

EMERGENCY ROOM MEDICINE NOTES

FOURTH EDITION

**PRE-SUMMARIZED
READY-TO-STUDY
HIGH-YIELD NOTES**

**FOR THE TIME-POOR
MEDICAL, PRE-MED,
USMLE OR PA STUDENT**

EMERGENCY



PDF



289 PAGES

A Message From Our Team

Studying medicine or any health-related degree can be stressful; believe us, we know from experience! The human body is an incredibly complex organism, and finding a way to streamline your learning is crucial to succeeding in your exams and future profession. Our goal from the outset has been to create the greatest educational resource for the next generation of medical students, and to make them as affordable as possible.

In this fourth edition of our notes we have made a number of text corrections, formatting updates, and figure updates which we feel will enhance your study experience. We have also endeavoured to use only open-source images and/or provide attribution where possible.

If you are new to us, here are a few things to help get the most out of your notes:

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Table Of Contents:

What's included: Ready-to-study summaries of a broad range of commonly-seen medical emergencies, presented in succinct, intuitive and richly illustrated downloadable PDF documents. Once downloaded, you may choose to either print and bind them, or make annotations digitally on your ipad or tablet PC.

Emergency Medicine Topics: (Red = Clickable Hyperlink)

- **OVERVIEW OF EMERGENCY MEDICINE**
 - BASIC LIFE SUPPORT
 - ADVANCED LIFE SUPPORT
 - POTENTIALLY REVERSIBLE CAUSES OF AN ARREST
- **LOSS OF CONSCIOUSNESS/ALOC (ALTERED LEVEL OF CONSCIOUSNESS)**
- **NEUROLOGICAL EMERGENCIES**
 - COMMON NEUROLOGICAL PRESENTATIONS
 - PATTERNS OF LOSS OF SENSATION
 - SPINAL CORD DEFICITS
 - CONCUSSION
 - BRAIN CONTUSION
 - BRAIN LACERATION
 - DIFFUSE AXONAL INJURY
 - INTRACRANIAL HAEMORRHAGES
 - STROKES
 - SEIZURES & EPILEPSY
 - MENINGITIS
 - ENCEPHALITIS
 - RAISED INTRACRANIAL PRESSURE
 - BRAIN HERNIATIONS
 - "RED EYE"
- **CARDIOVASCULAR EMERGENCIES**
 - SHOCK
 - FLUID REPLACEMENT THERAPY
 - HYPERTENSION
 - ARRHYTHMIAS
 - FRAMEWORK FOR LOOKING AT ECGs
 - HEART FAILURE
 - ACUTE CARDIOGENIC PULMONARY OEDEMA
 - DEEP VEIN THROMBOSIS ("PHLEBOTHROMBOSIS"/"THROMBOPHLEBITIS")
 - PULMONARY EMBOLISM
 - CARDIAC TAMPONADE
 - ANEURYSMS & DISSECTIONS
 - ISCHAEMIC HEART DISEASE
 - ASSESSMENT OF CVS EMERGENCIES
- **RESPIRATORY EMERGENCIES**
 - AIRWAY HYPERSENSITIVITY & ASTHMA
 - ACUTE LARYNGOTRACHEOBRONCHITIS (CROUP)
 - ACUTE EPIGLOTTITIS
 - LOWER RESPIRATORY TRACT INFECTIONS
 - BRONCHIOLITIS:
 - SARS & COVID – SEVERE ACUTE RESPIRATORY SYNDROME
 - CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)
 - PNEUMOTHORAX
 - HYPOXIA AND HYPERCAPNIA
 - TREATING RESPIRATORY EMERGENCIES
- **GASTROINTESTINAL EMERGENCIES**

- ABDOMINAL PAIN
- GASTRIC EMERGENCIES
- PANCREATIC EMERGENCIES
- GALLBLADDER EMERGENCIES
- LIVER-RELATED EMERGENCIES
- INTESTINAL EMERGENCIES
- RECTAL BLEEDING
- GASTROENTERITIS
- MUSCULOSKELETAL EMERGENCIES
 - BONY INJURIES
 - OSTEOMYELITIS
 - SEPTIC ARTHRITIS
 - GOUT (GOUTY ARTHRITIS):
- ENDOCRINE EMERGENCIES:
 - THYROID EMERGENCIES
 - PITUITARY EMERGENCIES
 - ADRENAL EMERGENCIES
 - DIABETIC EMERGENCIES
- RENAL EMERGENCIES
 - UROGENIC PAIN
 - ACUTE RENAL FAILURES
 - NEPHROLITHIASIS & UROLITHIASIS
 - CATHETERIZATION
- TOXICOLOGICAL EMERGENCIES
- WOMEN'S HEALTH EMERGENCIES
- MEN'S HEALTH EMERGENCIES
- OBSTETRIC EMERGENCIES
- PAEDIATRIC CONSIDERATIONS IN AN EMERGENCY SETTING
- FLUID MANAGEMENT (EMERGENCY CONTEXT)
- POST OPERATIVE COMPLICATIONS
- PSYCHIATRIC EMERGENCIES
 - PSYCHOSIS
 - SUICIDE & SELF-HARM
 - GRIEF & LOSS

OVERVIEW OF EMERGENCY MEDICINE

OVERVIEW OF EMERGENCY MEDICINE

Key words + Definitions:

- **Emergency:**
 - “A medical condition requiring *Immediate Treatment*”
 - (Not necessarily life-threatening)
- **Triage:**
 - “The Process of Sorting Patients based on *Urgency*.”
- **Resuscitation:**
 - To revive somebody from unconsciousness or apparent death
- **The Primary survey – ABCDE:**
 - Airway
 - Breathing
 - Circulation
 - Disability
 - Expose
- **Retrieval Medicine**
 - Pre-Hospital care performed in an emergency retrieval vehicle (Helicopter/Ambulance/Etc)
- **National Triage Scale:**
 - The standardized triage guidelines for your local hospital.

Framework Dealing with an Emergency:

- **1: Triage:**
 - “The Process of Sorting Patients based on *Urgency*.”
 - Usually performed by a specially-trained ED nurse.
 - **Triage establishes ‘Priorities of Care’ among groups of patients.**
 - Triage aims to answer the question: “This patient should wait for medical assessment no longer than...?... Minutes.”
 - **Example of National Triage Scales for AU & UK:**
 - (May vary in your jurisdiction)
 - (Note: Children & psychiatric patients often have their own specific triage scales.)

Table 17.1 Australasian triage scale

Designation	Treatment acuity	Numeric code
Resuscitation	Immediately	1
Emergency	Within 10 min	2
Urgent	Within 30 min	3
Semi-urgent	Within 60 min	4
Non-urgent	Within 120 min	5

Table 17.2 UK national triage scale

Designation	Treatment acuity	Numeric code
Immediate resuscitation	Immediately	1
Very urgent	Within 10 min	2
Urgent	Within 60 min	3
Standard	Within 120 min	4
Non-urgent	Within 240 min	5

• **2: 30-Second Patient Assessment in an Emergency: “The Primary Survey” - “ABCDE”:**

- Airway (With c-spine control)
 - Breathing
 - Circulation
 - Disability
 - Expose
- } Achieved by: **“Tell me your name”**
“How are you today?”
“Where does it hurt?”

“Tell me your name”:

- **Pt: “I’m John Smith” - You Know That:**
 - 1: Airway is Patent
 - 2: Pt’s Breathing is Adequate.
 - 3: Consciousness = Adequate Cerebral Perfusion = BP is >Sys 80mmHg.
- **If Unresponsive:**
 - There is a Problem with One/More of the ABC.

“How are you today?”:

- **Pt: “Awful! This pain is dreadful”:**
 - You now know the Problem = Pain.

“Where does it Hurt?”:

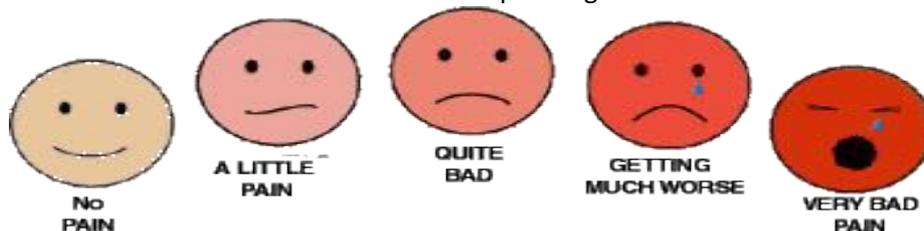
- **Pt: “In my belly. Just here”:**
 - You now know the Location = Abdomen.

▪ **At the Same Time You are LOOKING & FEELING:**

<u>LOOKING</u>	<u>FEELING</u>
<ul style="list-style-type: none"> • APPEARANCE General, rash, pallor, cyanosis, jaundice • NECK Neck veins, thyroid • CHEST Respiratory distress, rate 	<ul style="list-style-type: none"> • PULSE Rate, rhythm, volume • SKIN Temperature, sweating
<p>You Now Have an Approximation of the First 3 Vital Signs:</p> <ul style="list-style-type: none"> - Respiratory Rate. (High/Normal/Low) - Pulse (Tachy/Brady; Strong/Bounding/Thready) - Temperature (Hot-ish/Cold-ish) <p>You Also Have an Idea of O₂ Saturation:</p> <ul style="list-style-type: none"> - If Central Cyanosis = Low O₂ Saturation. - If No Cyanosis = O₂ Sats are Ok (for now) <p>Other Observations:</p> <ul style="list-style-type: none"> - Normal Skin Colour = Unlikely Anaemia/Jaundice/Cyanosis/Shock. - Normal Pulse = Cardiac Output is OK; No major Arrhythmias - Warm, Dry Extremities = Adequate Peripheral Perfusion; Not Hypothermic - Regular, Symmetrical Chest Movement = Unlikely Pneumothorax/Acidosis. - Soft Neck with NO JVP = No RHF, No Goitre, No Neck Trauma. 	
<p><u>Note: As a Problem is Identified/Arises, it is IMMEDIATELY Dealt With:</u></p> <ul style="list-style-type: none"> - If Blocked Airway → Clear It - If Not Breathing → Ventilate - If Pulse is Weak/Thready → Get IV Access - If in Pain → Give Analgesia 	

- **3: Assess the Patient's Pain Status:**

- ***Analgesia should be the NEXT PRIORITY After Prolonging Life (& checking allergies):**
 - Is it needed?..If So:
 - What Drug?
 - Which Route?
 - What Dose?
 - **Pain Assessment:**
 - **Site of Pain:**
 - Location/Radiation?
 - **Circumstances @ Pain Onset:**
 - Trauma?
 - Ie: What caused it
 - **Character of Pain:**
 - Pain Description – (Sharp, throbbing, aching, dull, burning)
 - **Intensity of Pain:**
 - @ Rest
 - On Movement
 - **Duration**
 - Continuous/Intermittent
 - Aggravating Factors
 - **Somatic Pain?**
 - Sharp, hot or stinging
 - Well localised
 - Local Tenderness
 - **Visceral Pain?**
 - Dull, cramping pain
 - Poorly localised
 - Local Tenderness or Referred Tenderness
 - Related symptoms – (Nausea, Sweating & CV Changes)
 - **Treatment?**
 - Current & Previous Meds
 - **Pain Scales – (Because Pain is a *Subjective* Experience):**
 - **Eg: Categorical Scales:**
 - Verbal Descriptors (mild/moderate/severe/excruciating/agonising)
 - Numeric (0-10)
 - **Eg: Visual Analogue Scale:**
 - 5 Emoticon faces with corresponding scores



- **Note: Different Pain Scales are used for different people:**
 - Eg: Deaf people are more suited to picture-based pain scale
 - Eg: Blind people are best suited to verbal/numeric scales
 - Eg: Babies/Foreigners are best suited to picture-based scales
- **Importance of Analgesia:**
 - Relieves pain
 - Improves Patient Communication
 - Improves Patient Cooperation
 - Can improve symptoms (eg: Pain-related tachycardia)
- **Advantages and Disadvantages of various Forms of Analgesia:**
 - **Oral Analgesia (Paracetamol/Aspirin)** – Cheap & Easy; But Weak
 - **Parenteral Analgesia (IM/IV opiates)** – Strong; But More Expensive/Complicated
 - **Regional Blocks (LA injection around a nerve)** – Only Good for Isolated Injuries

• **4: Mnemonic: 'AMPLE':**

A	Allergies
M	Medications
P	Past history, including alcohol and cigarette use
L	Last meal
E	Events/environment relating to the injury, including time, speed of impact, initial vital signs, and any change in condition

• **5: Early Management:**

- **Prevention of Morbidity & Complications:**
 - By stopping a disease process early, you can limit the collateral damage caused by that disease process, thereby improving the patient's prognosis
- **Minimises Suffering:**
 - Timely, accurate diagnosis and effective management reduces the physical and emotional suffering of the patient

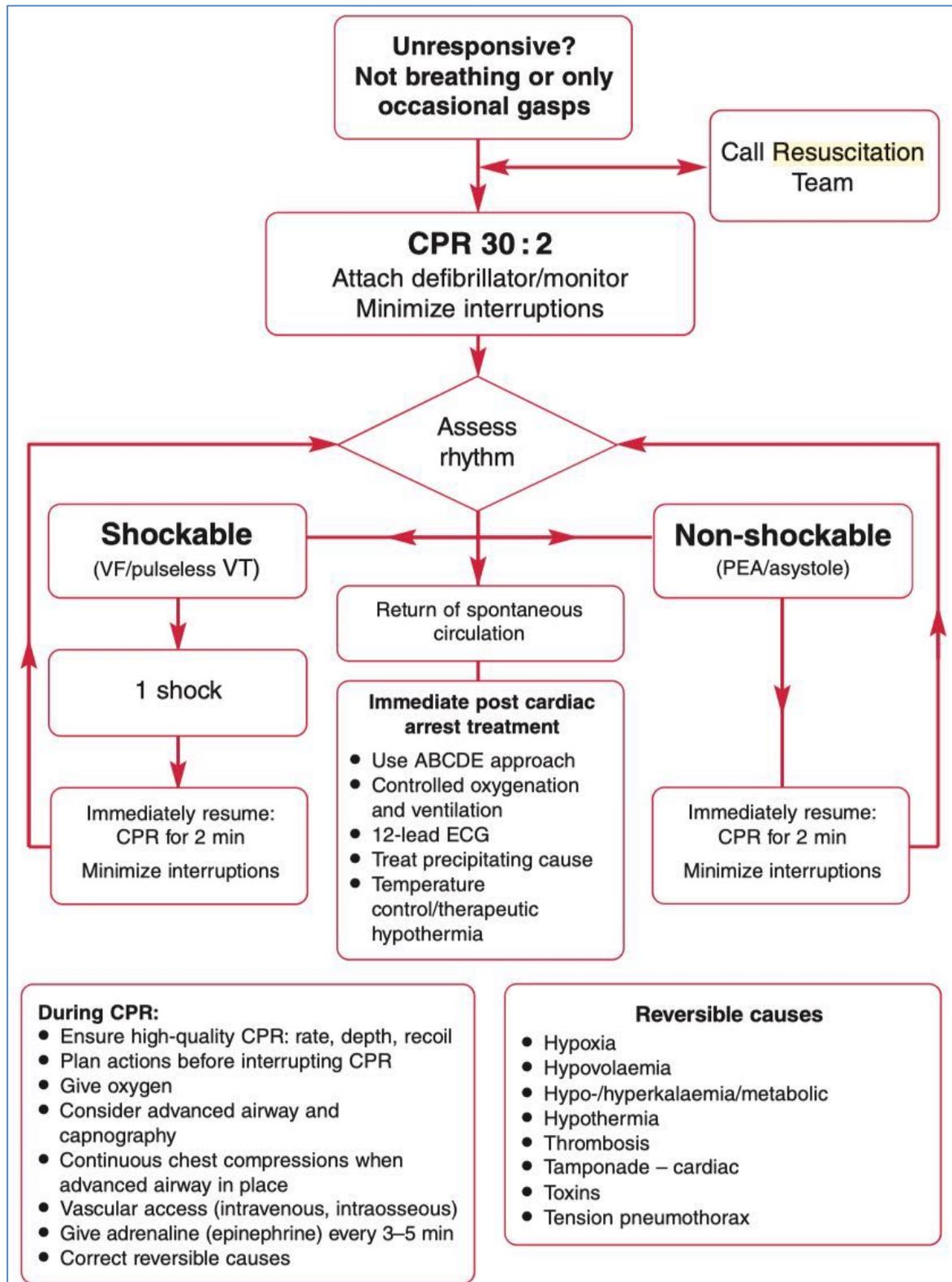
BASIC LIFE SUPPORT

D	<p>Dangers?</p> <p>Check for danger to yourself, bystanders and the patient.</p>	
R	<p>Responsive?</p> <p>Check for a response: ask name, squeeze shoulders. No response? Send for help. Response? Make comfortable, monitor breathing and response.</p>	
S	<p>Send for help</p> <p>Call triple zero (000) for an ambulance or ask a bystander to make the call. Stay on the line.</p>	
A	<p>Open Airway</p> <p>Open the mouth and check the airway for foreign material. Foreign material? Place in the recovery position and clear the airway. No foreign material? Leave in position. Open the airway by tilting the head back with a chin lift.</p>	
B	<p>Normal Breathing?</p> <p>Check for breathing: look, listen, feel for 10 seconds. Not normal breathing? Ensure an ambulance has been called and start CPR. Normal breathing? Place in the recovery position and monitor breathing.</p>	
C	<p>Start CPR</p> <p>30 chest compressions : 2 breaths. Continue CPR until help arrives or the patient starts breathing.</p>	
D	<p>Attach defibrillator</p> <p>and follow the voice prompts.</p>	

****Disclaimer: Please follow your local/hospital guidelines****

ADVANCED LIFE SUPPORT

- Required if a collapsed person is unconscious or unresponsive, not breathing, and has no pulse in a large artery such as the carotid or femoral
- Sudden cardiac arrest still causes over 60% of deaths from coronary heart disease in adults
- **Immediate Priorities:**
 - (to maintain oxygenation of the brain and myocardium until a stable cardiac output is achieved)
 - Lay the patient flat
 - Administer Precordial Thump (if within the first few seconds of arrest & if defibrillator not yet on hand)
 - Head tilt & chin lift → Open airway
 - If still unresponsive & breathing abnormal/absent → Call Resus Team & Begin CPR



Disclaimer: Please follow your local/hospital guidelines

POTENTIALLY REVERSIBLE CAUSES OF AN ARREST:

The 4x H's:

- **Hypoxia:**
 - o Ensure 100% oxygen is being delivered at 15 L/min
 - o Ensure tidal volume (6–7 ml/kg) is creating a visible rise and fall of both sides of the chest
- **Hypovolaemia:**
 - o Eg: Severe blood loss following trauma, GI bleed, ruptured AAA, or ruptured ectopic pregnancy
 - o Search for the source of bleeding
 - o If so, give stat fluids and call surgical, vascular, or obstetrics and gynaecology team as appropriate
- **Hyper/Hypo-Kalaemia, Hypocalcaemia, & Other Metabolic Disorders**
 - o Rapidly check the potassium and calcium initially
 - o Give 10% calcium chloride 10 ml IV For hyperkalaemia, hypocalcaemia or calcium-channel blocking drug overdose
 - o Give a bolus of potassium 5 mmol IV For hypokalaemia
- **Hypothermia:**
 - o Moderate (30–32°C) or severe (under 30°C) hypothermia will require heroic measures such as active core re-warming with warmed pleural, peritoneal or gastric lavage, or even extracorporeal re-warming, when a patient is in cardiac arrest

The 4x T's:

- **Thrombosis:**
 - o Eg: PE; CPR may break up a massive pulmonary embolus (PE), and give a fluid load of 20 mL/kg
 - o If clinical suspicion is high and there are no absolute contraindications, give thrombolysis such as alteplase
- **Tamponade:**
 - o May follow trauma, usually penetrating, myocardial infarction, dissecting aneurysm or pericarditis
 - o Hypotension, tachycardia, pulsus paradoxus and engorged neck veins that rise on inspiration (kussmaul's sign)
 - o Heart sounds are quiet, the apex beat is impalpable and pea may ensue
 - o Perform pericardiocentesis if the patient is in extremis. Insert a cardiac needle between the angle of the xiphisternum and the left costal margin at 45° to the horizontal, aiming for the left shoulder
 - o Sometimes aspirating as little as 50 ml restores the cardiac output
- **Toxins:**
 - o Eg: poisoning with tricyclic antidepressants, calcium-channel blocking drugs, or B-blockers, and hydrofluoric acid burns
 - o Consider these based on the history, recognize early, and treat supportively or with antidotes where available
- **Tension Pneumothorax:**
 - o usually follows a traumatic rather than a spontaneous pneumothorax
 - o results in extreme respiratory distress and circulatory collapse
 - o life-threatening situation requiring immediate relief, without waiting for a chest radiograph (CXR)
 - o insert a wide-bore needle or cannula through the second intercostal space in the mid-clavicular line
 - o insert an intercostal drain

Post-Resuscitation Care:

- continue CPR until the heartbeat produces a peripheral pulse, and/or there are signs of life
- maintain oxygen saturation 94–98%
- Check the ABG to exclude hypocarbia from over-ventilation (aim for PaCO₂ from 35 to 45 mmHg)
- Insert a gastric tube to decompress the stomach
- Contact the cardiology service urgently in a suspected acute coronary syndrome, such as a cardiac arrest following chest pain
- Give 1 in 10 000 adrenaline (epinephrine) 50µg (0.5 mL) IV if there is persistent hypotension
- Control seizures with midazolam 0.05–0.1 mg/kg up to 10 mg IV, diazepam 0.1–0.2 mg/kg up to 20 mg IV or lorazepam 0.07 mg/kg up to 4 mg IV
- Maintain blood glucose at 6≤10 mmol/L
- Transfer the patient to the ICU, catheter laboratory or coronary care unit (CCU)

LOSS OF CONSCIOUSNESS/ALOC (ALTERED LEVEL OF CONSCIOUSNESS)

LOSS OF CONSCIOUSNESS/ALOC (ALTERED LEVEL OF CONSCIOUSNESS)

Many Potential Causes of Loss of Consciousness:

- **Head Trauma:**
 - **Primary Injury:**
 - Concussion
 - Contusion
 - Laceration
 - Diffuse Axonal Injury
 - **(Note: Primary injury determines the best possible outcome)**
 - **Secondary Injury:**
 - Hypoxia
 - Hypoglycaemia
 - Decreased cerebral perfusion
 - Hypotension
 - Haemorrhage
 - Oedema
 - **(Secondary Injury determines the *Actual Outcome*)**
 - **(All treatments are focussed on preventing secondary injury)**
- **Drugs:**
 - **Prescription Medication:**
 - (Ie: Taken in accidental overdose – Especially Old people/suicide)
 - (Or Drug Interaction)
 - Analgesics
 - Sedatives
 - Antidepressants
 - **Recreational Drugs:**
 - Alcohol
 - Opiates
 - Etc
 - **Treatment:**
 - Treat Specific OD
 - Assess Suicide Risk
 - Psych Review
- **Tumours:**
 - Rare
 - Benign or Malignant
 - May be metastases
- **Systemic Causes of LOC:**
 - Hypoxia
 - Hypoventilation
 - Hypotension
 - Sepsis
- **Endocrine Causes:**
 - Diabetes
 - **YOU MUST ALWAYS CHECK BLOOD SUGAR (despite obvious trauma/stroke/etc)**
 - Hypoglycaemia
 - Hyperglycaemia/ketoacidosis
 - Hypothyroidism/Thyrotoxicosis
- **Metabolic Causes:**
 - Uraemia (due to acute renal failure) → Requires renal transplant/dialysis
 - Hepatic Failure (eg: Alcoholic liver disease → Acute liver failure)
- **Infection:**
 - Meningitis – Diagnosis is ESSENTIAL
 - Encephalitis
 - Tuberculosis
 - Malaria

ASSESSMENT OF ALOC:

- Glasgow Coma Scale (GCS) - KNOW THIS:

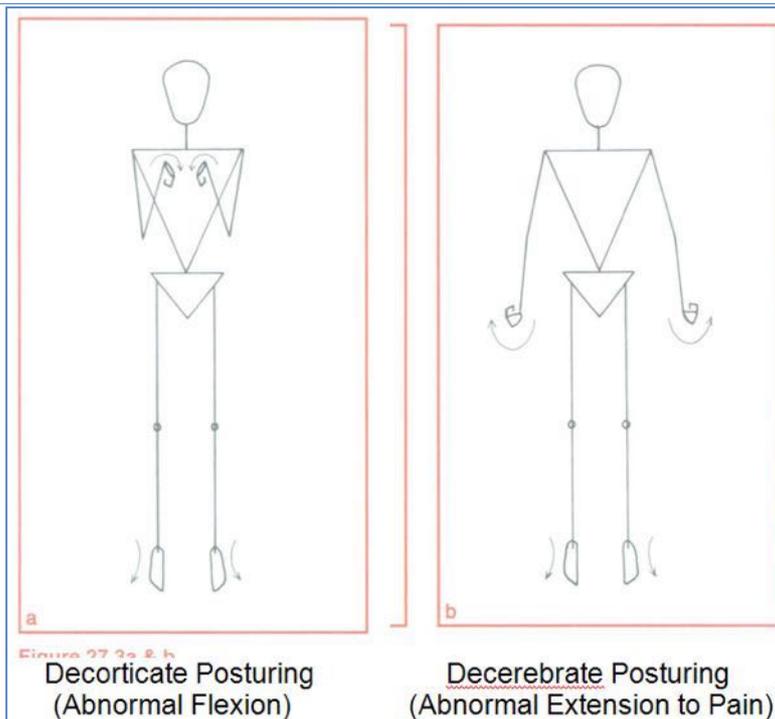
- (Max Score = 15 = Awake, Alert, Responsive = Conscious)
- (Less than GCS10 = Deeply unconscious; Less than GCS8 = Coma)
- (Min Score = 3 = Dead)

Table 1.1 The Glasgow Coma Scale (GCS) score

		Score
Eye opening	Spontaneously	4
	To speech	3
	To pain	2
	None	1
Verbal response	Oriented	5
	Confused	4
	Inappropriate	3
	Incomprehensible	2
	None	1
Motor response	Obeys commands	6
	Localizes pain	5
	Withdraws (pain)	4
	Flexion (pain)	3
	Extension (pain)	2
	None	1

The maximum score is 15. Any reduction in score indicates deterioration in the level of consciousness.

- (i) A patient in coma has a score of 8 or less.
- (ii) A decrease in score of 2 or more points indicates a significant deterioration.
- (iii) Repeat neurological examinations, including the GCS, are essential for detecting and managing secondary brain damage.



The 'AVPU' Scale:

- **A simplification of the Glasgow Coma Scale**
- This is the most simple and categorizes the patient into one of four states
 - **Alert** = awake *but* may be confused (Conscious)
 - **Verbal** = responding to verbal stimulus (Conscious)
 - **Pain** = responding *only* to painful stimulus (Unconscious)
 - **Unresponsive** = no response to *any* stimulus (Unconscious)

		ADULT BEHAVIOR	PEDIATRIC BEHAVIOR
A	ALERT	Eyes open spontaneously. Appears aware of and responsive to the environment. Follows commands eyes track people and objects.	Child is active and responds appropriately to SO and other external stimuli.
V	VOICE	Eye do not open spontaneously but open to verbal stimuli. Able to respond in some meaningful way when spoken to.	Responds only when his or her name is called by SO.
P	PAIN	Does not respond to questions but moves or cries out in response to painful stimuli such as pinching the skin or earlobe.	Responds only when painful stimuli is received such as pinching the nail bed.
U	UNRESPONSIVE	Patient does not respond to any stimuli.	No response at all.

LEARN MORE: THE "AVPU" SCALE

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The AVPU scale is a system where you can measure and record a patient's responsiveness to indicate their level of consciousness. It is a simplification of the Glasgow Coma Scale, which assesses a patient response in three measures: eyes, voice, and motor skills. The AVPU scale should be assessed during these three identifiable traits, looking for the best response for each. It has four possible outcomes for recording and the nurse should always work from best (A) to worst (U) to avoid unnecessary tests on patients who are clearly conscious. On the other hand, it should not be used for long-term follow up of neurological status.

Source: Nurselabs.com

Note: Traumatic Brain Injury (TBI):

- **Mild** = GCS 14 or 15
 - Likelihood of +ve CT scan = 10% and 1% will require neurosurgery
- **Moderate** = GCS 9-13
 - Likelihood of +ve CT scan = 40% and 8% will require neurosurgery
- **Severe** = GCS < 9
 - Mortality around 40%!

- **PRACTICE ALOC CASES:**

- Give each of the following cases a AVPU rating and GCS

- **Case 1**

- A 16 year old female is brought into your ED by ambulance after falling from a third floor balcony. Her eyes are closed despite painful stimulus and she's making groaning noises. She pulls her hands and feet away when painful stimulus applied to them.

- AVPU.....

- GCS.....

- **Case 2**

- A 24 year old man who is cheerfully intoxicated with alcohol is brought to your ED by Police. His speech is slurred he doesn't know what day or month it is, but is very happy to assist you with your physical examination of him.

- AVPU.....

- GCS.....

- **Case 3**

- A febrile 82 year old is brought into your ED by relatives. She is looking around the ED but every time you ask a question she tells you to "@#\$% off" and this response never varies. She tries to hit you when you ask her to move her arms or legs.

- AVPU.....

- GCS.....

- **Case 4**

- A six month old is brought your ED by his parents after suffering a generalised seizure. His eyes are open but he makes no response to any stimulus.

- AVPU.....

- GCS.....

- How useful do you think the AVPU and GCS scales are in this age group? Why?

FRAMEWORK FOR MANAGING CASES OF ALOC:

- Primary Survey ABCDEFG:

- **Airway:**
 - **Commonest cause of Unconsciousness is Airway Obstruction**
 - **Clear The Airway:**
 - Left Lateral Position/Suction/Guedell Airway/Jaw Thrust
 - **(Generally GCS<8 require definitive airway management – Endotracheal tube/Intubation → Ventilation)**
- **Breathing:**
 - Essential to ensure adequate ventilation
 - (without adequate ventilation, pt will suffer a secondary hypoxic brain injury)
 - **Give Oxygen**
 - **Maintain Sats & Normocarbia**
 - If hypoventilation → Hypercarbia → Cerebral Vasodilation → Increases Intracranial Pressure → Decreases Cerebral Perfusion
- **Circulation:**
 - Must ensure adequate circulation (IV fluids)
 - Cerebral perfusion pressure = Blood Pressure – Intracranial Pressure
 - As ICP goes up, must ensure at least a normal BP in order to maintain cerebral circulation
 - In head trauma, 5 minutes of Hypotension → 25% increase in mortality
- **Disability (Ie: Level of Consciousness):**
 - Assess level of consciousness & Document it
 - Monitor for changes
 - Assess Pupillary Size/Reactivity
- **Exposure:**
 - Examine the Whole Patient (Including the Back)
- **DON'T EVER FORGET GLUCOSE**

- History:

- Past history
- Medication, drug use
- Collateral History
- Trauma?
- Overseas Travel?

- Examination:

- Primary Survey
- Look for Trauma
- Look for needle marks (Drug use)
- Signs of Infection (Fever, neck stiffness, focal neurology?)
- Respiratory Effort

- Investigations:

- Haematology (WBC count)
- Biochemistry
- Blood Culture (If suspect infection)
- CSF (Via Lumbar Puncture)
- Check Glucose
- Urine & Electrolytes
- FBC
- Head CT/MRI

- Specific Treatment:

- **Depends entirely on cause**
- **All receive Supportive Care:**
 - O₂, Iv fluids, Glucose, Antibiotics
 - (All of these apply *even* if you don't know what's wrong)
- **Rarely surgery**
- **Rarely Drugs-Antidotes:**
 - Eg: Naloxone/Narcan (Opioid Antagonist – Reverses Respiratory Depression)

NEUROLOGICAL EMERGENCIES

COMMON NEUROLOGICAL PRESENTATIONS

HEADACHES:

- (One of the most common presentations in ED)
- **Broad Differential Diagnoses:**
 - **First, consider the serious/life-threatening differentials:**
 - Meningitis
 - Subarachnoid haemorrhage
 - Space-occupying lesion
 - Temporal arteritis (age >50 years; erythrocyte sedimentation rate [ESR] >50 mm/h)
 - Acute narrow-angle glaucoma
 - Hypertensive encephalopathy
 - **The majority, however, will be due to:**
 - Migraine
 - Tension or muscle contraction headache
 - Post-traumatic headache
 - Disease in other cranial structures
- **Classification:**
 - **Primary (Typically Benign):**
 - Migraine
 - Cluster Headache
 - Tension Headache
 - **Secondary (Due to Specific Pathology):**
 - Eg: Meningitis
 - Eg: Brain Tumour
 - Eg: Bleed/Haemorrhage (Eg: Thunderclap headache of SAH)
 - If there's a Neurological Deficit + Headache → Investigate

	<u>Pattern:</u>	<u>Probable Diagnoses:</u>
Isolated SEVERE Headache	History: Acute Onset Syx: "Thunderclap Headache", Pain 10/10, Vomiting, Meningism, ALOC.	?Subarachnoid Haemorrhage (Arterial)
Headache Following Head Injury	History: Acute Onset Syx: Acute LOC Following Severe Head Trauma → Lucid Interval → Rapid Deterioration + Vomiting + Seizures	?Extradural Haemorrhage (Arterial)
	History: Days-Weeks-Months Syx: Worsening Headache following Mild Head Trauma.	?Subdural Haematoma (Venous)
Subacute Onset Headaches	History: Days Syx: Headache + Constitutional Syx (Fever, Rash, N/V/D, Fatigue), + Meningism/Photophobia.	?Infective: - ?Meningitis - ?Encephalitis
Chronic or Recurrent Headaches	History: Months-Years Duration: Hours-Days Syx: Vague Muscle Tension/ Migraine/Sinus.	?Tension Headache (Muscular) ?Migraine (Functional) ?Sinusitis (Inflammatory/Pressure)
Pressure Headaches	History: Months-Years Syx: Pain worse Lying Down, Coughing, Straining or Sneezing. + Vomiting	?Intracranial Space-Occupying Lesion → ↑ICP
Headaches with Scalp Tenderness	History: Older Patient Syx: Headache + Extreme Tenderness over Scalp Vessels.	?Temporal Arteritis (Giant Cell Arteritis)

DIZZINESS, VERTIGO & BLACKOUTS

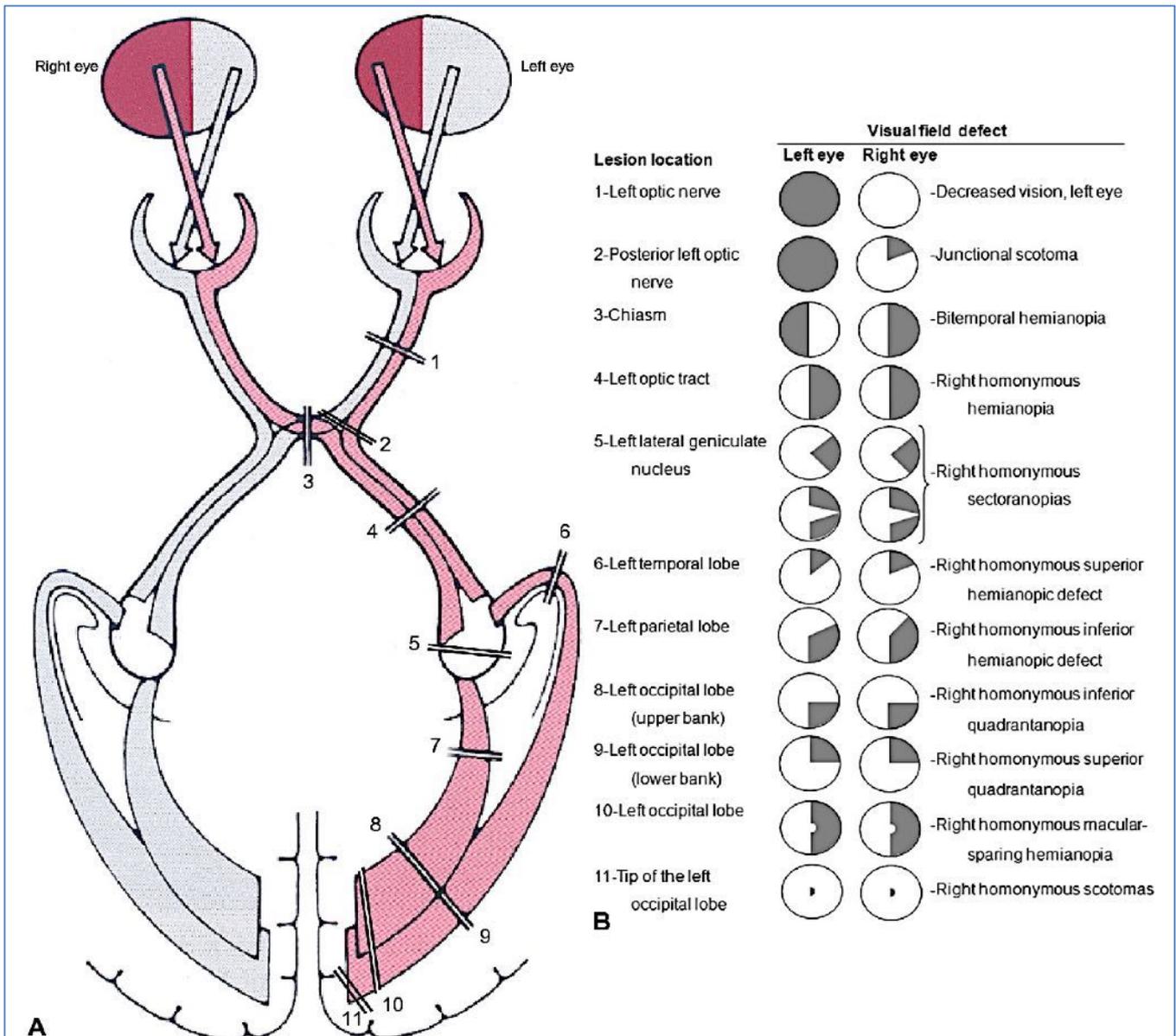
	Pattern:	Probable Diagnoses:
Dizziness	Vague Unsteadiness, Light-Headedness.	?Postural/Orthostatic Hypotension ?Panic/Anxiety ?Palpitations (Eg: Atrial Fibrillation) ?Anaemia
Vertigo	The Illusion of Movement, Sensation or Rotating/Tipping. + Nausea & Vomiting	?Otolith ?Vestibulocochlear Disease (Eg: Acoustic Neuroma)
Blackout	Implies ALOC, Visual Disturbance, or Falling	?Syncope ?Epilepsy ?Hypoglycaemia ?Anaemia

DIFFICULTY WALKING & FALLS:

	Pattern:	Probable Diagnoses:
Spasticity	Stiff, Jerky Walking Toe-Scuffing and Catching Maintained Narrow Base	?Spastic Diplegia (Neonatal Asphyxia) ?Multiple Sclerosis ?Cerebral Palsy ?Bilateral Spinal Cord Injury
Hemiparesis	Unilateral Spasticity (See Above) + Circumduction of Spastic Leg to prevent Toe Dragging.	?Stroke (ACA) ?Unilateral Spinal Cord Injury
Parkinson's Disease: Shuffling Gait	Short Rapid Steps, Shuffling, Maintained Narrow Base, Stooping, Difficulty Turning Quickly	?Parkinson's Disease
Cerebellar Ataxia: Broad-Based Gait	Broad-Based Ataxia , Unstable, Tremulous	?Lateral Cerebellar Lobe Disease
	Truncal Ataxia (Unsteady Trunk without Limb Ataxia) + Tendency to fall Back/Sideways	?Midline Cerebellar (Vermis) Disease (*Remember Cpt. Jack Sparrow)
Sensory Ataxia: Stamping Gait	Broad-Based, High-Stepping, Stamping Gait. (Worse with Eyes Closed) (Romberg's Test Positive)	?Polyneuropathy & Loss of Proprioception
Lower Limb Weakness: Slapping & Waddling Gaits	Slapping Gait: Audible Sole-Slap when returned to Ground	?Distal Leg Weakness (Eg: Common Peroneal nerve Palsy)
	Waddling Gaits: Difficulty Rising from Sitting + Waddling	?Proximal Leg Weakness (Eg: Poliomyelitis, Muscular Dystrophy) (*Remember Maggie Grant)
Gait Apraxia	Failure to Initiate/Organize Walking, Shuffling Small Steps, Undue Hesitancy. (But Normal Leg Mvts when Sitting/Lying)	?Frontal Lobe Disease (Tumour, Hydrocephalus, Infarction)

VISUAL FIELD DEFECTS + CAUSES:

Lesion Location	Visual Field Defect
Retinal Lesion (Eg: Retinal Haemorrhage)	Paracentral Scotoma (Focal Visual Field Defect)
Unilateral Optic Nerve Lesion	Monocular Field Loss
Optic Chiasm Lesion	Bitemporal Hemianopsia
Unilateral Optic Tract Lesion	Contralateral Homonymous Hemianopsia
Temporal Optic Radiation Lesion (Upper Retinae; Lower Visual Field)	Contralateral Homonymous Lower Quadrantanopsia
Parietal Optic Radiation Lesion (Lower Retinae; Upper Visual Field)	Contralateral Homonymous Upper Quadrantanopsia
Full-Thickness Optic Radiation Lesion	Contralateral Homonymous Hemianopsia
Occipital Pole Lesion (Visual Cortex Lesion)	Contralateral Homonymous Hemiscotoma



Source: Dattilo, Michael et al. "Functional and simulated visual loss." *Handbook of clinical neurology* 139 (2016): 329-341 .

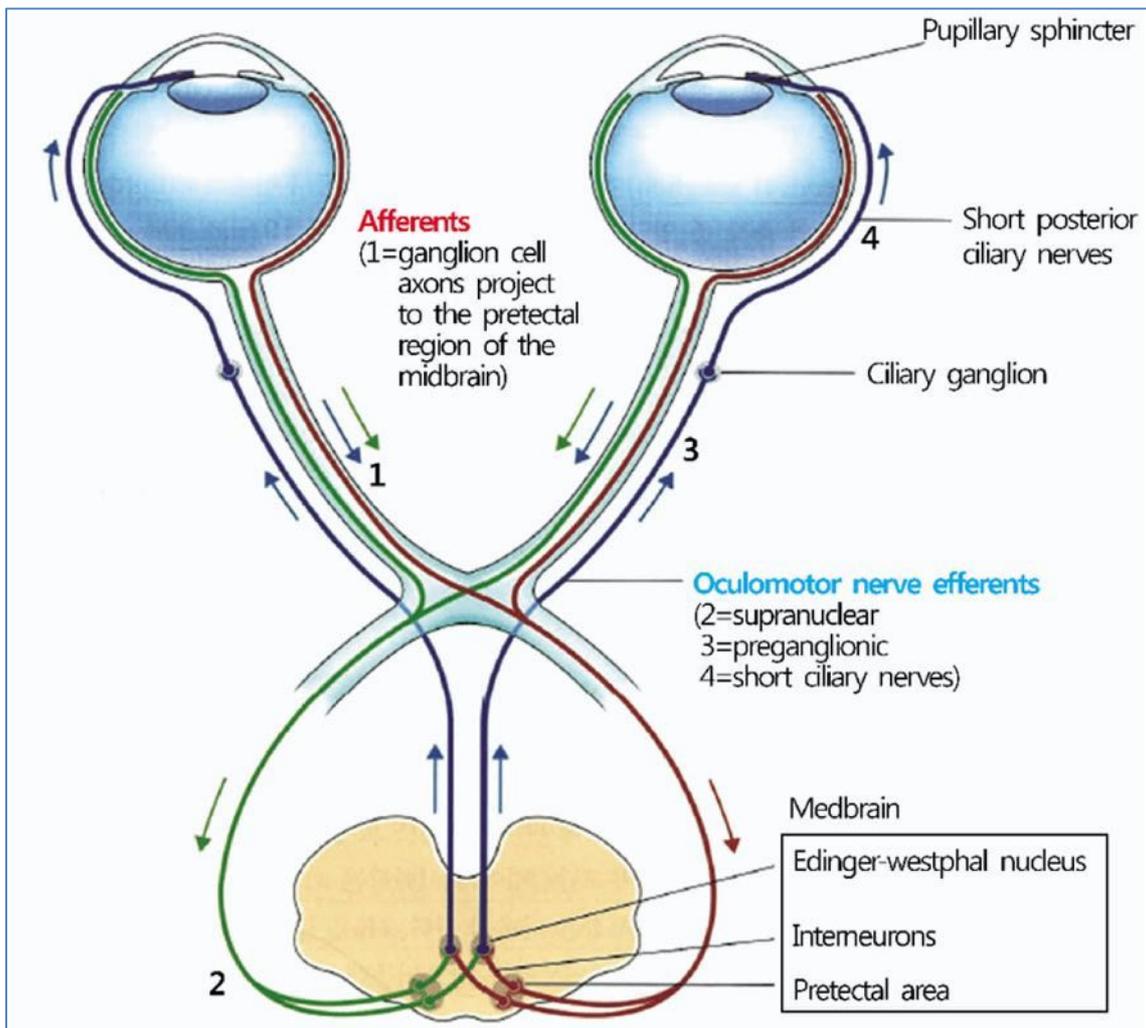
PUPILLARY DEFECTS + CAUSES:

- Afferent Pupillary Defect:

- (Ie: An Optic Nv/Optic Chiasm/Optic Tract Lesion)
- Eg: A Blind Left Eye:
 - L-Pupil Unreactive to Light
 - Present Consensual Reflex in L-Pupil
 - R-Pupil Reactive to Light
 - Absent Consensual Reflex in R-Pupil

- Efferent Pupillary Defect:

- (Ie: Oculomotor Nv/Ciliary Nv Lesion)
- Eg: Left 3rd Nerve Palsy:
 - L-Pupil Unreactive to Light
 - Absent Consensual Reflex in L-Pupil
 - R-Pupil Reactive to Light
 - Present Consensual Reflex in R-Pupil



<https://healthjade.net/pupillary-light-reflex/>

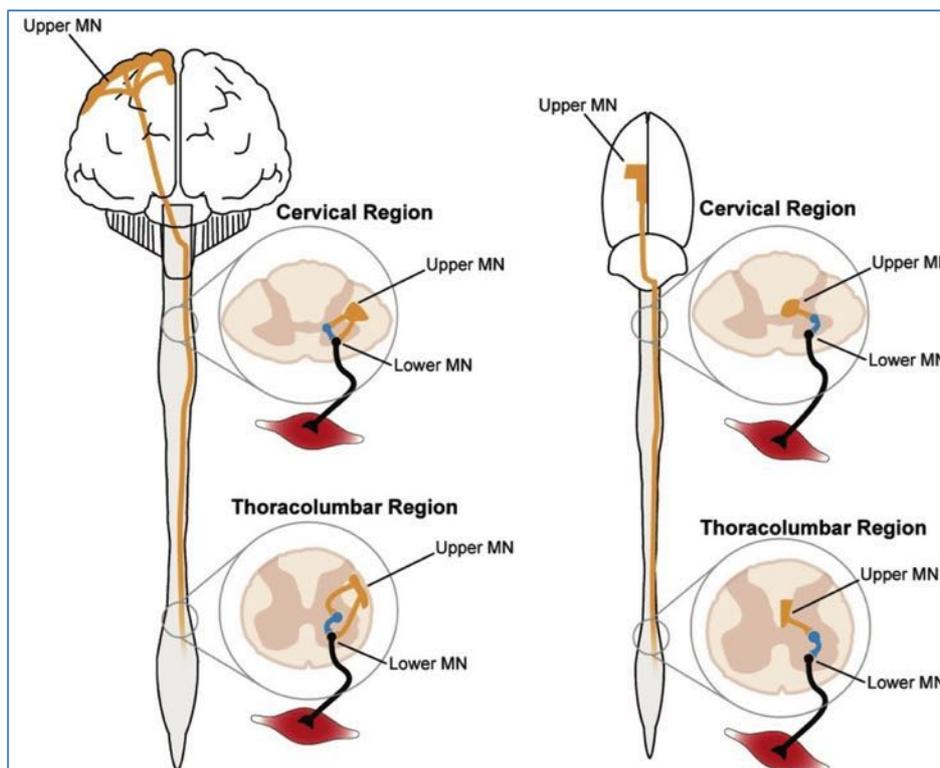
UPPER MOTOR NEURON DEFICITS:

- = Lesions of the Neural Pathway *ABOVE* the Anterior Horn of the Spinal Cord (Or the Motor Nuclei of the Cranial Nerves)
- **Causes:**
 - o Stroke
 - o Traumatic Brain Injury
 - o Cerebral Palsy
- **General Symptoms of UMN Syndrome:**
 - o Muscle Weakness ('Pyramidal Weakness')
 - o Hyperreflexia (Due to ↓ CNS Inhibition)
 - o Spasticity
 - o Babinski Sign (Extension of Big Toe rather than Flexion)
 - o Pronator Drift (Pt Flexes Arms to 90°, Supinates Forearms & Closes Eyes; Inability to maintain this position = Pronator Drift) (Sidenote: Drifting *Upwards* is a Sign of a Cerebellar Lesion)
- **Specific UMN Lesion Locations & Their Consequences:**

Unilateral Motor Cortex Lesion (Eg: Stroke)	Contralateral Hemiplegia
Unilateral Internal Capsule Lesion (Eg: Tumour)	Contralateral Hemiplegia
Laceration of Spinal Cord Between Medulla & Brachial Plexus	Quadriplegia
Laceration of Spinal Cord Between Brachial Plexus & Sacral Plexus	Paraplegia

LOWER MOTOR NEURON DEFICITS:

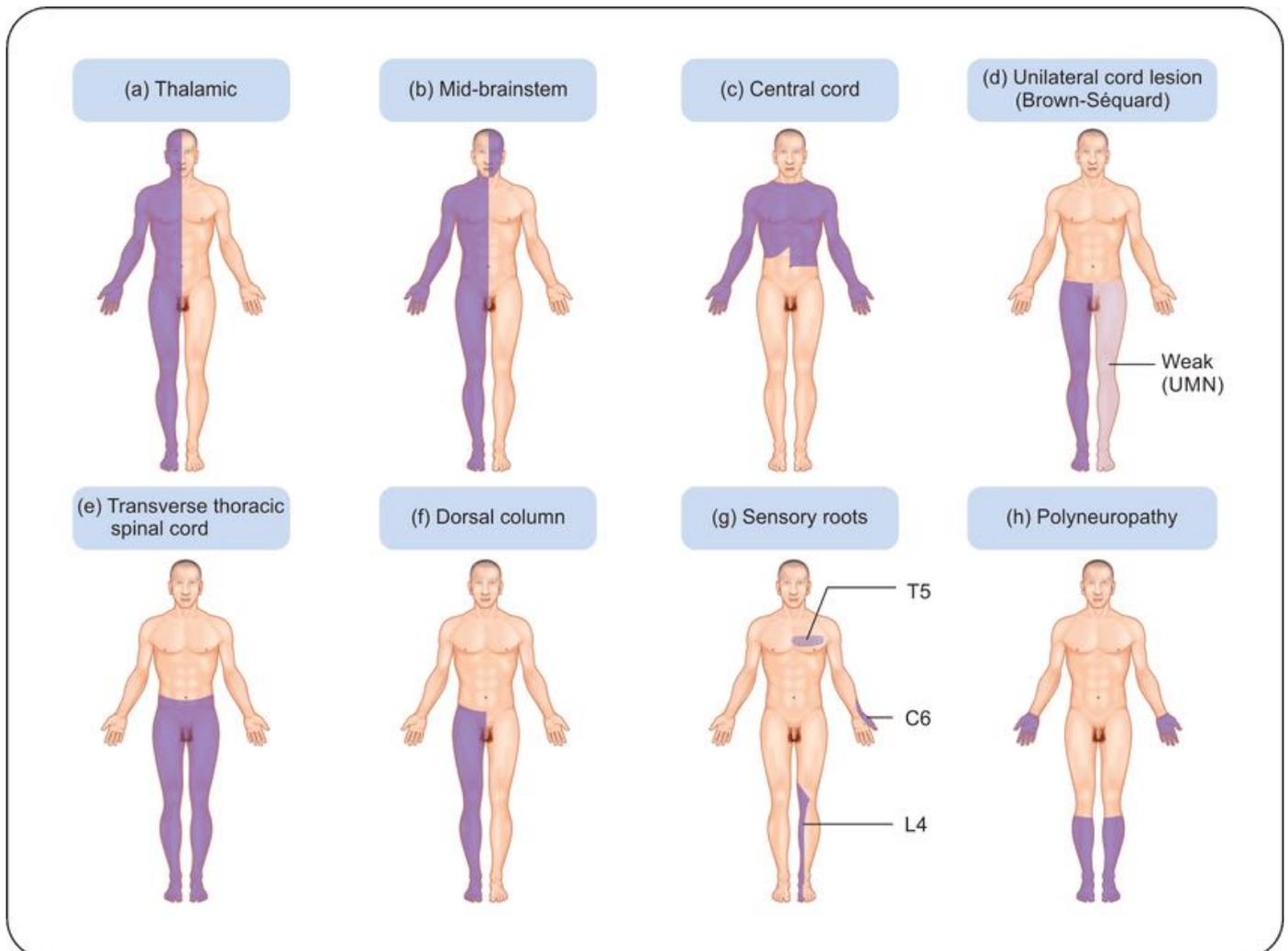
- = Lesions of the Neural Pathways *BELOW* the Anterior Horn of the Spinal Cord (Or the Motor Nuclei of the Cranial nerves)
- **Causes:**
 - o Injuries/Trauma to Peripheral Nerves
 - o Poliomyelitis (Virus Selectively Attacks the Anterior Horns of the Spinal Cords)
 - o Guillain-Barre Syndrome
 - o Botulism
- **General Symptoms of LMN Syndrome:**
 - o Flaccid Paralysis of the Affected Muscle
 - o Muscle Wasting of the Affected Muscle
 - o Fasciculations
 - o Areflexia



Source: Timothy Warner: https://www.researchgate.net/figure/Species-divergent-organisation-of-motor-systems-A-The-corticospinal-tracts-CSTs_fig1_337215634

PATTERNS OF LOSS OF SENSATION:

- **3x Conscious Sensory Pathways:**
 - **Dorsal Column Medial-Lemniscal Pathway:**
 - Vibration, Proprioception, 2-Point Discrimination
 - Ascends Ipsilaterally → Decussates in Medulla → Thalamus → Sensory Cortex
 - **Spinothalamic Pathway:**
 - Pain & Temperature
 - Decussates @ Spinal Level → Ascends Contralaterally → Thalamus → Sensory Cortex
 - **Trigeminal Nerve:**
 - All Facial Sensation
 - Decussates in Medulla → Thalamus → Sensory Cortex
- **1x Unconscious Sensory Pathway:**
 - **Spinocerebellar:**
 - Role in Proprioception & Balance

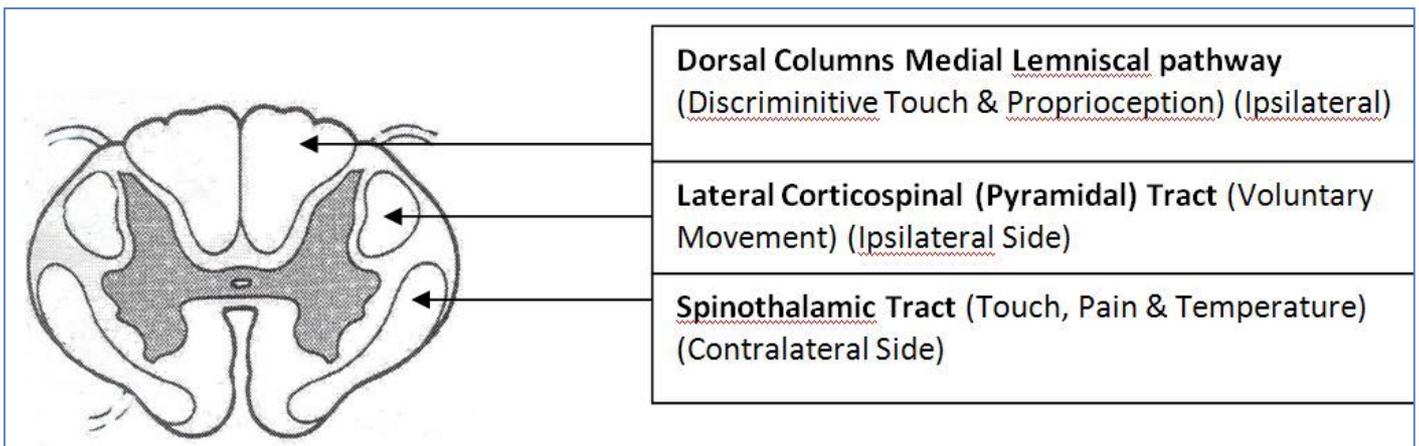


Source: <https://www.grepmed.com/images/3568/brownséquard-patterns-loss-diagnosis-bilaterality-neurology-sensory>

SPINAL CORD DEFICITS:

- Remember Spinal Cord Tracts & Notable Deficits:

- **Dorsal Column Medial Lemniscal Tract (Afferent):**
 - Ascends in the Dorsal Aspect of the Spinal Cord
 - Functions:
 - Fine/Discriminative Touch
 - Proprioception
 - Decussates in the Medial Lemniscal Tract in the Medulla
 - Sensory Deficits will be Ipsilateral to the Spinal Lesion
- **Spinothalamic (Afferent):**
 - Ascends in the Lateral Aspects of the Spinal Cord
 - Functions:
 - Touch
 - Pain
 - Temperature
 - Decussates @ The Level of the Spinal Cord
 - Sensory Deficits will be Contralateral to the Spinal Lesion
- **Corticospinal (Efferent):**
 - Descends from the Motor Cortex through the Lateral Aspects of the Spinal Cord
 - Function:
 - Voluntary Movement
 - Decussates in the Pyramidal Tracts (In the Brain)
 - Motor Deficits will be Ipsilateral to the Lesion



- Note: Changes in Motor Reflexes with Spinal Cord Injury:

- **Immediate Consequences:**
 - Reflexes are conserved since they aren't mediated by the brain
 - (Note: Reflexes are only lost if the lesion is @ the level of that reflex)
- **Consequences Over Time:**
 - Muscle movement diminishes over a period of time
 - Due to Progressive Muscle Atrophy (not Nerve Atrophy)

'BROWN-SEQUARD' (HEMICORD) SYNDROME:

- (seen if someone is stabbed in the back with a knife or shot with a handgun causing a hemi-transection of the spinal cord)
- **Pathways Affected & Clinical Consequences:**
 - Dorsal Column Medial Lemniscal Pathway
 - Loss of Discriminative Touch & Proprioception
 - (Ipsilateral to & below the level of the lesion)
 - Spinothalamic Tract
 - Loss of somatosensation (Touch, Pain, Temperature)
 - (Contralateral to & below the level of the lesion)
 - Lateral Corticospinal:
 - Loss of voluntary movements
 - (Ipsilateral to the side of the lesion. Because it decussates in the pyramidal tracts)

ANTERIOR CORD SYNDROME (ANTERIOR SPINAL ARTERY SYNDROME):

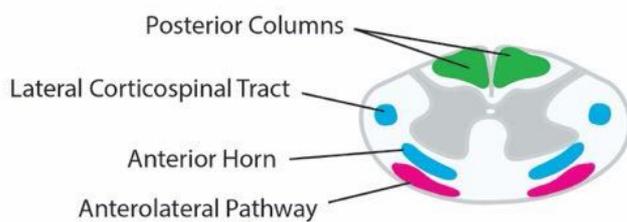
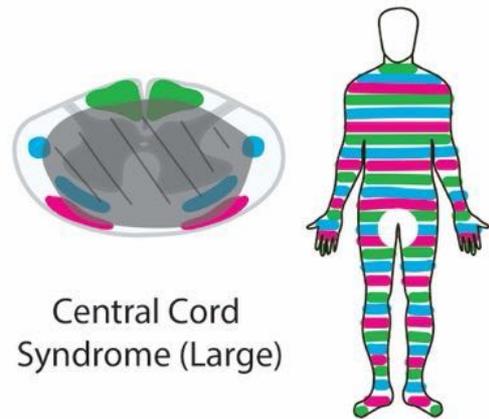
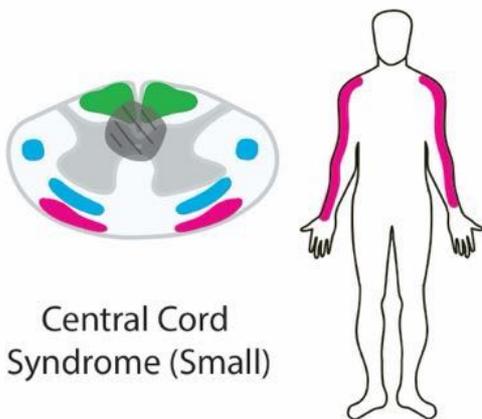
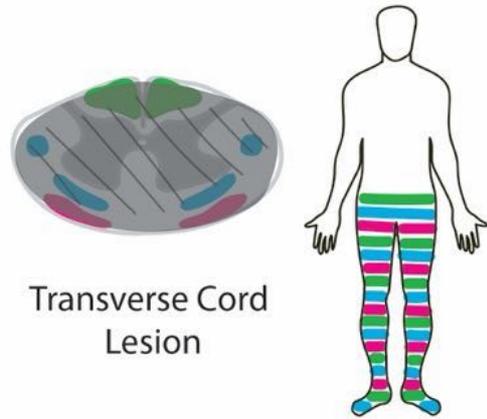
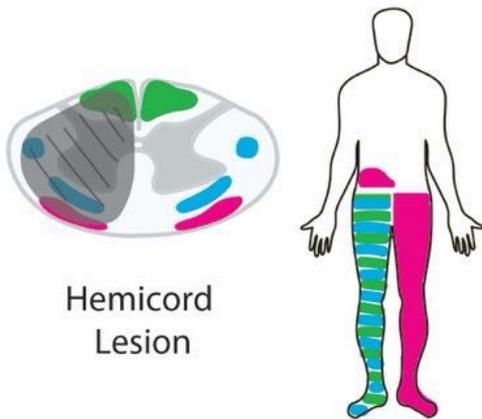
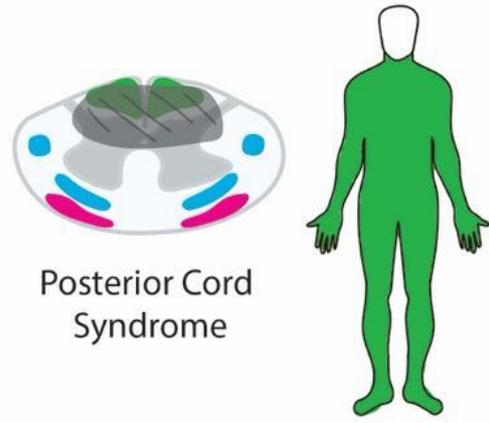
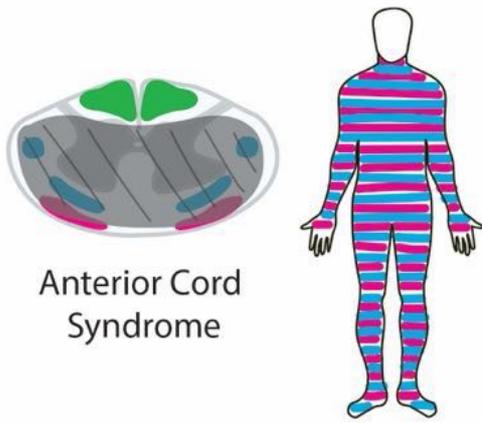
- (Due to Lesion of the Anterior Spinal Artery. Eg: Diving injury)
- Results in loss of function of the anterior two-thirds of the spinal cord
- **Pathways Affected & Clinical Consequences:**
 - Doesn't affect the Dorsal Column Medial Lemniscal pathway
 - No loss of Vibration Sensation or Proprioception
 - Affects the descending Corticospinal Tract
 - Complete motor paralysis below the level of the lesion
 - Affects the ascending Spinothalamic Tract
 - Loss of Pain & Temperature Somatosensation below the level of the lesion
 - Autonomic dysfunctions – eg: Hypotension, sexual dysfunction, bowel/bladder dysfunction

CENTRAL CORD SYNDROME:

- (Usually secondary to spinal trauma and, affects the centre of the spinal cord)
- **Pathways Affected & Clinical Consequences:**
 - Mainly Corticospinal Tracts
 - → Motor Impairment (Mostly in Upper Extremities)
 - (Why? Motor Fibres supplying Upper limbs tend to be more Central than those supplying the lower limbs)
 - Dorsal Column & Spinothalamic Tracts:
 - Variable sensory losses below the Lesion

DORSAL COLUMN SYNDROME:

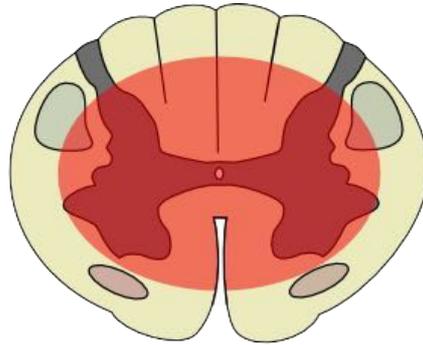
- (Very Unusual)
- **Pathways Affected & Clinical Consequences:**
 - Dorsal Column Medial Lemniscal Tracts:
 - Ipsilateral Loss of Vibration & Proprioception Below the Lesion
 - Doesn't Affect Spinothalamic Tract:
 - Somatosensation (Touch, Pain, Temperature) Unaffected
 - Doesn't Affect Corticospinal Tract:
 - Motor Functions Conserved



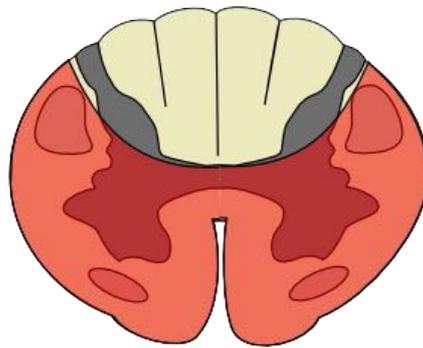
- Loss of Proprioception & Position Sense
- Loss of Motor Function
- Loss of Pain & Temperature Sense
- Location of Lesion

Incomplete lesions of the spinal cord

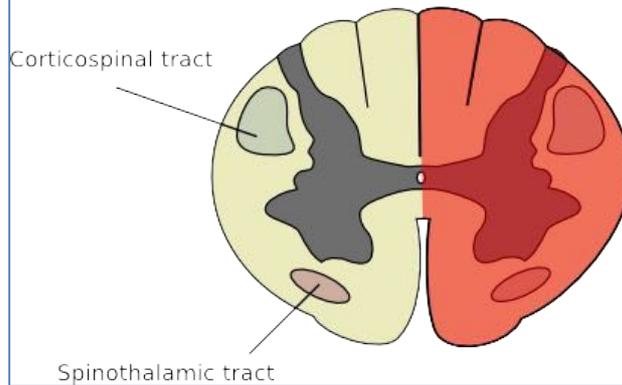
Central Cord Syndrome



Anterior Cord Syndrome



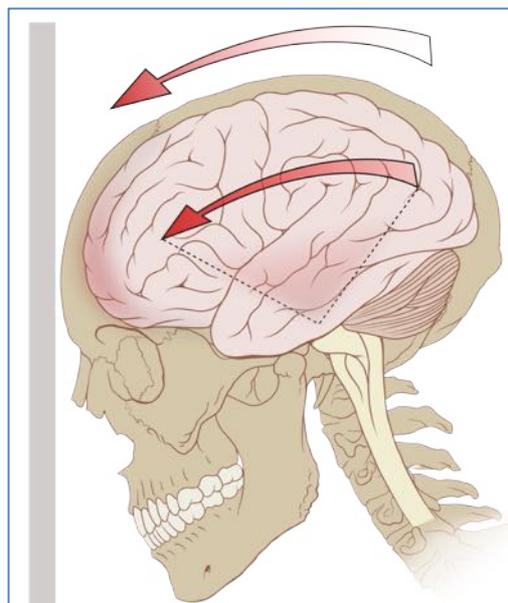
Brown-Séquard Syndrome



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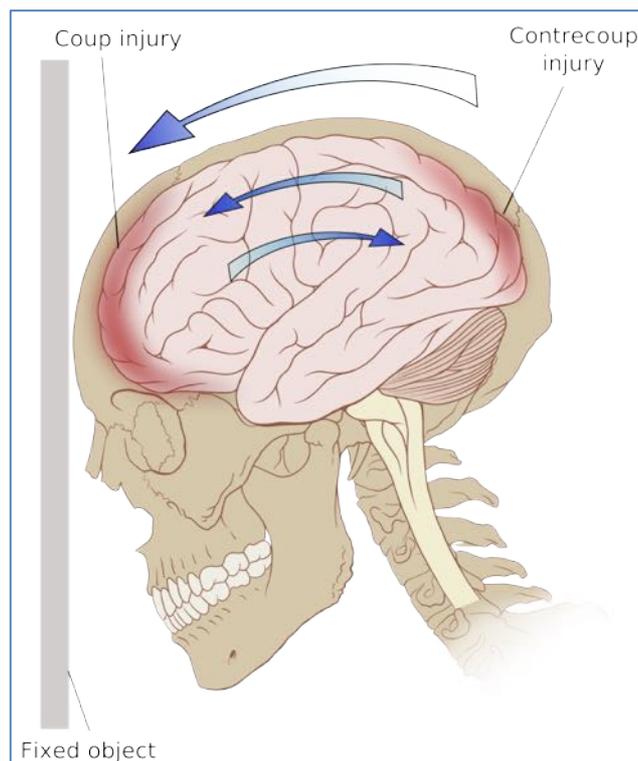
CONCUSSION:

- **Aetiology:**
 - Moderate-Force Blunt Trauma to Head
- **Pathogenesis:**
 - Brain Trauma → Metabolic/Ionic/Neurotransmitter Disruption → Impaired Neurotransmission
- **Morphology:**
 - **Macro:**
 - No structural damage
 - No visible Bleed
- **Clinical Features:**
 - **Course** = Acute, Temporary Unconsciousness (Secs-Mins) → Normal Arousal
 - **Symptoms:**
 - Temporary Loss of function
 - Likely to fully recover (unless secondary injury)
 - Anterograde & Retrograde Amnesia (↓Memory before & after Injury)
 - Headache
 - **“Post-Concussion Syndrome” <3wks Post injury**
 - Memory Problems
 - Dizziness/Loss of Balance
 - Visual Disturbances/Photophobia
 - Tiredness
 - Sickness
 - Depression/Irritability/Restlessness
 - Rarely, Post-Traumatic Seizures
- **Investigations:**
 - History (Mechanism & Duration of LOC)
 - Concussion Grading Systems:
 - Grade I: Confusion, No LOC
 - Grade II: Confusion, Amnesia, No LOC
 - Grade III: Any LOC
 - Physical Examination
 - Neurological Examination
 - Including GCS
 - If GCS is <14 → CT
- **Management:**
 - Usually Benign ∴ Just Supportive Treatment (Analgesics, Rest, Sleep, Avoid Drugs/Alcohol)
 - Avoid Further Head Trauma to Prevent “*Second-Impact Syndrome*” (Dangerous cerebral oedema following second impact. Occurs days-weeks after an initial concussion)



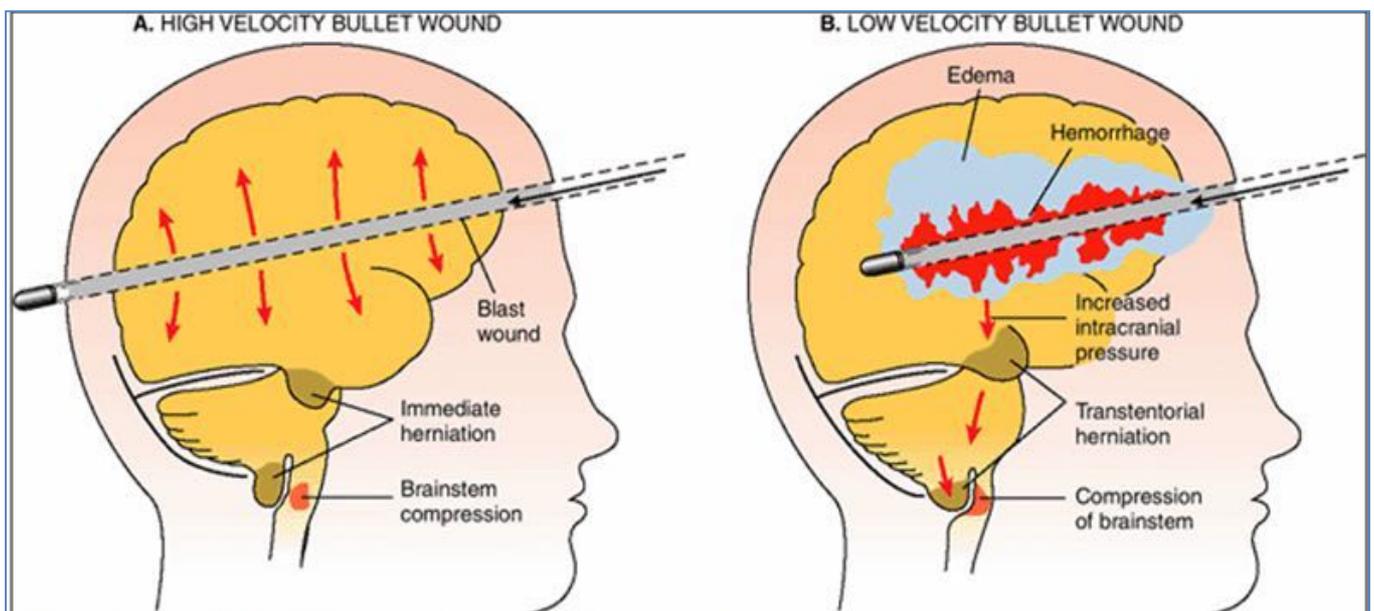
BRAIN CONTUSION:

- **Aetiology:**
 - Higher-Force Blunt Trauma to Head
 - **(Often a “Contre-Coup injury” = Brain Injury on the Opposite Side of Impact – Due to Rebound of the Brain)**
 - **(Note: “Coup Injuries” = Brain Injury on the Side of Impact)**
- **Pathogenesis:**
 - Higher-Force Trauma → Coup &/or Contre-Coup Injury → Bruising & Swelling of the Brain
- **Morphology:**
 - **Macro:**
 - Contusion = Local Injury + haemorrhage
 - Some damage
 - Localised, Visible Injury with Bleeding (Bruising)
- **Clinical Features:**
 - Headache
 - Confusion/Sleepiness/Loss of Consciousness
 - Dizziness/Nausea/Vomiting
 - Cognitive Impairment
 - Sensory Impairment
 - Seizures
 - Ataxia
- **Specific Investigations:**
 - **CT/MRI:**
 - Focal Cerebral Oedema and often Surrounding Brain tissue
 - Transtentorial Herniation
- **Management:**
 - **ICU management**
 - **Goal = Treat ↑ICP**
 - Prevent Hypotension, Hyponatraemia, Hypercapnia
 - May require surgical Intervention
 - Usually heal without other treatments
- **Prognosis:**
 - Expect a reasonable recovery (but decreased memory, concentration; but still retain normal function)



BRAIN LACERATION:

- **Aetiology:**
 - Penetrating Head Trauma
 - An incised wound of brain tissue (Eg: Bullet/knife/etc)
- **Pathogenesis:**
 - Mechanical Destruction of Brain Matter due to Invading Object
 - Usually SEVERE damage
- **Morphology:**
 - **Macro:**
 - Visible tear in the tissue
 - Haemorrhage
- **Clinical Features:**
 - **High Velocity:**
 - Instant Death due to “Blast Effect” → Immediate ↑Supratentorial Pressure → Brainstem Herniation through Foramen Magnum
 - **Low Velocity:**
 - May have Lucid Interval and No LOC
 - May have LOC as the laceration bleeds into the skull (↑ICP)
- **Specific Investigations:**
 - **CT:**
 - Frequently Associated with Skull Fractures &/or Diffuse Axonal Injury
 - Cerebral Laceration
 - Large amounts of Blood
- **Management:**
 - Prevent ↑ICP
- **Prognosis:**
 - Typically a Poor Prognosis



The “blast effect” of a high-velocity projectile causes an immediate increase in Supratentorial pressure and results in death because of impaction of the cerebellum and medulla into the foramen magnum. A low-velocity projectile increases the pressure at a more gradual rate through haemorrhage and oedema.

Source: Unattributable

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