary
    - Genetic/Metabolic disease* (Eg. Renal Fanconi's, Wilsons disease)
    - Drugs
    - Heavy metals
    - Nutritional

- Transient Proteinuria
  - Exercise
  - Fever

- Orthostatic Proteinuria

- First morning urine x 3

Glomerular Proteinuria
- Urine Microscopy
  - Active Sediment: RBC cells and casts, WBC casts
  - See “Edema: Clinical approach to Hematuria”

- Benign Sediment

  - Glomerular Proteinuria
    - Primary
    - Secondary
      - Infection (Hepatitis virus, HIV, Malaria, Syphilis)
      - Drugs (Penicillamin, NSAIDs)
      - Immune/Allergic disorders (Bee sting, Food allergies)
      - Malignancy (Lymphoma, Leukemia)
      - Diabetic nephropathy
Hematuria

Urinalysis
Urine microscopy

Exclude other causes of red urine

Red/pink urine, isomorphic RBC, no casts, no protein

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*)

Brown urine, dysmorphic RBCs, casts, proteinuria

Glomerular

Isolated Hematuria with Benign Sediment

- IgA nephropathy*
- Thin basement membrane
- Alport
- Benign Familial Hematuria
- Henoch Schonlein Purpura*

Hematuria with Active Sediment

C3

Normal/high C3

- Antibody mediated (anti-GBM antibodies)
  - Anti GBM/ Goodpastures
  - Pauci-immune (+ANCA)
    - Granulomatosis with polyangiitis
    - Polyarteritis Nodosa
- Henoch Schonlein Purpura*

Low C3

- Immune Complex mediated
  - Post-infectious glomerulonephritis*
  - Membranoproliferative glomerulonephritis
  - Lupus nephritis

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
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%)

Urnalysis, urine microscopy, CBC

Post-Renal (Obstruction/hydronephrosis on U/S)
- Constipation*
- Tumor (Eg. Wilms Tumor*)
- Congenital defects (Eg. Posterior Urethral valve)
- Urolithiasis
- Blocked Foley catheter

Sterile pyuria, eosinophiluria, epithelial casts

Tubular/Interstitial
- Acute Tubular Necrosis (ATN) (Eg. Severe hypotension, drugs, myoglobin)
- Acute Interstitial Nephritis (Eg. Infections, immune mediated)
- Tubular obstruction (Eg. Stones)

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*

Active sediment: RBC casts, dysmorphic RBCs, proteinuria

Glomerular

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Pediatric Chronic Kidney Disease

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)
- Hypercalciuria/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.
Edema

Clinical history
Clinical fluid assessment

Altered Starlings 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

Low serum albumin due to loss or impaired synthesis

Increased Capillary Permeability
- Sepsis*
- Vasculitis/inflammation (eg. Henoch Schönlein Purpura, Kawasaki disease*, Systemic Lupus Erythematosus)
- Burn*
- Anaphylaxis*

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Dysuria

Dysuria

Detailed history of physical exam
Urinalysis
Urine cultures

Normal Genitourinary exam

Urine Culture positive

*Urinary Tract Infection

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)

Further urine studies warranted

• Viral infection
• Inflammatory (Eg. Kawasaki Disease*)
• Nephrolithiasis

Urine Culture negative

No fever, otherwise well

Upper Urinary Tract Infection/Pyelonephritis

• Bacterial
• Candida
• Sexually Transmitted Infections*

Lower Urinary Tract Infection/Cystitis

• Bacterial
• Candida
• Sexually Transmitted Infections*

Pediatric

This is not an exhaustive list of medical conditions.
Increased Urinary Frequency

Detailed history and physical exam

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

Urine Osmolality < Serum Osmolality

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.
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-illuminate
    - Tumor (Eg. Leukemia*)

*Indicates Key Condition
This is not an exhaustive list of medical conditions.
Lymphadenopathy

- Reactive
  - Inflammatory
    - Systemic Lupus Erythematosus
    - Juvenile Idiopathic Arthritis*
    - Kawasaki Disease*
  - Infectious
    - Viral (Eg. Viral URTI, EBV, CMV)
    - Bacteria (Eg. Pharyngitis*, cervical adenitis*, Tuberculosis)
  - Other
    - Acne
    - Allergy
    - Insect Bites

- Neoplastic
  - Leukemia*
  - Lymphoma*

*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.
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.
General Presentations

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Fatigue

Exclude Sleep Disturbance/Lifestyle Issues/Pregnancy

Organic Etiologies

No Organic Etiologies

Endocrine/Metabolic
- Anemia
- Malignancy

Neoplastic/Hematologic
- Endocarditis
- Tuberculosis
- Epstein-Barr Virus
- Hepatitis
- HIV

Infectious
- Endocarditis
- Tuberculosis
- Epstein-Barr Virus
- Hepatitis
- HIV

Chronic Disease
- Hypnotics
- Anti-hypertensives
- Anti-Depressants
- Drug Abuse (e.g. Alcohol)
- Drug Withdrawal

Psychogenic
- Anxiety
- Somatization Disorder
- Malnutrition/Drug Addiction

Idiopathic
- Chronic Fatigue Syndrome

Endocrine
- Hypo/Hyper-thyroidism
- 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**
    - PE
    - Thrombophlebitis
    - DVT
    - Pancreatitis

- **Non-infectious**
  - **Inflammatory**
    - Transfusion reaction
    - Malignant Hyperthermia
    - Neuroleptic malignant syndrome
  - **Iatrogenic**
    - Thyroid storm
    - Acute Adrenal Insufficiency
  - **Endocrine**
    - 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
- Bacterial
  - Organ Specific Infection
    - Infectious endocarditis
    - Osteomyelitis
    - Occult abscess
    - Sinusitis
    - Cholangitis
    - UTI
    - Meningitis
  - Non-organ specific
    - Brucellosis
    - Q-fever
    - Salmonella
    - Yersinia
    - Tuleremia
    - Septic Phlebitis
    - Rheumatic fever
    - Lyme disease
    - TB
    - Whipple’s disease
- Viral
  - HIV
  - EBV
  - CMV
  - Viral hepatitis
  - Enterovirus

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
- 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
  - Acute viral Pharyngitis
  - Acute Influenza
  - Acute Viral Laryngotracheitis
  - Acute Viral Tracheobronchitis
  - Acute Infectious Mononucleosis
  - Herpangina
- Chronic
  - GERD
  - Environmental
  - Trauma
  - Foreign Body
  - Neoplasm

Viral

- Streptococcal Tonsillopharyngitis
- Peritonsillar Abscess
- Ludwig’s Angina

Bacterial
Historical Executive Student Editors

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2013-14  Yang (Steven) Liu & Bryan Glezerson
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2010-11  Jonathan Dykeman & Kathy Truong
2009-10  Lucas Gursky & Ting Li
2008-09  Linnea Duke & Mustafa Hirji
2007-08  Brett Poulin (Founder of the Calgary Black Book Project)
Scheme Creators

Students


Faculty


Missing a credit?

If you are the creator of a scheme currently used in the Blackbook and believe you have not been credited appropriately, please contact us at blackbk@ucalgary.ca
# Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>AAA</td>
<td>Abdominal Aortic Aneurysm</td>
</tr>
<tr>
<td>ACE</td>
<td>Angiotensin-Converting Enzyme</td>
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<tr>
<td>ACTH</td>
<td>Adrenocorticotropic Hormone</td>
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<tr>
<td>ADPKD</td>
<td>Autosomal Dominant Polycystic Kidney Disease</td>
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<tr>
<td>ADH</td>
<td>Antidiuretic Hormone</td>
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<tr>
<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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<tr>
<td>ARB</td>
<td>Angiotensin Receptor Blocker</td>
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<td>ARF</td>
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<td>ARPKD</td>
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<td>BPH</td>
<td>Benign Prostatic Hypertrophy</td>
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<tr>
<td>CCD</td>
<td>Cortical Collecting Duct</td>
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<td>CHF</td>
<td>Congestive Heart Failure</td>
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<td>CIN</td>
<td>Chronic Interstitial Nephritis</td>
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<td>CLL</td>
<td>Chronic Lymphocytic Leukemia</td>
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<tr>
<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>
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<td>CRH</td>
<td>Corticotrophic Releasing Hormone</td>
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<td>CT</td>
<td>Computed Tomography</td>
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<tr>
<td>DCIS</td>
<td>Ductal Carcinoma In Situ</td>
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<tr>
<td>DHEA</td>
<td>Dehydroepiandrosterone</td>
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<tr>
<td>DHEA-S</td>
<td>Dehydroepiandrosterone 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>
</tr>
<tr>
<td>DRE</td>
<td>Digital Rectal Exam</td>
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<tr>
<td>DVT</td>
<td>Deep Vein Thrombosis</td>
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<tr>
<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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<td>FSGS</td>
<td>Focal Segmental Glomerulosclerosis</td>
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<tr>
<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>Growth Hormone Releasing Hormone</td>
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<tr>
<td>GN</td>
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<td>GnRH</td>
<td>Gonadotropin Releasing Hormone</td>
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<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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<tr>
<td>H+</td>
<td>Hydrogen</td>
</tr>
<tr>
<td>HCG</td>
<td>Human Chorionic Gonadotropin</td>
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<tr>
<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>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>HSP</td>
<td>Henoch-Schönlein Purpura</td>
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<tr>
<td>HSV</td>
<td>Herpes Simplex Virus</td>
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<tr>
<td>HUS</td>
<td>Hemolytic-Uremic Syndrome</td>
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<tr>
<td>IBD</td>
<td>Irritable Bowel Disease</td>
</tr>
<tr>
<td>IBS</td>
<td>Irritable Bowel Syndrome</td>
</tr>
<tr>
<td>ICP</td>
<td>Increased Intracranial Pressure</td>
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<tr>
<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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<tr>
<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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<tr>
<td>IVP</td>
<td>Intravenous Pyelogram</td>
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<td>JVP</td>
<td>Jugular Venous Pyelogram</td>
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<tr>
<td>K+</td>
<td>Potassium</td>
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<tr>
<td>KUB</td>
<td>Kidney, Ureter, Bladder</td>
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<td>LCIS</td>
<td>Lobular Carcinoma In Situ</td>
</tr>
<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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<tr>
<td>LOC</td>
<td>Level of Consciousness</td>
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<tr>
<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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<tr>
<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 Neoplasma</td>
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<tr>
<td>MI</td>
<td>Myocardian 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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<tr>
<td>MS</td>
<td>Multiple Sclerosis</td>
</tr>
<tr>
<td>MSK</td>
<td>Musculoskeletal</td>
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<tr>
<td>Na+</td>
<td>Sodium</td>
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<tr>
<td>NSAIDs</td>
<td>Non-Steroidal Anti-Inflammatories</td>
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<tr>
<td>OCP</td>
<td>Oral Contraceptive Pill</td>
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<tr>
<td>OSM</td>
<td>Osmolality</td>
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<tr>
<td>PE</td>
<td>Pulmonary Embolism</td>
</tr>
<tr>
<td>PID</td>
<td>Pelvic Inflammatory Disease</td>
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<tr>
<td>PMN</td>
<td>Polymorphic Neutrophils</td>
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<tr>
<td>POSM</td>
<td>Plasma Osmolality</td>
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<tr>
<td>PPROM</td>
<td>Preterm Premature Rupture of Membranes</td>
</tr>
<tr>
<td>PROM</td>
<td>Premature Rupture of Membranes</td>
</tr>
<tr>
<td>PT</td>
<td>Prothrombin Time</td>
</tr>
<tr>
<td>PTH</td>
<td>Parathyroid Hormone</td>
</tr>
<tr>
<td>PTT</td>
<td>Partial Thromboplastin Time</td>
</tr>
<tr>
<td>PUD</td>
<td>Peptic Ulcer Disease</td>
</tr>
<tr>
<td>PUJ</td>
<td>Pelviureteric Junction</td>
</tr>
<tr>
<td>RAPD</td>
<td>Right Afferent Pupillary Defect</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Description</td>
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<td>--------------</td>
<td>-------------</td>
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<tr>
<td>RAS</td>
<td>Renal Artery Stenosis</td>
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<tr>
<td>RBC</td>
<td>Red Blood Cell</td>
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<tr>
<td>RTA</td>
<td>Renal Tubular Acidosis</td>
</tr>
<tr>
<td>SGA</td>
<td>Small for Gestational Age</td>
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<tr>
<td>SLE</td>
<td>Systemic Lupus Erythematosus</td>
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<tr>
<td>TORCH</td>
<td>Toxoplasmosis, Other (Hepatitis B, Syphilis, Varicella-Zoster virus, HIV, Parvovirus B19), Rubella, Cytomegalovirus, Herpes Simplex Virus</td>
</tr>
<tr>
<td>TSH</td>
<td>Thyroid Stimulating Hormone</td>
</tr>
<tr>
<td>TSHR</td>
<td>Thyroid Stimulating Hormone Receptor</td>
</tr>
<tr>
<td>TTKG</td>
<td>Transtubular Potassium Gradient</td>
</tr>
<tr>
<td>TTP</td>
<td>Thrombotic Thrombocytopenic Purpura</td>
</tr>
<tr>
<td>UTI</td>
<td>Urinary Tract Infection</td>
</tr>
<tr>
<td>US</td>
<td>Ultrasound</td>
</tr>
<tr>
<td>VACTERL</td>
<td>Vertebral Anomalies, Anal Atresia, Cardiovascular Anomalies, Tracheoesophageal Fistula, Esophageal Atresia, Renal Anomalies, Limb Anomalies</td>
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<tr>
<td>VSD</td>
<td>Ventricular Septal Defect</td>
</tr>
<tr>
<td>VUJ</td>
<td>Vesicoureteral Junction</td>
</tr>
</tbody>
</table>
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.

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