Ministry of Higher Education and Scientific Research

College of Health and Medical Technology

Anesthesia Techniques Department

Subject: Advance Anesthesia (2)

4th stage.

2025-2026

Lecture 1&2: Anesthetic Management for Craniotomy in Acute Head Injury / Intracranial Tumor Debulking

1. Craniotomy for Acute Head Injury

Acute head injury (AHI) is a critical surgical emergency requiring rapid intervention to prevent secondary brain injury from insults such as hypotension, hypoxia, or hypercarbia. The anesthesiologist's primary role is to maintain physiological stability while facilitating an emergency craniotomy. Surgery is indicated when intracranial lesions cause a midline shift or elevated intracranial pressure (ICP), including:

- **Epidural Hematoma (EDH):** Typically an arterial bleed (middle meningeal artery) often characterized by a "lucid interval" before rapid decline.
- **Subdural Hematoma (SDH):** Venous bleeding from bridging veins, common in the elderly or those on anticoagulants.
- **Intracerebral Hemorrhage/Contusions:** Evacuated if they create a significant mass effect.
- Depressed Skull Fractures: Indicated if the fracture is contaminated or exerting pressure on functional brain tissue.

2. Preoperative Stabilization:

In the Emergency Department (ED), stabilization must address the systemic "lethal triad" (acidosis, hypothermia, and coagulopathy).

- **Respiratory Status:** Approximately 70% of AHI patients are hypoxemic due to pulmonary contusions, fat emboli, or neurogenic pulmonary edema.
- **C-Spine Precautions:** Assume injury (~10% incidence). **Manual Inline Stabilization (MILS)** required during all airway maneuvers.
- **Intubation Criteria:** GCS < 8, absent gag reflex, or persistent hypoventilation requires immediate airway control.

3. Rapid Sequence Induction (RSI)

All trauma patients are considered to have a **"full stomach,"** necessitating an RSI to minimize the risk of gastric aspiration. However, in AHI, we modify the traditional RSI to include **Blunting the Pressor Response**.

- **Sympathetic Blunting:** Before induction, adjuncts like **Fentanyl (1–3 µg/kg)** or **IV Lidocaine (1.5 mg/kg)** are administered. These drugs dampen the surge in catecholamines caused by the laryngoscope, preventing a sudden rise in MAP and ICP.
- **Cricoid Pressure (Sellick Maneuver):** Applied to occlude the esophagus, though it must be performed carefully to avoid obstructing the view or compromising C-spine stability.

4. Choice of anesthetic agents

The choice of induction agent is dictated by the patient's hemodynamic stability and the urgency of brain protection.

- **Etomidate (0.2–0.3 mg/kg):** It is the agent of choice for the poly-trauma patient in shock. It has minimal effect on heart rate and blood pressure while maintaining the "coupling" between Cerebral Blood Flow (CBF) and Metabolic Rate (CMRO2).
- **Propofol (1.5–2.5 mg/kg):**
  - Ideal for the hemodynamically stable patient. It provides the most potent reduction in CMRO2 , effectively "resting" the brain. It is also an excellent anticonvulsant.
  - *Risk:* Can cause significant vasodilation and myocardial depression, potentially dropping MAP.
- **Ketamine (Controversial):**
  - Historically avoided in AHI due to fears of increasing ICP. However, modern evidence suggests that if the patient is ventilated, Ketamine is safe and may actually improve cerebral perfusion in hypotensive trauma patients.

 Neuromuscular Blockade:

- **Succinylcholine (1–1.5 mg/kg):**
  - *Advantages :* Fastest onset and shortest duration; allows for early neurological assessment.
  - *Disadvantages:* Can cause a transient increase in ICP due to muscle fasciculations and a slight increase in CMRO2. This is usually clinically insignificant if the patient is properly pre-oxygenated and sedated.
- **Rocuronium (0.6–1.2 mg/kg):**

- The primary alternative. At a high dose (1.2 mg/kg), its onset matches Succinylcholine without the risk of increasing ICP.

5. Intraoperative Management

The "slack brain" concept is essential for surgical visibility and brain protection.

- **Cerebral Perfusion Pressure (CPP):** Maintain CPP = MAP - ICP.
  - **Target MAP:** Maintain **> 80 mmHg**. Correct hypotension immediately to ensure the brain is perfused.
- **Ventilation Strategy:** Target **(**EtCO2 of **30–35 mmHg)**.
  - *Note:* Hyperventilation used only as a temporary "rescue" for acute ICP spikes.
- **Fluid Choice:** Iso-osmolar crystalloids (**Normal Saline**) commonly used.
  - **Warning:** Avoiding glucose-containing fluids unless hypoglycemia is proven, as they can exacerbate lactic acidosis in injured brain tissue.
- **Osmotherapy: Mannitol (0.5–1 g/kg)** or **3% Hypertonic Saline** required to reduce brain volume and bulk.

6. Brain Protection & Emergence

- **Metabolic Suppression:** Using agents like Propofol to "silence" the EEG during periods of low cerebral blood flow.
- **Seizure Prophylaxis: Levetiracetam** or **Phenytoin**. Post-traumatic seizures increase oxygen demand (CMRO2) by 300%.
- **Emergence:** Awakening must be smooth. Prevent coughing or straining, as this can lead to postoperative hematoma or "re-bleeding."
- **Delayed Awakening:** If the patient does not wake within 2 hours, urgent evaluation for increased ICP or new embolic events is required

Anesthetic Management for Intracranial Tumor Debulking

Craniotomy for Intracranial Tumor Debulking :is a specialized neurosurgical procedure where the primary anesthetic goal is to facilitate surgical access while protecting the brain from secondary injury. The anesthesiologist must manage the delicate balance between Mean Arterial Pressure (MAP) and Intracranial Pressure (ICP) to maintain adequate Cerebral Perfusion Pressure (CPP). Surgery is typically indicated when tumors cause neurological deficits, midline shift, or signs of increased ICP, such as headache and papilledema.

I. Primary Objectives

The goal is to facilitate surgical access ("Slack Brain") while ensuring a **rapid emergence** for immediate postoperative neurological assessment.

2. Preoperative Assessment

- **Neurological Baseline:** Document pre-existing deficits clearly.
- **Steroids:** Patients on **Dexamethasone** require strict glucose monitoring (Target: 140–180 mg/dL).
- **Anticonvulsants:** Chronic Phenytoin use can cause resistance to non-depolarizing muscle relaxants.
- **Fluid Status:** Patients may be dehydrated due to chronic diuretic use or restricted intake.

3. Nociception and Stimulus Peaks

Surgical stimulus is non-linear. Anesthesia must be titrated for:

- **High Stimulus:** Intubation, **Mayfield frame (Skull Pins)**, and dural opening.
- **Low Stimulus:** Tumor dissection (brain parenchyma lacks nociceptors).
- **Vascular Surge:** Manipulation of cerebral vessels can cause sudden hypertension/tachycardia.

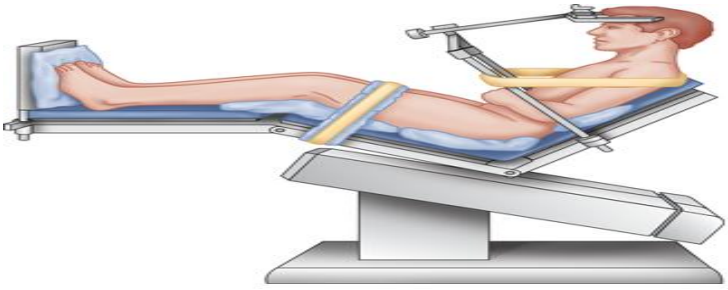
4. Choice of Anesthesia: TIVA vs. Volatile

- **TIVA (Propofol/Remifentanil):** The "Gold Standard." Maintains physiological coupling (decreases CBF in proportion to CMRO2), providing a slack brain and rapid awakening.
- **Volatile Agents (Iso/Sevo):** Safe at < 1 MAC. Higher doses cause cerebral vasodilation and brain bulging.
- **Muscle Relaxants:** Complete paralysis is vital while in skull pins to prevent catastrophic C-spine injury if the patient coughs or moves.

5. Positioning and VAE Risk

- **Posterior Fossa/Sitting Position:** High risk for **Venous Air Embolism (VAE)**.
- **VAE Detection:** Precordial Doppler (most sensitive non-invasive) or TEE. Look for a sudden drop in EtCO2.
- **VAE Management:**

1.Notify surgeon (Flood field with saline/Bone wax).
2.100% O2; Stop N2O.
3.Aspirate air via CVP catheter if present.
4.Jugular compression to identify the leak source.



***Pediatric Considerations**

- **Posterior fossa tumors** are the most common brain tumors in children.
- **Specific Risks:** High susceptibility to VAE and sudden bradycardia/arrhythmias due to **cranial nerve root stimulation** (Vagal or Trigeminal reflexes) during surgery.

6. Emergence and Brain Protection

- **Smooth Awakening:** Prevent coughing/straining to avoid postoperative hematoma.

- **Delayed Awakening:** If the patient does not wake within 2 hours, urgent CT may be required to rule out new hemorrhage or stroke.

Protection: Maintain normothermia and seizure prophylaxis Levetiracetam (Keppra).

MCQ

1-Which induction agent is preferred for a poly-trauma patient with an acute head injury who is in a state of shock?
A-Isoflurane induction
B-Etomidate
C-Midazolam only
D-Propofol
D-High-dose Thiopental
2-A patient undergoing posterior fossa surgery in the sitting position shows a sudden drop in *EtCO*2. What is the most likely complication?
A-Acute Myocardial Infarction
B-Endotracheal tube leak
C-Venous Air Embolism (VAE)
D-Anaphylactic shock
E-Malignant Hyperthermia

3-What is the primary anesthetic management step if a Venous Air Embolism (VAE) is suspected?
A-Place the patient in a prone position
B-Increase the concentration of Nitrous Oxide
C-Decrease *FiO*2 to 21%
D-Notify the surgeon to flood the field and stop N2O
E-Give a large dose of Furosemide

4-Why is smooth emergence (avoiding coughing) crucial after a craniotomy?
A-To prevent Malignant Hyperthermia during recovery
B-To prevent the patient from remembering the surgery
C-To avoid sudden spikes in ICP and postoperative hematoma formation
D-To ensure the patient can walk immediately
E- Because coughing destroys the surgical bone wax

Lectur 3 :Anesthetic management for bronchoscopy /Pneumonectomy

Bronchoscopy**:** is a critical endoscopic procedure that allows for the direct visualization of the larynx, trachea, and the branching bronchi. It serves as a versatile tool in pulmonary medicine, bridgeable between simple diagnostic observation and complex therapeutic interventions.

2. Types of Bronchoscopy

- **Flexible bronchoscopy** (most common – diagnostic)
- **Rigid bronchoscopy** (therapeutic / interventional)

3. Indications

- Evaluation of lung masses or tumors
- Diagnosis of infection
- Bronchoalveolar lavage (BAL)
- Biopsy
- Removal of foreign body
- Control of airway bleeding

5. Preoperative Assessment and Preparation

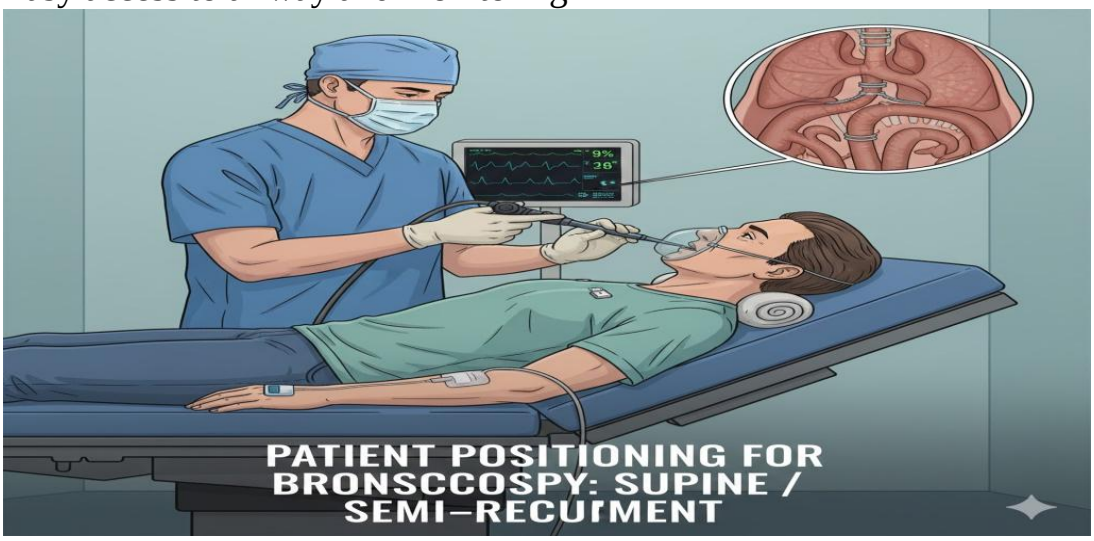
- Preoperative Assessment and Preparation Assess for airway obstruction, including:
  -Stridor
  -Tracheal tumor on CT scan
  -Foreign body
  Many bronchoscopic procedures are suitable as day-case procedures in appropriately selected patients.
  -The patient should be warned preoperatively about possible postoperative effects:

-Coughing ,Haemoptysis
-Myalgia related to suxamethonium (if used)
-Bronchoscopy is often combined with mediastinoscopy to assess suitability for subsequent lung resection.
-The airway is usually unprotected during bronchoscopy; therefore:
Patients at risk of regurgitation or aspiration should receive aspiration prophylaxis.

- **Recommended regimen:**
  Omeprazole 40 mg orally the night before surgery
  Omeprazole 40 mg orally 2–6 hours before the procedure
  Ranitidine may be used as an alternative

4. Patient Position

- Supine or semi-recumbent
- Head elevated if possible
- Easy access to airway and monitoring



5. Monitoring

- Standard ASA monitoring:
  - ECG
  - Pulse oximetry
  - Non-invasive blood pressure
- Supplemental oxygen mandatory
- Capnography if deep sedation or GA used

7. Anesthetic Techniques

A. Local Anesthesia with Sedation (Most common)

- Topical anesthesia:
  - Lidocaine spray/gel to nose, pharynx, vocal cords
- Light to moderate sedation

B. General Anesthesia

- **Indicated for:**
  - Rigid bronchoscopy
  - Uncooperative patients
  - Therapeutic procedures
- **Airway control with:**
  - Endotracheal tube
  - LMA
  - Rigid bronchoscope

8. Sedation and Drugs

Commonly used agents:

- Midazolam
- Propofol
- Dexmedetomidine
- Remifentanil or fentanyl

 Goal: patient comfort with maintained spontaneous ventilation.

9. Airway Management

- Oxygn via nasal cannula or face mask
- Suction readily available
- Emergency airway equipment must be prepared
- Risk of airway obstruction due to scope

10. Intraoperative Considerations

- Hypoxia (most common complication)
- Coughing or laryngospasm

- Bradycardia (vagal stimulation)
- Hypertension or tachycardia
- Bleeding after biopsy

11.Post-Procedure Care

- Monitor oxygen saturation
- Observe for:
  - Respiratory distress
  - Bleeding
  - Laryngospasm
- Keep patient NPO until airway reflexes return

12. Complications

- Hypoxemia
- Bronchospasm
- Laryngospasm
- Aspiration
- Pneumothorax (after biopsy)
- Bleeding

Anesthetic management for Pneumonectomy

1.Pneumonectomy

Pneumonectomy is the **excision of a whole lung**, most commonly performed for **lung cancer**, via a **posterolateral thoracotomy**.It represents the **highest-risk lung resection**, with an operative mortality exceeding **5–6%**, significantly higher than lobectomy.

2.Surgical Characteristics

- **Procedure duration:** 2–4 hours
- **Blood loss:** 200–800 ml (occasionally significantly more)
- **Pain severity:** +++++ (severe)
- **Indications:**
  - Lung cancer (most common)
  - Benign tumors

- Bronchiectasis
- Tuberculosis

3.Preoperative Assessment

Standard assessment for major thoracic surgery include

-Full cardiorespiratory reserve evaluation
-Estimation of post-resection lung function
-Airway assessment for double-lumen tube (DLT) placement
-Blood group & save, cross-match at least 2 units
Identify paraneoplastic syndromes:
-Eaton–Lambert myasthenic syndrome
-Ectopic hormone production
-Plan postoperative analgesia in advance

4.Premedication

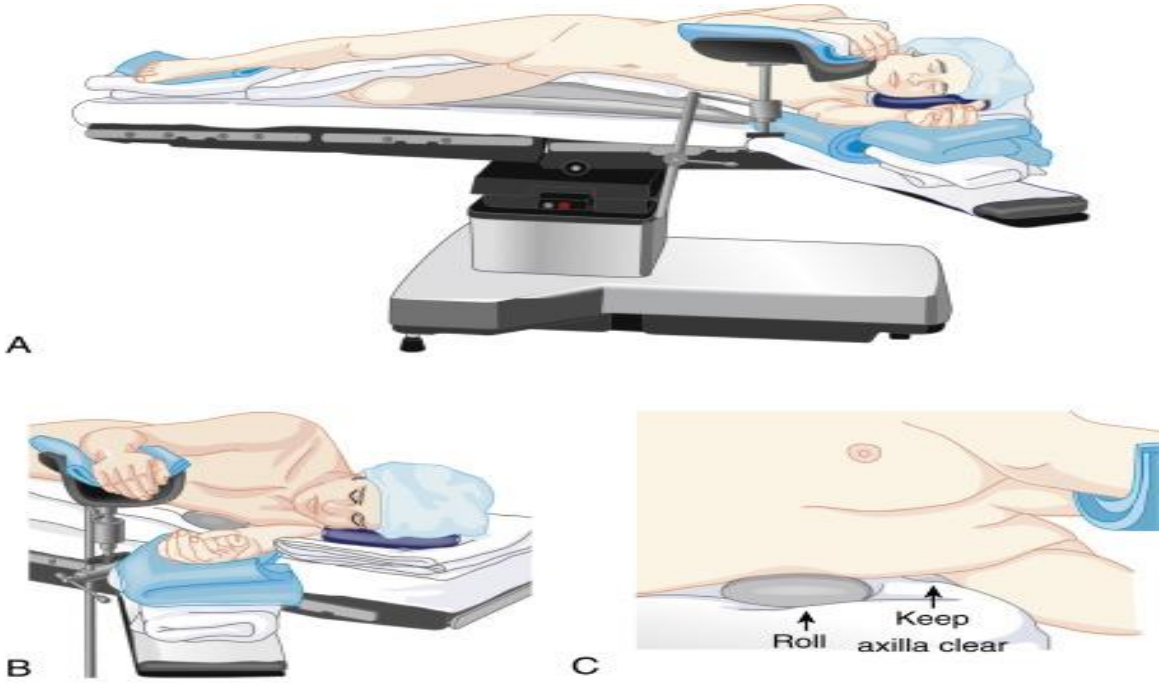
- Usually **none required**
- Full explanation to the patient regarding:
  - High-dependency or ICU care
  - Postoperative monitoring
  - Regional analgesia (benefits and risks)

5.Anaesthetic Technique

- **General anesthesia** (volatile or TIVA)
  - Desflurane / Remifentanil / Atracurium commonly used
- **Nitrous oxide is contraindicated**
- **Regional anesthesia**:
  - Thoracic epidural or paravertebral block preferred
  - Preoperative or surgically placed catheter
  - Epidural dosing: incremental boluses (e.g. 3 ml of 0.25% bupivacaine ± opioid)
- **Rigid bronchoscopy** often performed initially
- Intubation with **double-lumen endobronchial tube**
  - Left-sided DLT preferred unless contraindicated
- **One-lung ventilation (OLV)** during resection phase
- Treat epidural-induced hypotension with **vasoconstrictors, not fluids**

6.Patient Position

- **Lateral decubitus**
- Table “broken”
- Elbows flexed, forearms parallel to face
- Upper arm supported in a gutter
- Careful padding to prevent nerve injury



Adapted from: Miller RD, Cohen NH, Eriksson LI, et al. **Miller’s Anesthesia**. 9th ed. Philadelphia: Elsevier; 2023

7.Monitoring

- Standard ASA monitoring
- **Invasive arterial line** (essential)
- Central venous pressure:
  - Not routinely recommended (unreliable in lateral position)
- Core body temperature
- Arterial blood gases
- Urine output (especially if epidural or high-risk patient)
- Continuous airway pressure–volume loop display during OLV

8.Intraoperative Management

- IV access in **non-dependent arm** (14–16G)
- Arterial line functions better in the **dependent arm**
- OLV facilitates surgery and prevents contamination of the dependent lung
- Surgical manipulation may cause:
    - Cardiac compression
    - Reduced venous return
    - Hypotension and arrhythmias
- Avoid excessive fluid administration
    - Especially critical in pneumonectomy
- Suction collapsed lung **before reinflation**
- **Bronchial stump leak test**:
    - Submerged in saline
    - Manual inflation to **30–40 cmH_2O**
    - Air leak identified by bubbles
- Maintain strict **normothermia**

9.HemodynamicManagement

Pulmonary artery and veins are isolated and ligated during standard pneumonectomy. During isolation and clamping, it is crucial that the anesthesiologist and surgeon communicate to maintain a stable cardiac output, as the entire pulmonary circulating volume begins to pass through one lung. Significant increases in central venous pressure (CVP) or hemodynamic perturbations indicate insufficient compliance of the right ventricle and can lead to lung collapse, with a significantly higher risk of cardiac complications and mortality. Furthermore, resulting increases in peripheral venous return (PVR) can rapidly start a chain reaction causing left- and right-sided heart failure .

10.Postoperative Management

- Aim to extubate **awake, spontaneously breathing, sitting upright**
- Continuous supplemental oxygen (humidified preferred)
- Excellent analgesia is mandatory
- Chest X-ray in recovery room
- **Fluid restriction**
- Vasoconstrictors for hypotension rather than fluids
- **Pneumonectomy drain:**
    - Never apply suction
    - Often kept clamped, intermittently released

- Usually removed after 24 hours

11.Complications

- Hemorrhage into pneumonectomy space
- Acute lung injury (2–5% overall, **3× more common after pneumonectomy**)
  - Mortality 25–50%
- Arrhythmias (especially atrial fibrillation)
  - β-blockers ± amiodarone
  - Some advocate prophylactic digoxin
- Infection, sputum retention, respiratory failure
- Bronchopleural fistula

11.1 Risk factors for lung injury:

- High plateau pressures (>15 cmH_2O)
- Excessive IV fluids (>4 L/24 hr)
- Chronic alcohol abuse
- Inflammatory response to surgery

12.Pain Sources

- Chest wall & pleura → intercostal nerves
- Diaphragmatic pleura → phrenic nerve
- Mediastinal pleura → vagus nerve
- Shoulder pain → C5–C7

13.Aims of Analgesia

- Reduce distress
- Improve ventilation and sputum clearance
- Reduce complications
- Shorten hospital stay and improve outcome

14.Analgesic Techniques

Regional

- Thoracic epidural (gold standard)
- Paravertebral block

- Intercostal block
- Extrapleural / intrapleural block

Systemic

- Opioids (PCA)
- Paracetamol
- NSAIDs
- Tramadol

MCQ

1- During Pneumonectomy, which gas is strictly contraindicated due to its potential to expand in closed spaces and increase pulmonary vascular resistance?
A-Carbon Dioxide (*CO*2)
B-Sevoflurane
C-Oxygen (*O*2)
D-Medical Air
E-Nitrous Oxide (*N*2*O*
2- What is the 'Gold Standard' for managing severe postoperative pain following a posterolateral thoracotomy for pneumonectomy?
A-Thoracic Epidural Analgesia
B-Interscalene Block
C-Intramuscular Pethidine
D-Oral Paracetamol and NSAIDs
E-Intravenous Morphine PCA
3-Which of the following is a major risk factor for developing Acute Lung Injury (ALI) after lung resection?
A-Low airway pressures during One-Lung Ventilation
B-Prophylactic use of antibiotics
C-Using a Left-sided Double-Lumen Tube
D-Change in hemoglobin levels
E-Excessive IV fluid administration (>4 L/24 hr)
4-When testing for a bronchial stump leak, the anesthesiologist manually inflate the lungs to what pressure?
A)60-80 cmH2O

B)30-40 cmH2O
C)20 cmH2O
100) cmH2O
10)15 cmH2

Lecture 4: Anesthetic Management for Aortic Aneurysm / Peripheral Vascular Procedures

1. Aortic Aneurysm : An **aortic aneurysm** is a pathological focal dilatation of the aorta in which the vessel diameter increases to at least **1.5 times its normal size**. In adults, the normal aortic diameter ranges from 2–3 cm; therefore, an aneurysm is generally defined when the diameter reaches **3 cm or more**. Abdominal aortic aneurysm **(AAA)** occur more commonly than the thoracic .

- **Complications:** Many remain asymptomatic and are discovered incidentally; however, the most feared complication is **rupture**, leading to massive hemorrhage and sudden death.
- **Risk Factor:** The risk of rupture is strongly related to size, with a marked increase when the diameter exceeds **5–5.5 cm**.
- **Etiology:** Mostly caused by atherosclerosis, but also connective tissue disorders, inflammatory diseases, infection, and trauma.

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2. Surgical Overview: Excision & Grafting

- **Procedure:** Excision of aortic aneurysmal sac and replacement with synthetic graft (tube/trouser graft).
- **Time:** approximately 2–4 hours.
- **Pain:** Very High (++++).
- **Position:** Supine, arms out (Crucifix position).
- **Blood Loss:** 500–2000+ ml, X-match 6U. Suitable for auto-transfusion.
- **Practical Techniques:** ETT + IPPV, Arterial + CVP lines. Epidural if possible.

3. Preoprative Management

- **Patient Profile:** The elderly often have multiple coexisting diseases. Mortality for elective surgery is **5–10%** (predominantly MI and multi-organ failure).

- **Cardiac & Renal Assessment:** Scrutinize ECG for signs of ischemia. Patient needs dynamic cardiac assessment. Check for any renal impairment.

- **Prophylactic Therapy:** All patients should be considered for **beta-blocker and statin therapy**. beta-blockers can reduce perioperative mortality by 50% to 90%.

- **Medications:** Continue the usual cardiac medications perioperatively.

- **HDU/ICU Planning:** Postoperative ICU care is essential. Pre-optimization in the HDU/ICU a few hours preoperatively is performed in some units to optimize hemodynamic status.

4. Emergency Management: Ruptured AAA

- **Immediate Action:** Rapid transfer to the **OR** is vital; resuscitation occurs simultaneously with surgical intervention.
- **Access & Resuscitation:** Insert multiple **large-bore IVs** and activate **Massive Transfusion Protocols (MTP)** for unstable patients.
- **Monitoring:** Continuous **intra-arterial blood pressure** monitoring is mandatory.
- **Induction Safety: Prep and drape** the patient *before* induction. The loss of sympathetic tone during induction can trigger immediate **cardiovascular collapse**.
- **Hemodynamic Goals:** Maintain **Permissive Hypotension** (SBP < 100 mmHg) to limit bleeding. Use **blood products** instead of vasopressors until the aorta is clamped.
- **Coagulopathy:** Use **Thromboelastography (TEG)** to guide targeted blood component replacement.

5. Intraoperative Management & Organ Protection

A. Aortic Clamping & Unclamping

- **Clamping:** Increases SVR and left ventricular afterload, stressing the heart. Minimize effects by increasing anesthetic depth or using vasodilators (Nitroglycerin, Sodium Nitroprusside).
- **Unclamping:** Hypotension often occurs due to the return of acidotic blood and ischemic metabolites. An **intravenous fluid bolus** before unclamping is required.

B. Organ Protection

- **Renal Function:** Maintain normal intravascular volume and cardiac output. Avoid nephrotoxic medications (e.g., Gentamicin, NSAIDs). *Note: Diuretics (Furosemide/Mannitol) do not reduce AKI incidence.*
- **Spinal Cord:** During thoracic surgery, hypoperfusion of the anterior spinal artery can cause paraplegia. A lumbar drain may be necessary.
- **Glycemic Control:** Blood glucose should be monitored and controlled to avoid hypovolemia and surgical site infections.

6. Postoperative Care

- **Disposition:** ICU/HDU is essential. Extubate if the patient is warm, stable, and has a working epidural; otherwise, transfer to ICU intubated.
- **Analgesia:**

  * **Epidural Advantages:** Suppresses stress response, limits myocardial workload by controlling tachycardia, and provides excellent pain relief without excessive sedation.
    - **Safety:** To avoid epidural hematoma, **heparin should be given at least 1 hour after** epidural placement.
    - **Alternative:** Opioid infusion or PCA if no epidural is present.
- **Observations:** Continuos invasive monitoring. Assessesment of **distal pulses** and monitor for large fluid shifts that require replacement.

Anesthesia Management for Peripheral Vascular Procedures

I. Peripheral vascular disease (PVD) :is rarely an isolated clinical finding; rather, it serves as a prominent local manifestation of a widespread, systemic atherosclerotic process. While the condition is characterized by the narrowing or occlusion of peripheral arteries—most commonly in the lower extremities—it reflects an underlying pathology that often involves the coronary, carotid, and renal vascular beds simultaneously. Consequently, patients presenting with PVD carry a significantly heightened risk for major adverse cardiovascular events, such as myocardial infarction and stroke, necessitating a comprehensive anesthetic approach that addresses both the localized surgical requirements and the extensive systemic comorbidities.

II. Preoperative Risk Stratification

Vascular surgery is classified as **High-Risk** (>5% risk of major adverse cardiac events).

Cardiac Evaluation: Metabolic Equivalents of Task (MET

- **1 (MET):** Represents the body's resting metabolic rate while sitting quietly.

- **> 4 METs:** The critical safety threshold for surgery; achieved if a patient can climb two flights of stairs or walk uphill without symptoms, indicating low cardiac risk.

- **< 4 METs:** Indicates poor functional capacity; if the patient cannot meet this threshold, dynamic cardiac testing (e.g., Dobutamine Stress Echo) is required

- **Renal Baseline:** Serum creatinine is the strongest predictor of postoperative renal failure.
- **Pharmacology:**
    - **Statins:** Should be continued; they reduce perioperative MI and stroke.

    - **Antiplatelets:** Aspirin is usually continued; P2Y12 inhibitors (Clopidogrel) are often stopped 5–7 days prior unless the risk of stent thrombosis is high.

III. Monitoring & Access

Standard monitoring is insufficient for major vascular procedures.

- **Invasive Arterial Line:** Essential for beat-to-beat BP monitoring and frequent ABG/Electrolyte/Hematocrit sampling. **Placement:** Usually the right radial (to avoid compression if the left subclavian is involved).
- **Central Venous Access:** Necessary for vasoactive drug infusions and volume status assessment.
- **Temperature Monitoring:** Essential, as hypothermia causes coagulopathy and increases myocardial oxygen demand (shivering).
- **Neuromonitoring:** (For carotid or thoracic cases) EEG or SSEP/MEP to monitor brain/spinal cord ischemia.

IV. Intraoperative Challenges: The Cross-Clamp

The most critical periods are the application and removal of the aortic cross-clamp.

1. Application (Clamping Phase)

- **Hemodynamics:** Acute increase in Afterload (SVR) and Preload. This can lead to **Left Ventricular failure** or **Myocardial Ischemia**.
- **Anesthetic Goal:** Reduce SVR using vasodilators (Nitroprusside/Nitroglycerin) or volatile anesthetics before the clamp is applied.

2. Release (Unclamping Phase)

- **"Unclamping Shock":** Massive drop in SVR and venous return. Release of **vasodilator metabolites** (lactate, K+, H+) from the ischemic limbs leads to myocardial depression and severe hypotension.
- **Anesthetic Goal:** * Pre-emptive fluid loading.
    - Decrease anesthetic depth.
    - Communication with the surgeon for a "gradual" release.

V. Anesthetic Techniques

- **General Anesthesia (GA):** Provides a controlled airway and is preferred for prolonged, complex cases.
- **Regional Anesthesia (RA):** (e.g., Spinal/Epidural) Useful for lower limb bypass.
    - *Advantages:* Reduced stress response, improved graft blood flow (vasodilation).
    - *Disadvantages:* Risk of **Epidural Hematoma** due to intraoperative heparinization.
- **Local with Sedation (MAC):** Preferred for EVAR or carotid endarterectomy in high-risk patients to allow neurological monitoring.

VI. Organ Protection Strategies

- **Renal Protection:** Maintain MAP and cardiac output. Use of Mannitol or Fenoldopam is controversial but common. Nephrotoxins (NSAIDs, certain antibiotics) should be avoided .
- **Spinal Cord Protection:** Especially in thoracic procedures. Maintain high MAP during clamping and consider **Lumbar CSF Drainage** to improve spinal cord perfusion pressure (CPP = MAP - CSFP).
- **Heparinization:** Prior to clamping, Heparin (50–100 units/kg) is given. Verify with **ACT (Activated Clotting Time)**—target is usually >250–300 seconds.

VII. Postoperative Care

- **Pain Management:** Multimodal. Epidural analgesia is the "gold standard" for open abdominal/lower limb surgery.
- **Respiratory:** Early extubation is preferred but depends on temperature, stability, and blood loss.
- **Surveillance:** Routine 12-lead ECGs and Troponins post-op, as most MIs in these patients are "silent.

MCQ

1-An Abdominal Aortic Aneurysm (AAA) is generally defined when the aortic diameter reaches which of the following thresholds?
A)1.5 cm
B)5.5 cm or more

C)3.0 cm or more
D)10 cm
E)2.0 cm
2-In the management of a Ruptured AAA, what is the recommended hemodynamic goal regarding blood pressure before the aorta is clamped?
A-Maintain Normal (SBP 120 mmHg) using Vasopressors
B-Goal-directed fluid therapy to reach CVP of 15
C-Maintain SBP at exactly 60 mmHg using Nitroglycerin
D-Permissive Hypotension (SBP < 100 mmHg)
E-Maintain Hypertension (SBP > 160 mmHg)
3-During the 'Aortic Clamping' phase, what is the primary physiological stress placed on the heart?
A-Severe decrease in Systemic Vascular Resistance (SVR)
B-Decrease in myocardial oxygen demand
C-Increased Left Ventricular afterload and SVR
D-Profound Bradycardia due to vagal stimulation
E-Acute decrease in Preload
4-Regarding preoperative cardiac risk, a patient who cannot climb two flights of stairs without symptoms is classified as having:
A-Athlete level fitness
B-Poor functional capacity (< 4 METs)
C-Normal resting metabolic rate
D-High functional capacity (> 10 METs)
E-Low cardiac risk

Lecture 5: Hypertension and Anesthesia

1. Definition and Grading

Hypertension is a persistent rise in arterial blood pressure. According to the British Hypertension Society and WHO, it is graded as follows:

- **Grade 1 (Mild):** Systolic 140–159 mmHg | Diastolic 90–99 mmHg.
- **Grade 2 (Moderate):** Systolic 160–179 mmHg | Diastolic 100–109 mmHg.

- **Grade 3 (Severe):** Systolic 180 mmHg | Diastolic 110 mmHg.

2. Etiology (Causes)

- **Primary (Essential) Hypertension (95%):** No apparent cause. Associated with family history, obesity, diet (salt intake), stress, smoking, and caffeine.
- **Secondary Hypertension (5%):**
    - **Adrenal Disorders:** Cushing's syndrome, Phaeochromocytoma, Hyperaldosteronism.
    - **Renal Disease:** Renal artery stenosis, Diabetic nephropathy, Glomerulonephritis.
    - **Others:** Coarctation of the aorta, Pre-eclampsia, and Drugs (Corticosteroids, Oral contraceptives).

3. Causes of Hypertension During Anesthesia

During surgery, BP may rise due to:

1. **Inadequate Anesthesia/Analgesia:** (Sympathetic response to pain).
2. **Airway Manipulation:** Tracheal intubation and extubation.
3. **Ventilation Issues:** Hypercapnia (High CO2) or Hypoxemia.
4. **Surgical Factors:** Aortic clamping.
5. **Neurological:** Raised ICP or Cerebral ischemia.
6. **Drugs:** Ketamine, Adrenaline, or Cocaine use.
7. **Rare Crises:** Malignant Hyperthermia, Thyroid crisis, or Phaeochromocytoma.

4. Preoperative Management

- **Assessment:** Screen for end-organ damage:
    - **Cardiac:** Ischemic heart disease or failure.
    - **Neurological:** History of CVA (Stroke).
    - **Renal:** Impairment or failure.
- **Postponement Criteria:** Elective surgery should be postponed if **Diastolic BP > 110 mmHg** until treated.
- **Medications:** Antihypertensive drugs must be **continued** up to the morning of surgery (especially beta-blockers).
- **Premedication:** Sedative premedication is often used to reduce stress-induced catecholamine release.

5. Intraoperative anagement

- **Hemodynamic Swings:** Hypertensive patients often have "labile" BP due to arteriolar hypertrophy.
    - **Induction:** Significant **hypotension** may occur.
    - **Intubation:** Significant **hypertension** may occur.
- **Anesthetic Technique:** * Maintenance should be similar to Ischemic Heart Disease (IHD) management.
    - **Regional Anesthesia:** Spinal or Epidural anesthesia may cause severe cardiovascular instability if hypertension is poorly controlled preoperatively.

6. Postoperative Management

- **Analgesia:** Providing excellent pain relief is critical to prevent postoperative hypertensive surges.
- **Monitoring:** Continuous observation for persistent hypertension which may require IV antihypertensive treatment

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MCQ

1- According to the WHO and British Hypertension Society, a blood pressure of 165/105 mmHg is classified as:
A)Grade 3 (Severe) Hypertension
B)Hypertensive Emergency
C)Normal Blood Pressure
D)Grade 2 (Moderate) Hypertension
E)Grade 1 (Mild) Hypertension

2- Elective surgery should be postponed if the patient's blood pressure exceeds which value?
A)Systolic 140 mmHg
B)Diastolic 90 mmHg
C)Systolic 150 mmHg
D)Heart Rate > 100 bpm

E)Diastolic > 110 mmHg

3- Regarding preoperative medications, which class of antihypertensive is specifically mentioned as vital to continue until the morning of surgery to prevent perioperative death?
A)ACE Inhibitors
B)Beta-blockers
C)Diuretics
D)NSAIDs
E)Aspirin

4- What is the primary neurological cause of hypertension during surgery?
A)Sleep deprivation
B)Peripheral Nerve Block
C)Excessive use of Midazolam
D)Raised Intracranial Pressure (ICP) or Cerebral ischemia
E)Patient being too deep under anesthesia

Lecture 6 : Pre-eclampsia / Eclampsia& Anesthesia

1. Pre-eclampsia

Pre-eclampsia is a pregnancy-specific multisystem disorder presenting after **20 weeks of gestation**, characterized by hypertension and significant proteinuria.

A. Classification by Severity

- **Mild-Moderate:** Systolic 140–159 mmHg or Diastolic 90–109 mmHg.
- **Severe Pre-eclampsia:** * Systolic 170 mmHg or Diastolic 110 mmHg on two occasions + Proteinuria (>3+).
    - **OR** Systolic >160 / Diastolic >100 mmHg with **Severe Features**: (Headache, visual disturbances, epigastric pain, clonus 3 beats, thrombocytopenia, or HELLP syndrome).

B. HELLP Syndrome

A life-threatening variant of pre-eclampsia diagnosed by:

1. **H**emolysis.
2. **E**levated **L**iver enzymes (ALT > 75 IU/L).
3. **L**ow **P**latelets.

2. Pathophysiology

The disease starts with **impaired trophoblast invasion** of the placenta, leading to:

1. Failure of spiral artery dilatation ⟶ Placental hypoperfusion & hypoxia.
2. Release of inflammatory cytokines into maternal circulation.
3. **Widespread endothelial damage** affecting kidneys (proteinuria), brain (seizures), and lungs (edema).

3. Medical Management

- **Antihypertensive Therapy:**
  - **1st Line:** Labetalol.
  - **2nd Line:** Nifedipine or Hydralazine (especially if Labetalol is contraindicated, e.g., in asthma).
- **Fluid Management:** High risk of pulmonary edema. **Restrict total fluid input to 80 mL/h** and monitor output via urinary catheter.
- **Seizure Control: Magnesium Sulfate (MgSO4)** is the gold standard for seizure prophylaxis and treatment of Eclampsia.

4. Anesthetic Management

A. Regional Anesthesia (RA)

- **Epidural Analgesia:** Recommended for labor; it blunts the hypertensive response to pain.
- **Pre-procedure Check: Platelet count is mandatory.** Neuraxial techniques should be avoided if thrombocytopenia or coagulopathy is present (risk of spinal hematoma).
- **Hypotension:** If it occurs, manage with **Phenylephrine** as in normal obstetric patients.

B. General Anesthesia (GA)

Required if RA is contraindicated or for emergencies. Key concerns include:

1. **Airway Edema:** Expect a **difficult airway** due to widespread edema; use a **smaller endotracheal tube** (e.g., 6.0 or 6.5 mm).
2. **Laryngoscopy Response:** Hypertension during intubation can cause cerebral hemorrhage. Ameliorate the response using:
    - Opioids (Alfentanil/Fentanyl).
    - Lidocaine, Esmolol, or Magnesium.
3. **Emergence:** Hypertension must be controlled during extubation.
4. **Drug Interactions:** Magnesium **potentiates** non-depolarizing muscle relaxants (e.g., Atracurium). Suxamethonium fasciculations may be reduced.

5. Postoperative & Critical Care

- **Multidisciplinary Team:** Requires coordination between obstetricians, anesthetists, and neonatologists.
- **Invasive Monitoring:** Consider an arterial line if BP is unstable, patient is obese, or repeated blood sampling is needed.
- **Analgesia: NSAIDs** (e.g., Ibuprofen, Diclofenac) should be avoided as acute kidney injury (AKI) is often present

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MCQ

1-What are the three diagnostic components of HELLP Syndrome?
A)Hypertension, Edema, and Lung Lead Placement
B)Hemolysis, Elevated Liver enzymes, and Low Platelets
C)Headache, Epigastric pain, and Low Protein
D)Hypotension, Electrolyte loss, and Liver Pain
E)Hyperglycemia, Elevated Leukocytes, and Low Potassium

2) When performing General Anesthesia for an emergency C-section in a severe pre-eclamptic patient, why is a smaller endotracheal tube (e.g., 6.0 or 6.5 mm) recommended?
A)Smaller tubes prevent aspiration more effectively
B)To allow the patient to speak immediately after surgery
C)Due to widespread airway edema making the glottic opening narrow
D)To prevent damage to the vocal cords during coughing
E)Because the patients are usually shorter in height

3-Before performing Regional Anesthesia (Epidural/Spinal) in a pre-eclamptic patient, which laboratory test is mandatory to avoid a spinal hematoma?
A)Hemoglobin level
B)Urinary protein concentration
C)Blood Glucose level
D)Liver enzymes (ALT/AST)
E)Platelet count

4) Which drug is considered the 'Gold Standard' for both the prophylaxis and treatment of eclamptic seizures?
A)Propofol infusion
B)Phenytoin
C)Diazepam
D)Magnesium Sulfate (*MgSO*4)
E)Labetalol

Lecture 7 : Anesthesia Management for the Shocked Patient

1. Shock

Shock is a state of acute circulatory failure where oxygen delivery (DO2) fails to meet cellular oxygen demand (VO2), leading to cellular hypoxia, metabolic derangement, and ultimately, multi-organ failure. At its core, shock is not defined by hypotension alone, but by **inadequate tissue perfusion**. When the delivery of oxygen—governed by cardiac output and arterial oxygen content—falls below a critical threshold, cells transition from aerobic to anaerobic metabolism. This shift results in the accumulation of lactic acid, the depletion of adenosine triphosphate (ATP), and a cascade of systemic inflammatory responses that can become irreversible if not rapidly corrected.

Types of Shock :

- **Hypovolemic:** (Most common) Massive hemorrhage, trauma, or severe dehydration.

- **Distributive:** Sepsis, Anaphylaxis, or Neurogenic shock (loss of sympathetic tone).
- **Cardiogenic:** MI, arrhythmias, or heart failure.
- **Obstructive:** Tension pneumothorax, cardiac tamponade, or pulmonary embolism.

2. Pre-Induction Stabilization

"Resuscitate before Intubation " whenever possible.

- **Oxygenation:** High-flow O2 via mask to maximize dissolved oxygen in the blood.
- **Vascular Access:** Two **large-bore** peripheral IV cannulas (14G or 16G). Central lines are for monitoring/vasopressors, not rapid volume replacement.
- **Monitoring:** Minimum standard + **Arterial Line** (ideally placed *before* induction to monitor the "crash").
- **Volume:** Balanced crystalloids or blood products (Massive Transfusion Protocol if indicated).

3. The Induction "Crash"

Induction is the most dangerous period. Anesthetic agents (Propofol, Thiopental) cause **vasodilation** and **myocardial depression**, which can trigger immediate cardiac arrest in a patient relying on high sympathetic tone to stay alive.

Technical Priorities:

- **Pre-Oxygenation:** Mandatory to increase the "apneic window."
- **Drug Selection:** * **Ketamine:** Drug of choice (0.5–1 mg/kg). It stimulates the sympathetic system.
    - **Etomidate:** Hemodynamically stable; avoids the BP drop seen with Propofol.
    - **Fentanyl:** Use low doses to blunt the stress of intubation without dropping SVR.
- **Rapid Sequence Induction (RSI):** Most shocked patients are "full stomach" (trauma or delayed gastric emptying). Use **Suxamethonium** or high-dose **Rocuromium**.

4. Maintenance of Anesthesia

- **Inhalational Agents:** Volatile gases (Isoflurane/Sevoflurane) cause dose-dependent vasodilation. Keep MAC low (0.5–0.7) and supplement with opioids.
- **Ventilation:** Avoiding high **PEEP** and high tidal volumes. Increased intrathoracic pressure reduces venous return (preload), further dropping blood pressure.
- **The Lethal Triad:** In trauma shock, aggressively treat:
    1. **Acidosis**
    2. **Hypothermia** (Use fluid warmers/forced air blankets)
    3. **Coagulopathy** (Give FFP/Platelets/Cryoprecipitate)

5. Hemodynamic Targets

- **Mean Arterial Pressure (MAP):** Aim for **>65 mmHg** to maintain renal and cerebral perfusion.
    - *Note:* In active trauma bleeding, "Permissive Hypotension" (MAP 50–60) may be used until bleeding is controlled.
- **Vasopressors vs. Inotropes:**
    - **Noradrenaline:** First-line for septic or distributive shock (increases SVR).
    - **Adrenaline:** Used if myocardial contractility is also impaired.

6. Postoperative Care

- **Transfer:** Patients almost always remain intubated and are transferred to the **ICU**.
- **Handover:** Must include total fluids given, estimated blood loss (EBL), and current vasopressor requirements.
- **Renal Protection:** Continuous monitoring of urine output (>0.5 mL/k

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MCQ

1- A patient with a Tension Pneumothorax or Cardiac Tamponade is suffering from which type of shock?

A)Hypovolemic Shock
B)Obstructive Shock
C)Distributive Shock
D)Neurogenic Shock

E)Cardiogenic Shock
2- What is the primary rule for managing a shocked patient before proceeding with intubation?
A)Give 100 mg of Furosemide
B)Wait for a full stomach to empty naturally
C)Place a Central Line for rapid fluid replacement
D)Administer high-dose Propofol immediately
E)Resuscitate before Intubation
3-Why should high PEEP and high tidal volumes be avoided during mechanical ventilation of a patient in shock?
A)Increased intrathoracic pressure reduces venous return
B)They increase the risk of malignant hyperthermia
C)They lead to excessive oxygen toxicity
D)They cause the patient to wake up during surgery
E)They prevent coagulation
4-What is the first-line vasopressor for Septic or Distributive shock to increase Systemic Vascular Resistance (SVR)?
A)Phenylephrine
B)Noradrenaline (Norepinephrine)
C)Atropine
D)Furosemide
E)Dobutamine

Lecture 8 : Anesthetic Management of Placenta Previa / Abruptio Placentae/ Dilatation and Curettage

1. Placenta Previa :Implantation of the placenta in the lower uterine segment, in advance of the fetal presenting part, covering or lying near the internal cervical os.

- **Incidence:** Approximately 0.5% (or 1 in 200) of pregnancies.
- **The "Classic" Presentation:** Painless vaginal bleeding, typically occurring in the third trimester.
- **Why does it bleed?** As the lower uterine segment thins and the cervix begins to dilate in late pregnancy, the placental attachments are disrupted, leading to maternal hemorrhage.

2. Risk Factors
The risk increases significantly with:

- **Previous Uterine Surgery:** Prior Cesarean Section (C-section) or Myomectomy.
- **Multiparity:** Higher number of previous pregnancies.
- **Advanced Maternal Age:** (Older than 35 years).
- **Large Placental Surface:** (e.g., multiple gestations).
- **Smoking** and assisted reproductive techniques.

3. Clinical Management & Delivery Timing

- **Diagnosis:** Primarily via **Ultrasonography** (antenatal diagnosis).
- **Preterm (<37 weeks):** If bleeding is mild/moderate and the patient is stable ⟶ Conservative management (Bed rest and observation).
- **Term (>37 weeks):** Usually scheduled for C-section.
- **Mode of Delivery:**
    - **Distance > 2 cm from internal os:** Trial of labor is acceptable.
    - **Distance < 1 cm from internal os:** Mandatory C-section.
    - **Distance 1–2 cm:** Individualized management.

4. Anesthetic Considerations

A. Preoperative Preparation

1. **Multidisciplinary Team:** Communication between anesthesia, obstetrics, and pediatrics.
2. **Vascular Access: Two large-bore IV catheters** (14G or 16G) are mandatory.
3. **Blood Setup:** * Cross-matched blood must be immediately available (PRBCs, FFP, Platelets).
    - In extreme emergencies: Use **O-negative blood**.
4. **The "Accreta" Warning:** Always assess for **Placenta Accreta Spectrum (PAS)** if the patient has a prior C-section scar, as this dramatically increases the risk of massive hemorrhage and hysterectomy.

B. Choice of Anesthesia

1. Neuraxial Anesthesia (Spinal, Epidural, or CSE)

Historically, General Anesthesia was the standard for all previa cases. However, modern guidelines now favor Neuraxial techniques for **stable, elective patients**.

- **Advantages:**
    - **Reduced Blood Loss:** Studies suggest that neuraxial anesthesia may result in less intraoperative blood loss compared to GA, likely due to lower peripheral venous pressure.
    - **Airway Safety:** Avoids the risks of "failed intubation" and "aspiration.
    - **Maternal Experience:** Allows the mother to remain awake and interact with the newborn.
    - **Reduced Uterine Atony:** Unlike high-dose volatile gases used in GA, neuraxial anesthesia does not interfere with uterine contraction.
- **Disadvantages& Contraindications:**
    - **Absolute Contraindication:** Active, massive hemorrhage or profound maternal hypovolemia/shock.
    - **Sympathetic Blockade:** The resulting vasodilation can worsen hypotension in a patient who is already borderline hypovolemic.

2. General Anesthesia (GA)

General Anesthesia remains the technique of choice for **emergencies** and cases with a high probability of **massive transfusion**.

- **Indications:**
  - **Category 1 Emergency:** Severe, ongoing vaginal bleeding.
  - **Hemodynamic Instability:** Maternal shock or severe hypotension.
  - **Coagulopathy:** If the patient has developed a bleeding disorder due to massive loss.
  - **Suspected Accreta/Percreta:** If an emergency hysterectomy is anticipated, GA provides better control for a long, complex surgery.
- **Induction Strategy (RSI):**
  - **Rapid Sequence Induction (RSI):** Required to prevent aspiration of gastric contents.
  - **Hemodynamic Support:** In the bleeding patient, **Ketamine (1.0–1.5mg/kg)** or **Etomidate (0.3mg/kg)** are the preferred induction agents because they maintain cardiovascular stability better than Propofol.
  - **Maintenance:** Volatile agents (Isoflurane/Sevoflurane) should be kept at low concentrations (< 0.5 MAC) after delivery to avoid uterine relaxation (atony), which would worsen the bleeding.

5. Management of Intraoperative Hemorrhage

If massive bleeding occurs (> 1500 mL):

1. **Activate Massive Transfusion Protocol (MTP):** Balanced replacement of blood components.
2. **Pharmacology:**
   - **Uterotonic Agents:** Oxytocin (first line), Ergometrine, or Carboprost to help the lower segment contract.
   - **Tranexamic Acid (TXA):** 1 - 2 g IV (ideally within 3 hours of delivery) to reduce death from exsanguination.
3. **Neonatal Care:** The baby may be acidotic and hypovolemic; the pediatric team must be ready for resuscitation.

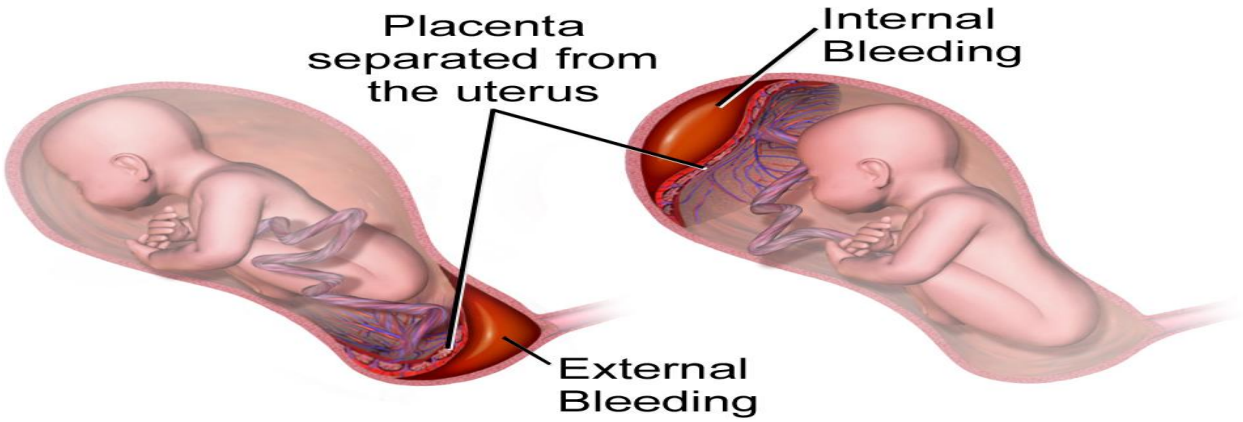
6. Post-Delivery Complications

- **Postpartum Hemorrhage (PPH):** Even after the baby is out, bleeding can continue because the **lower uterine segment does not contract as effectively** as the fundus.
- **Hypocalcemia/Coagulopathy:** Resulting from massive transfusion; requires frequent ABG and electrolyte monitoring.

Abruptio Placentae

1. Abruptio Placentae: Premature separation of a normally implanted placenta from the uterine wall after 20 weeks of gestation but before delivery.Incidence rate approximately 1–2% of pregnancies (0.4 to 1 in 100).

Classification: Ranges from **Grade I** (Mild) to **Grade III** (Severe/Fetal Demise).



2. Clinical Presentation

- **Classic Triad:** Painful vaginal bleeding, uterine tenderness, and increased uterine tone/contractions.
- **The "Concealed" Danger:** Bleeding may remain trapped behind the placenta (**concealed hemorrhage**). Up to **2 Liters** of blood can be lost without being visible externally, leading to a dangerous underestimation of hypovolemia.

3. Risk Factors

- **Medical/Lifestyle:** Hypertension (most common), advanced maternal age, smoking, cocaine use, and alcohol abuse.
- **Obstetric/Trauma:** Trauma, multiparity, premature rupture of membranes (PROM), chorioamnionitis, and a short umbilical cord.

4. Major Complications & DIC

- **Maternal/Fetal Risks:** Acute kidney injury, thromboembolism, and neonatal acidosis/hypovolemia.
- **Disseminated Intravascular Coagulation (DIC):**
    - **Mechanism:** The damaged placenta releases **Tissue Thromboplastin** into maternal circulation, triggering widespread, uncontrolled clotting and factor consumption.
    - **Clinical Indicators:** Oozing from IV sites , or surgical wounds.
    - **Lab Findings:** Low Fibrinogen (most sensitive), elevated D-Dimer/FDPs (massive fibrinolysis), and prolonged PT/PTT.
    - **Definitive Treatment:** The only cure is **Delivery** (removing the source of thromboplastin).

4. Choice of Anesthesia

- **Neuraxial (Epidural):** Only for stable labor/delivery if there is **no** hypovolemia, **no** active heavy bleeding, and **normal** coagulation.
- **General Anesthesia (GA):** Mandatory for emergency C-sections involving severe hemorrhage, hemodynamic instability, or suspected DIC.

5. Massive Transfusion Protocol (MTP)

Activated in obstetric emergencies (e.g., Abruption) when blood loss exceeds **1500 mL**.

1. Balanced Resuscitation (1:1:1 Ratio)

To avoid **"Crystalloid Washout"** and prevent **Dilutional Coagulopathy**, a balanced ratio commonly used:

- **1 Unit PRBCs** : **1 Unit FFP** : **1 Unit Platelets**.

2. Therapeutic Targets & Drugs

- **Target Hb:** 7–8 g/dL.
- **Platelets:** > 50,000/mm³ (> 100,000 if bleeding persists).
- **Fibrinogen:** Maintain **> 150–200 mg/dL**.
    - **Cryoprecipitate:** The gold standard to raise fibrinogen.

- **Tranexamic Acid (TXA):** 1–2 g IV (Best within **3 hours** of bleeding onset).

Dilatation and Curettage (D&C)

Dilation and Curettage (D&C) is a common day-case procedure. Despite its short duration, it involves significant physiological changes and specific positioning requirements that demand precise clinical monitoring and careful patient management throughout the surgery

1. Patient Positioning

Performing a **Dilation and Curettage (D&C)** procedure necessitates the use of the **lithotomy position**. This postural adjustment triggers significant hemodynamic and respiratory alterations.:

- **Respiratory:** Cephalad displacement of the diaphragm by abdominal viscera reduces **Functional Residual Capacity (FRC)**. This leads to rapid desaturation if the airway is not optimally managed, especially in patients with a high BMI.
- **Circulatory:** Elevation of the legs causes an immediate autotransfusion of approximately **500–1000 mL** of blood. This increase in preload can be significant in patients with compensated cardiac disease.
- **Nerve Safety:** The **Common Peroneal Nerve** is highly susceptible to injury if compressed against the lateral supports of the stirrups. The **Saphenous Nerve** can also be compressed medially.

2. Autonomic Reflexes (The "Cervical Reflexes")

The cervix is richly innervated. Manipulation during dilatation can trigger two dangerous reflexes

- **The Vasovagal Reflex:** Rapid dilatation of the cervix can trigger a profound vagal response, resulting in **sudden bradycardia**, hypotension, or even asystole.
    - *Management:* Pre-emptive use of anticholinergics (Atropine 0.5 mg or Glycopyrrolate 0.2 mg) should be ready.

- **The Brewer-Luckhardt Reflex:** Visceral stimulation (cervical stretching) can cause reflex **Laryngospasm** if the depth of anesthesia is inadequate (Stage II). This can occur even in the absence of an Endotracheal Tube or LMA.

3. Anesthetic Technique & Airway Management

- **General Anesthesia (GA):**
  - **Induction:** Propofol is the agent of choice due to its antiemetic properties and rapid emergence.
  - **Maintenance: TIVA (Total Intravenous Anesthesia)** using a Propofol TCI (Target Controlled Infusion) is superior for day-cases to minimize **Postoperative Nausea and Vomiting (PONV)**.
  - **Airway:** The **Laryngeal Mask Airway (LMA)** is the standard. It provides better airway protection than a facemask during the strong stimulation of dilatation and allows for spontaneous ventilation.
- **Analgesia:**
  - **Alfentanil (250–500 mcg):** Highly effective for D&C due to its rapid onset and short duration, specifically blunting the sympathetic response to cervical dilatation.
  - **Multimodal:** IV Paracetamol and NSAIDs (Ketorolac or Diclofenac) are administered to provide a baseline for "cramping" pain post-procedure.

4. Surgical Complications: Uterine Perforation

- **Signs:** An unexplained drop in blood pressure or the surgical instrument passing further than the measured uterine sound.
- **Anesthetic Role:** If uterine perforation is suspected, maintaining hemodynamic stability is vital due to the risk of occult hemorrhage. Severe cases may require conversion to laparoscopy to assess for vascular or bowel injury.

5. Postoperative Recovery (Day Case Criteria)

- **PONV Prophylaxis:** D&C is associated with high rates of nausea. Dual prophylaxis with **Dexamethasone (4 mg)** and **Ondansetron (4 mg)** is recommended.

- **Discharge:** Patients must meet standard "Street Ready" criteria: stable vitals, absence of significant bleeding, pain controlled by oral medications, and ability to ambulate

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Lecture 9 : Anesthesia for Nonobstetric Surgery During Pregnancy/Cervical Cerclage

1. Introduction

- **Incidence:** Nonobstetric surgery occurs in **1% to 2%** of all pregnancies.
- **Common Indications:** Trauma (most frequent), appendicitis, cholecystitis, and malignancy.

2. Goals of Anesthetic Management

The primary objectives are to optimize maternal health while ensuring fetal safety:

1. **Maternal Safety:** Manage hemodynamics and ventilation while accounting for pregnancy-induced physiological changes.
2. **Fetal Safety:** Prevention of **intrauterine fetal hypoxia and acidosis**.
3. **Pregnancy Maintenance:** Prevention of spontaneous abortion (early pregnancy) or preterm labor (late pregnancy).

3. Surgical Timing & Approach

- **Elective Surgery:** Must always be delayed until after delivery.
- **Urgent Surgery:** Should **never** be denied or delayed regardless of the trimester, as delay harms both mother and fetus.
- **Preferred Timing:** The **second trimester** is ideal if surgery is required.
- **Laparoscopic Approach:** Considered as safe as open surgery in any trimester.
    - *Tip:* Use low pneumoperitoneum pressures (**10–15 mm Hg**) if feasible.

4. Prevention of Fetal Hypoxia and Acidosis

Fetal well-being depends on maintaining stable **Uterine Blood Flow (UBF)** and oxygenation.

- **Carbon Dioxide Control:** Both hypercapnia and hypocapnia (from over-ventilation) reduce UBF and lead to fetal acidosis.
- **Positioning:** Use **Left Uterine Displacement (LUD)** after mid-gestation to avoid aortocaval compression and maternal hypotension.
- **Oxygenation:** High maternal inspired oxygen (FiO2 50%) is recommended.
    - *Note:* This does **not** cause retinopathy in utero because the placenta limits fetal PaO2to < 60 mm Hg, even if maternal PaO2 > 500 mm Hg.

5. Anesthetic Techniques & Drugs

A. Choice of Technique

- **Neuraxial (Spinal/Epidural):** Preferred when appropriate as it limits fetal drug exposure and avoids maternal airway risks.
- **General Anesthesia:** If chosen, use:
    - Aspiration prophylaxis.
    - Rapid Sequence Induction (RSI).
    - Maintenance of **Eucarbia** (Target ETCO2 ~ 30 mm Hg).
    - Adequate perfusion using fluids and vasopressors (e.g., **Phenylephrine**).

B. Teratogenicity & FDA Warnings

- **The Critical Period:** Organogenesis occurs between **days 15 and 56**.
- **Current Evidence:** No currently used anesthetics (except cocaine) are proven human teratogens at standard doses.
- **FDA Warning (2016):** Lengthy use of GABA/NMDA binding drugs in the 3rd trimester *might* affect brain development, though human evidence of long-term cognitive impairment is currently lacking.

6. Fetal & Uterine Monitoring

- **Technical Milestones:** * FHR (Fetal Heart Rate) detectable via Doppler at **16–18 weeks**.
    - FHR variability (marker of well-being) established at **25–27 weeks**.
- **Monitoring Strategy:**
    - *Previable fetus:* Pre- and post-procedure checks are usually sufficient.

- *Viable fetus:* Intraoperative monitoring helps optimize maternal condition but is challenging because **most anesthetics naturally reduce FHR variability**.

7. Preterm Labor (PTL) Management

- **Risk Factors:** The underlying pathology (e.g., intra-abdominal infection) is the main driver of PTL, not the anesthetic technique.
- **Post-Op Monitoring:** Monitor FHR and uterine activity for at least **24 hours**.
  - *Caution:* Post-op analgesics can mask the perception of contractions.
- **Medical Intervention:**
  - **Tocolytics:** (Nifedipine/Indomethacin) to stop labor.
  - **Magnesium Sulfate:** Used for **fetal neuroprotection** (reduces cerebral palsy risk).
  - **Corticosteroids:** To reduce neonatal respiratory morbidity if delivery is imminent.

Cervical Cerclage

1. Procedure Overview

- **Indication:** Surgical treatment of an **incompetent cervical os** (caused by congenital abnormalities, scarring, or hormonal imbalance) to prevent premature dilation and fetal loss.
- **Timing:** Usually performed between the **14th and 26th week** of gestation.
- **Emergency vs. Prophylactic:** Emergency cerclage (performed when the cervix is already dilating or membranes are bulging) has a lower success rate than prophylactic cerclage.
- **Surgical Details:**
  - **Time:** ~20 minutes.
  - **Position:** Lithotomy.
  - **Pain Level:** Mild to moderate (+).
  - **Blood Loss:** Minimal/Nil.

2. Preoperative Considerations

- **Risk Assessment:** Risks of membrane rupture (especially if bulging), infection, hemorrhage, and induction of premature labor.
- **Maternal Assessment:** * Evaluation of airway and gestation age.
    - Check for symptoms of **reflux** and **supine hypotension**.
- **Premedication: Antacid prophylaxis** (due to minimize aspiration risk).

3. Perioperative Management

A. Regional Anesthesia (Commonly Preferred)

- **Level Required:** A sensory block of **T8–T10** is necessary for intraoperative comfort.
- **Uterine Relaxation:** If the surgeon needs to reduce bulging membranes:
    - Using of **Sublingual Glyceryl Trinitrate (GTN) spray** (2–3 puffs).
    - *Note:* Expect transient maternal hypotension.

B. General Anesthesia (GA)

- **Airway: Rapid Sequence Induction (RSI)** with a cuffed endotracheal tube (ETT) if the patient is **>18 weeks gestation** or has symptomatic reflux.
- **Uterine Relaxation:** If required, the concentration of **halogenated volatile agents** (e.g., Sevoflurane, Isoflurane) can be increased to relax the uterus.

4. Postoperative Care

- **Observation:** Closely monitor for signs of **premature labor**.
- **Follow-up:** Vaginal cerclage sutures are typically removed at the **38th week** of gestation to allow for vaginal delivery.

Lecture11 : Anesthetic Management for Posterior Spinal Reconstructive Surgery/ Arthroscopy

1. Introduction & Surgical Scope

- **Procedures:** Correction of scoliosis, kyphosis, or stabilization of spinal fractures/tumors.
- **Surgical Goals:** Realignment of the spinal column, decompression of neural elements, and bony fusion using hardware (rods, screws, hooks).

- **Key Challenges:** Massive blood loss, prone positioning, long surgical duration, and preservation of spinal cord integrity.

2. Preoperative Assessment

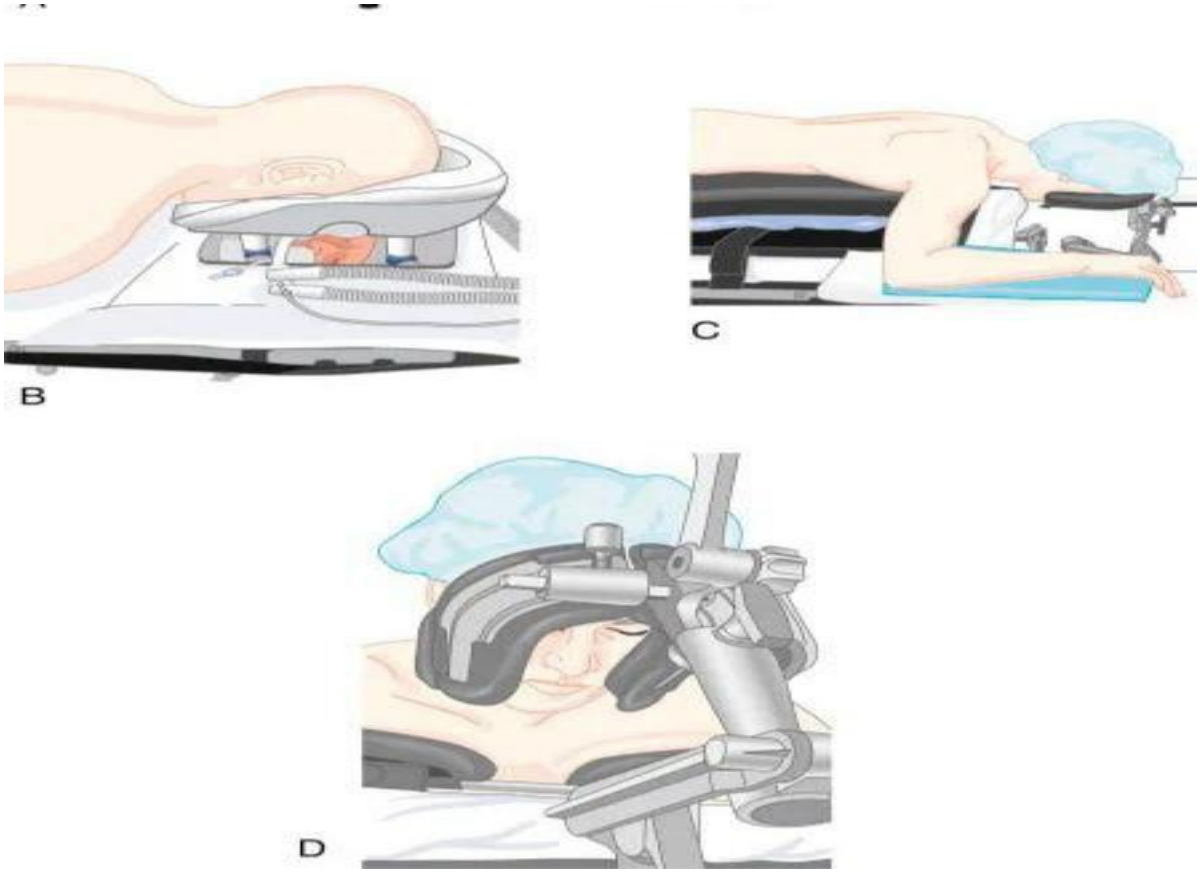
A thorough evaluation is critical, as many patients (especially those with scoliosis) may have associated systemic conditions.

- **Respiratory:** Assessment of restrictive lung disease (common in severe scoliosis). Check Forced Vital Capacity (FVC); an FVC < 40\% of predicted may indicate a need for postoperative ventilation.
- **Cardiac:** Evaluation for pulmonary hypertension or cor pulmonale in severe spinal deformities. Baseline ECG and Echo if indicated.
- **Neurological:** Comprehensive baseline documentation of sensory and motor deficits.
- **Airway:** Assessment for potential difficult intubation (e.g., cervical spine instability or limited neck mobility).

3. Positioning: The Prone Position

The prone position is required for posterior access but introduces significant physiological risks.

- **Respiratory:** Ensure the abdomen is free-hanging (using a Jackson table or Wilson frame) to prevent increased intra-abdominal pressure, which can impede venous return and increase surgical site bleeding.
- **Ocular Safety:** Risk of **Postoperative Visual Loss (POVL)**. Maintain the head in a neutral position, avoid pressure on the globes, and maintain adequate Mean Arterial Pressure (MAP).
- **Pressure Points:** Padding of the knees, elbows (ulnar nerve), and breasts/genitalia.



4. Maintenance of Anesthesia & Neuromonitoring

Intraoperative Neurophysiological Monitoring **(IONM)** is the standard of care to detect spinal cord ischemia or injury.

A. Monitoring Modalities

1. **Somatosensory Evoked Potentials (SSEPs):** Monitor the integrity of the dorsal (sensory) columns.
2. **Motor Evoked Potentials (MEPs):** Monitor the ventral (motor) tracts.

B. Anesthetic Impact on IONM

- **Total Intravenous Anesthesia (TIVA):** The preferred technique (Propofol and Remifentanil). MEPs are highly sensitive to volatile anesthetics; even 0.5 MAC can abolish the signal.
- **Neuromuscular Blockade (NMB):** Avoided or strictly limited during MEP monitoring to allow for muscle response. A "train-of-four" of 2/4 is sometimes used, but many centers prefer zero NMB after intubation.

- **Nitrous Oxide (N2O):** Avoided as it depresses SSEP amplitudes.

5. Hemodynamic Management & Blood Conservation

Reconstructive spinal surgery is often associated with "Major Obstetric-level" blood loss.

- **Fluid Management:** Large-bore IV access and often a Central Venous Catheter (CVC).
- **Controlled Hypotension:** Maintaining MAP between 60 -70 mmHg can reduce blood loss, provided it does not compromise spinal cord perfusion.
- **Blood Salvage:** Use of **Cell Saver** is standard.
- **Pharmacology: Tranexamic Acid (TXA)** or Aminocaproic acid is frequently used to reduce fibrinolysis and blood loss.

6. The "Wake-Up" Test

Though largely replaced by MEPs, the Stagnara wake-up test may be used if monitoring signals are lost.

- **Procedure:** Anesthesia is lightened until the patient can follow commands to move their feet, then deepened immediately.
- **Risks:** Accidental extubation, air embolism, and hardware displacement.

7. Postoperative Management

- **Pain Control:** Multimodal analgesia is essential. This includes IV opioids (PCA), Ketamine infusions, and potentially gabapentinoids.
- **Neurological Checks:** Immediate assessment of motor and sensory function in the PACU.
- **Complications:** Watch for spinal hematoma, respiratory failure, or surgical site infection

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Anesthetic Management for Arthroscopy

1. Arthroscopy

Arthroscopy has revolutionized the surgical management of various joints (knee, shoulder, ankle, hip, elbow, and wrist). While commonly associated with young athletes, it is frequently performed in elderly patients with significant comorbidities.

- **Common Procedures:** Examination under anesthesia (EUA), meniscal surgery, removal of loose bodies, synovectomy, and ligament reconstruction.
- **Evidence Note:** Arthroscopy for osteoarthritis of the knee is generally not supported by evidence of clinical effectiveness.

2. Procedure Overview (Lower Limb)

- **Time:** 20–60 minutes.
- **Pain:** Moderate (++).
- **Position:** Supine (for knee: often with the leg over the side of the table).
- **Blood Loss:** Negligible/Nil (facilitated by a bloodless field).
- **Tourniquet:** A pneumatic tourniquet is frequently used to provide a clear surgical field.

3. Preoperative Considerations

- **Patient Profile:** Usually healthy outpatients, but elderly patients require screening for cardiovascular and respiratory stability.
- **Ambulatory Goals:** The technique must allow for early ambulation and discharge (Day-case surgery).
- **Premedication:** Multimodal approach with oral Paracetamol and NSAIDs to reduce postoperative opioid requirements.

4. Intraoperative Management

A. General Anesthesia (GA)

- **Airway:** Laryngeal Mask Airway (LMA) is the "standard" for day-case arthroscopy.
- **Analgesia:** IV Fentanyl (1mcg/kg). Low-dose IV Ketamine (0.15mg/kg) can be used to enhance analgesia.

- **Opioid Sparing:** Large doses of IV Morphine in outpatients should be avoided , due to the high incidence of Postoperative Nausea and Vomiting (PONV) and delayed discharge.

B. Neuraxial Anesthesia

- **Options:** Both Spinal and Epidural anesthesia show equal success and patient satisfaction.
- **Limitation:** Time to discharge may be significantly prolonged compared to GA due to the duration of motor and sensory blocks.

C. Local & Regional Techniques

- **Peripheral Nerve Blocks:** Effective for pain but may be limited by long duration (delaying ambulation) and failure to block tourniquet pain.
- **Intra-articular/Infiltration:** EUA and washout can often be performed under local anesthesia (LA) infiltration alone.

5. Postoperative Pain Management

Successful recovery depends on the triad of **early ambulation**, **adequate analgesia**, and **minimal PONV**.

A. Intra-articular Injection

At the end of the procedure, surgeons often instill a "cocktail" into the joint cavity:

- **Local Anesthetic:** 20ml of 0.5% Bupivacaine or Ropivacaine.
- **Adjuvants:** Morphine , Clonidine, Ketorolac, Epinephrine may be added to extend the duration of the block.

B. Multimodal Strategy

- **Systemic Agents:** NSAIDs and Gabapentin.
- **Nerve Blocks:** Single or continuous blocks are reserved for more invasive procedures like ligament reconstruction (ACL/PCL).
- **Discharge:** Oral NSAIDs and strong oral analgesics for home use.

Lecture 12 : Anesthetic Management for Total Hip Replacement (THR)/ Total Knee Replacement

I. Preoperative Considerations for THR

1. Osteoarthritis (OA)

- **Pathology:** Degenerative "wear-and-tear" of joint surfaces.
- **Anesthetic Focus:** Often affects the cervical spine. So we have to **Minimize neck manipulation** during intubation to prevent nerve root compression or disc protrusion.

2. Rheumatoid Arthritis (RA)

A systemic autoimmune disease with significantly higher anesthetic complexity:

- **Airway Challenges:**
  - **Atlantoaxial Subluxation:** Cervical instability can cause the odontoid process to compress the spinal cord or brainstem during intubation.
  - **Cricoarytenoid Arthritis:** Signaled by hoarseness or stridor; indicates a narrow glottic opening and high risk of post-extubation obstruction.
  - **TMJ Involvement:** Limited jaw opening may make conventional laryngoscopy impossible.
- **Technical Difficulties:** Severe joint deformities in the hands/wrists can make IV access and radial artery cannulation challenging.
- **Required Actions:** * Obtain **flexion/extension cervical X-rays** for patients on steroids or methotrexate.
  - Use **Video or Fiberoptic Laryngoscopy** with inline stabilization if instability is suspected

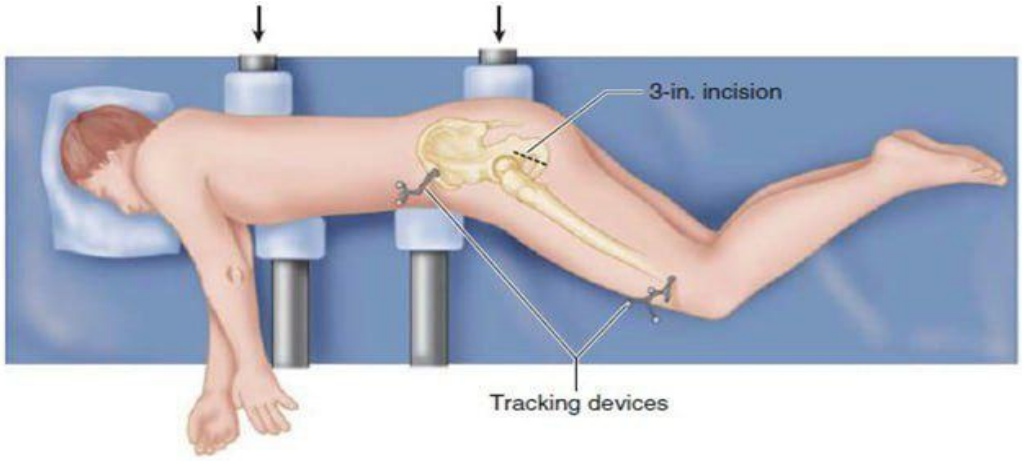
3. Medication Side Effects

Patients often take **NSAIDs**, which can lead to:

- Platelet dysfunction (bleeding risk).
- Renal toxicity.
- Gastric ulcers/bleeding.

II. Surgical Approaches & Patient Positioning

- **Supine Position (Anterior Approach):**
  - Allows for same-day discharge.
  - Operative-side arm must be flexed away from the body.
- **Lateral Decubitus Position** *(see the fig below):*
  - Axillary Roll: Placed caudal to the axilla to protect the brachial plexus and axillary artery.
  - Lateral Positioners: Can push abdominal contents cephalad, interfering with respiratory function.



III. Intraoperative Management & Critical Complications

The procedure involves dislocation of the femoral head, acetabular reaming, and femoral shaft reaming.

1. Bone Cement Implantation Syndrome (BCIS)

Occurs during the insertion of **Methyl Methacrylate (MMC)**.

- **Pathophysiology:** Reaming forces air, fat, and marrow into circulation. High liquid monomer content in poorly mixed cement increases toxicity.
- **Cardiac Impact:** MMC can increase right atrial pressure. In patients with a **Patent Foramen Ovale (PFO)**, emboli can shunt to the left heart, causing systemic arterial embolism.
- **Management:** Maintain high FiO2 (up to 1.0) during cementing/reaming. Ensure the patient is not hypovolemic or hypertensive before cementing.

2. Major Life-Threatening Risks

- **Hemorrhage:** Intra- and postoperative blood loss.
- **Venous Thromboembolism (VTE):** High risk due to pelvic/femoral manipulation.
- **Monitoring:** Invasive arterial monitoring may be justified for high-risk patients to manage hemodynamic swings during cementing.

IV. Postoperative Pain & PACU

- **Analgesia:** * **Neuraxial Opioids:** (e.g., Morphine) significantly extend the duration of relief.
    - **Multimodal:** Includes peripheral nerve blocks (Lumbar Plexus) or Epidural PCA.
- **PACU Priorities:** Supplemental O2, hemoglobin count checks, and coordination of pain management with the patient's anticoagulation

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Total Knee Replacement (TKA)

1. Total Knee Arthroplasty

Total Knee Arthroplasty (TKA) involves the prosthetic replacement of the knee joint. While the patient population is similar to those having hip surgery, TKA is typically a shorter operation but is associated with significantly higher levels of postoperative pain.

- **Time:** 1–2 hours (Revision: 2 hours).
- **Pain Level:** Extreme (++++/+++++).
- **Position:** Supine.
- **Blood Loss:** Minimal with tourniquet; 250–500ml without. Postoperative autologous blood salvage is frequently utilized.

2. Preoperative Considerations

- **Evaluation:** Similar to hip surgery, focusing on cardiovascular stability and inflammatory conditions (Osteoarthritis, Rheumatoid Arthritis).
- **Patient Profile:** Patients are often elderly with multiple comorbidities.
- **Ambulatory Goals:** Modern pathways prioritize techniques that facilitate early mobility (48 hours) and discharge.

3. Intraoperative Management

A. Anesthetic Techniques

1. **General Anesthesia (GA):** Often combined with an LMA. Airway control can be challenging under sedation in the supine position; therefore, GA provides a secure airway.
2. **Neuraxial:** Spinal anesthesia supplemented with intrathecal opioids (e.g., Diamorphine 0.25–0.5mg) is highly effective.
3. **Peripheral Nerve Blocks (PNB):** Sciatic and Femoral nerve blocks are the "Practical Techniques" of choice.
    - **Advantages:** Superior pain relief for 12–24 hours, avoids urinary catheters, and allows better bed mobility.
    - **Timing:** 30 minutes prior to surgery to ensure onset.

B. Tourniquet Dynamics & "Breakthrough" Pain

A tourniquet is standard to provide a bloodless field, but it introduces specific anesthetic challenges:

- **Tourniquet Pain:** Often occurs ~1 hour after inflation despite nerve blocks. It manifests as sudden hypertension and tachycardia (CVS stimulation).
- **Treatment:** Deepening the anesthetic, adding IV opioids, or using **low-dose Ketamine (0.25mg/kg)** to prevent the rise in blood pressure.
- **Release Event:** A short-lived reperfusion event (decreased BP, decreased SaO2, and increased ETCO2) occurs upon release.
    - *Management:* Preload the patient with fluids before and during release to mitigate hypotension.

5. Postoperative Care & Pain Management

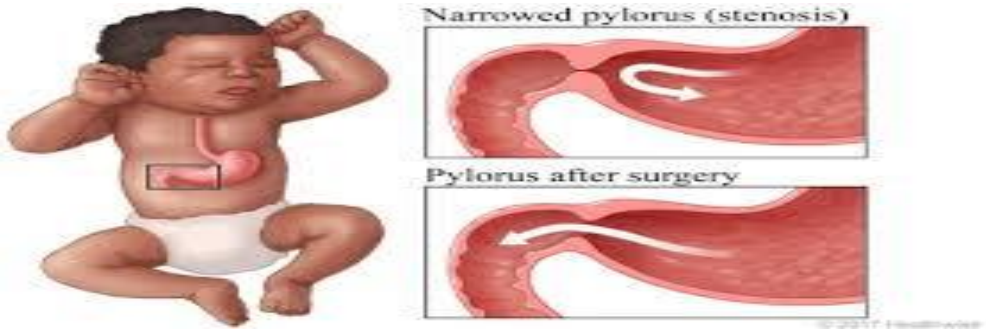
Postoperative pain is the primary determinant of anesthetic success and the greatest challenge in TKA.

- **Multimodal Approach:** Supplement nerve blocks with regular NSAIDs, oral analgesics, and parenteral opioids (PCA/IM).
- **Wound Drainage:** Expect up to 500ml (or more) from drains in the first hour. If brisk bleeding continues, surgeons may clamp the drains temporarily.
- **Mobilization:** Exercises begin at 24 hours, with full mobilization targeted at 48 hours

Lecture13: Anesthetic Management for Pediatric Pyloric Stenosis/ Circumcision

1. Pyloric Stenosis

Pyloric stenosis is characterized by hypertrophy of the pyloric muscle, leading to a gastric outlet obstruction. 5:1 male predominance; typical presentation between **2 and 8 weeks** of age (average: 5–6 weeks).



- **Clinical Signs:** Persistent, non-bilious **projectile vomiting**.
- **Physical Exam:** A palpable "olive-shaped" mass in the epigastrium.
- **Diagnosis:** Primarily via **ultrasound**.

2. Metabolic Consequences:

Frequent vomiting of gastric contents (hydrochloric acid) leads to a specific and dangerous electrolyte profile:

1. **Hypochloremic** (Loss of Cl-)
2. **Hypokalemic** (Loss of K+)
3. **Metabolic Alkalosis** (Loss of H+)

Dehydration: Sunken fontanels, poor skin turgor, lethargy, and decreased urine output. In severe cases, plasma chloride can drop to 65–70 mEq/dL.

3. Surgical Procedure: Pyloromyotomy

- **Technique:** The surgeon performs a longitudinal incision through the hypertrophied pyloric muscle fibers (pyloromyotomy).

4. **Approach:** Can be performed via a small open epigastric incision or laparoscopically

4. Preoperative Optimization

Pyloric stenosis is not a surgical emergency. Surgery should only proceed after the infant is hemodynamically stable and the metabolic alkalosis is corrected (this may take 12–72 hours).

- **Fluid Resuscitation:**
  - Initial bolus: 10–20 mL/kg of Normal Saline or Lactated Ringer's.
  - Maintenance: 5% Dextrose in 0.45% Saline + Potassium Chloride (KCl).
- **Readiness Criteria:** * Normal vascular volume and adequate urine output.
  - Serum Chloride **>100 mEq/L**.

5. Intraoperative Management

A. Pre-Induction Preparation

- **Aspiration Risk:** The patient is considered to have a **"full stomach"** despite vomiting.
- **Gastric Decompression:** A large-bore orogastric (OG) tube must be passed to evacuate gastric contents in the supine, left, and right lateral positions before induction.

B. Induction and Airway

- **Technique:** A **Rapid Sequence Induction (RSI)** or modified RSI is standard to prevent aspiration.
- **Medications:** * Preoxygenation is vital (infants have 2 -3times the O2 consumption of adults).
  - Pretreatment: **Atropine** (to prevent bradycardia).
  - Induction: Propofol (2–2.5 mg/kg).
  - Paralysis: Succinylcholine (1–2 mg/kg) or Rocuronium.
- **Cricoid Pressure:** Applied until the trachea is intubated and the cuff (if used) is inflated.

C. Maintenance and Analgesia

- **Maintenance:** Volatile anesthetics (Sevoflurane/Isoflurane).
- **Opioid Avoidance:** Opioids are generally **avoided** because they increase the risk of postoperative apnea.
- **Analgesic Alternatives:**
    - Local anesthetic infiltration of the incision by the surgeon.
    - Acetaminophen or Ketorolac.
    - Regional: Caudal block.

6. Emergence and Postoperative Care

A. Extubation

- The infant must be **fully awake** with the return of airway protective reflexes and a regular breathing pattern.
- Muscle relaxants must be fully reversed.

B. The Risk of Postanesthetic Apnea

Infants with pyloric stenosis are at high risk for apnea for two reasons:

1. **CSF Alkalosis:** Metabolic alkalosis increases the pH of the cerebrospinal fluid, which blunts the central respiratory drive. This effect can persist for **12–48 hours** after the electrolytes are normalized.
2. **Immaturity:** Respiratory drive may not be fully mature until **44 weeks postconceptual age**.

- **Monitoring:** All patients should be monitored for **12–24 hours postoperatively** for apnea and bradycardia.

Circumcision

1. Procedure Overview

- **Definition:** Removal of the prepuce (foreskin).
- **Time:** Approximately 20 minutes.
- **Position:** Supine.
- **Pain Level:** Moderate to Severe (++). It is considered one of the most painful pediatric outpatient procedures.

- **Blood Loss:** Minimal.
- **Modern Trends:** A move toward conservative management (e.g., preputioplasty or stretching) is becoming more common.

2. Preoperative Considerations

- **Day-Case Surgery:** Patients are typically healthy outpatients (ASA I or II).
- **Consent:** It is essential to obtain specific consent for:
    - **Suppositories** (Analgesic administration).
    - **Regional blocks** (The cornerstone of pain management for this procedure).

3. Perioperative Management

A. Airway and Induction

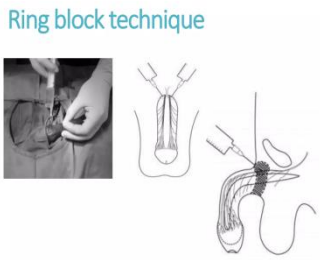
- **Induction:** Can be achieved via inhalational (Sevoflurane) or intravenous (Propofol) routes.
- **Airway:** Maintenance is usually via a Laryngeal Mask Airway (LMA) with spontaneous ventilation (SV).

B. Regional Analgesia (Mandatory)

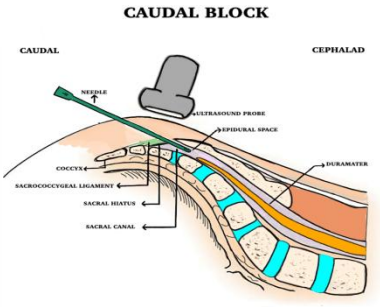
A regional block **must** be performed prior to the start of surgery to prevent central sensitization to pain.

Technique	Indication / Considerations
Caudal Block	Technically easier in infants; provides excellent coverage for the penis and surrounding skin.
Penile Block	Often preferred in children over **10 kg**; targets the dorsal nerves of the penis.
Ring Block	Easier in boys **> 5 kg**; provides consistent and excellent analgesia.

Penile Block



Ring block



Caudal block

C. Adjunctive Analgesia

- **Suppositories:** * **> 1 year:** Diclofenac suppository (1mg/kg).
    - **< 1 year:** Paracetamol suppository (30- 40 mg/kg).
- **Intravenous:** Paracetamol IV (15mg/kg if > 10 kg);(7.5 mg/kg if < 10 kg).

4. Postoperative Care and Discharge

- **Ongoing Pain:** Parents must be warned that the recovery period can be very painful.

Oral Analgesics: PRN Paracetamol (20mg/kg) should be continued for several days.
*Topical Relief: Lidocaine gel can be applied frequently to the surgical site (care must be taken not to exceed the total toxic dose).

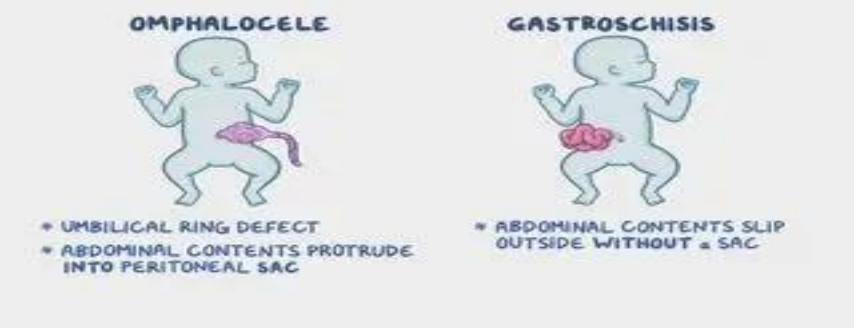
MCQ

1) Pyloric stenosis leads to a specific metabolic profile due to the loss of gastric contents. What is the classic electrolyte derangement seen in these infants?
A)Hyponatremic Metabolic Acidosis
B)Normal Electrolytes with Bilious Vomiting
C)Hyperkalemic Metabolic Alkalosis
D)Hyperchloremic Metabolic Acidosis
E)Hypochloremic, Hypokalemic, Metabolic Alkalosis
2) Which of the following regional techniques is considered technically easier in infants and provides excellent analgesia for circumcision?

A)Caudal Block
B)Spinal Anesthesia at L1-L2
C)Stellate Ganglion Block
D)Intercostal nerve block
E)Brachial Plexus Block
3) In the management of circumcision pain for a boy weighing 15 kg, what is the recommended intravenous dose of Paracetamol?
A)5 mg/kg
B)100 mg/kg
C)15 mg/kg
D)7.5 mg/kg
E)40 mg/kg

Lecture 14 :Anesthetic management for Omphalocele & Gastroschisis

Abdominal wall defects are neonatal surgical emergencies. While both involve the herniation of abdominal viscera, they have distinct embryological origins, associated risks, and management strategies.



1. Comparison and Clinical Presentation

Feature	**Omphalocele**	**Gastroschisis**
Location	**Central** (Umbilical ring)	**Lateral** (Right of umbilicus)
Sac	**Present** (Amnion/Peritoneum)	**Absent** (Exposed bowel)
Bowel State	Normal	Edematous / Matted

Feature	Omphalocele	Gastroschisis
Anomalies	**Common** (Cardiac, Genetic)	Rare (Atresia only)
Urgency	Elective (if sac intact)	**Emergency** (Heat/Fluid loss)

2. Perioperative Anesthetic Management

A. Preoperative Goals

- **Stabilization:** Focus on preventing **hypothermia, infection, and dehydration**.
- **Decompression:** The stomach **must** be decompressed with a nasogastric (NG) tube before induction to prevent aspiration and reduce bowel volume.

B. Intraoperative Management

- **Induction:** Can be accomplished awake or asleep, with or without muscle relaxation.
- **Nitrous Oxide (N2O): Avoid** to prevent further bowel distension.
- **Muscle Relaxation:** Mandatory to facilitate the replacement of the bowel into the abdominal cavity.
- **Fluid Management:** Replace "third-space" losses with:
    1. Balanced salt solutions.
    2. 5% Albumin.

3. The Staged Closure & Surgical Criteria

A one-stage closure (primary repair) is often avoided to prevent **Abdominal Compartment Syndrome**. Instead, a temporary **Silastic "silo"** is used.

*Criteria for Aborting Primary Repair (Switching to Staged Closure):

According to the guidelines, if any of the following thresholds are exceeded during the attempt to close the abdomen, a **staged closure** is necessary:

- **Intragastric/Intravesical Pressure:** > 20 H2O.
- **Peak Inspiratory Pressure (PIP):** > 35 H2O.
- **End-tidal CO2 (EtCO2):** > 50 mm Hg.

4. Postoperative Care

- **Ventilation:** The neonate remains intubated after the procedure.
- **ICU Course:** Weaning from the ventilator typically occurs over the next **1–2 days** in the ICU as the abdominal wall adapts to the new pressure

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Lecture15: Sleeve Gastrectomy &Anesthesia

Sleeve Gastrectomy has become the most frequently performed bariatric procedure worldwide due to its efficacy in achieving significant weight loss and resolving obesity-related comorbidities, such as Type 2 Diabetes and Obstructive Sleep Apnea (OSA).

From an anesthetic perspective, these patients present unique physiological challenges. The combination of **morbid obesity**, **altered pharmacology**, and the mechanical effects of **pneumoperitoneum** requires a meticulous, multimodal approach. Success in the perioperative period depends on specialized airway positioning, lung-protective ventilation strategies, and precise weight-based drug dosing to ensure rapid emergence and the prevention of postoperative respiratory complications.

1. Preoperative Evaluation & Optimization

The primary goal is to identify and stabilize obesity-related comorbidities before surgery.

A. Respiratory Assessment

- **OSA Screening:** Mandatory use of the **STOP-BANG score**.
    - *High Risk:* 5–8 | *Intermediate:* 3–4 | *Low:* 0–2.

STOP-BANG Screening Questionnaire

Letter	Criterion	Description / Question
S	**Snoring**	Do you **snore** loudly (louder than talking or heard through closed doors)?
T	**Tiredness**	Do you often feel **tired**, fatigued, or sleepy during the daytime?
O	**Observed**	Has anyone **observed** you stop breathing or choking during your sleep?
P	**Pressure**	Do you have (or are you being treated for) high blood **pressure**?
B	**BMI**	Is your Body Mass Index **more than 35 kg/m²**?
A	**Age**	Are you older than **50 years** of age?
N	**Neck**	Is your **neck circumference** > 40 cm (16") for females or > 43 cm (17") for males?
G	**Gender**	Are you **Male**?

- **OHS Evaluation:** Screen for **Obesity Hypoventilation Syndrome** if the patient shows hypercapnia or signs of pulmonary hypertension.

B. Cardiovascular & Metabolic

- **Cardiovascular:** Assess for hypertension, ischemic heart disease, and right-heart strain.
- **Metabolic:** Optimize glycemic control (**HbA1c**) and screen for metabolic syndrome.

C. Gastrointestinal (Aspiration Risk)

- Obese patients have a higher risk of **GERD** and delayed gastric emptying.
- **Prophylaxis:** Preoperative H2-blockers or PPIs are often indicated.

2. Intraoperative Management

A. Airway & Induction

- **Positioning:** Use the **Ramped Position (HELP - Head-Elevated Laryngoscopy Position)**. This aligns oral/pharyngeal/laryngeal axes and increases Functional Residual Capacity (FRC).
- **Preoxygenation:** Mandatory 3–5 minutes of 100% O2. Use **CPAP (10 cm H2O)** to prevent atelectasis and extend "safe apnea time."
- **Induction:** Typically a **Rapid Sequence Induction (RSI)** or modified RSI due to high aspiration risk.

B. Pharmacologic Dosing Principles

- **Induction (Propofol):** Dose based on **Lean Body Weight (LBW)**.
- **Maintenance:** Volatile agents with low fat solubility (**Desflurane or Sevoflurane**) are preferred for faster emergence.
- **Neuromuscular Blockade (NMB):**
    - Dose based on **Ideal Body Weight (IBW)**.
    - **Reversal: Sugammadex** is the gold standard. It provides complete reversal (TOF > 0.9) within 2 minutes, preventing upper airway collapse compared to Neostigmine.

C. Ventilation Strategies

- **Protective Ventilation:** Low tidal volumes (6–8 mL/kg of **IBW**).
- **PEEP:** Higher levels (10–12 cm H2O) to counteract chest wall weight and pneumoperitoneum.
- **Recruitment Maneuvers:** Periodic "sigh" breaths to reopen collapsed alveoli.

3. Surgical & Physiological Challenges

A. Pneumoperitoneum (CO2 Insufflation)The physiological changes during laparoscopy are summarized below

Parameter	Change	Primary Cause
FRC	Decrease	Cephalad displacement of the diaphragm
Peak Airway Pressure	Increase	Decreased thoraco-abdominal compliance
PaCO2	Increase	Peritoneal absorption of CO_2 gas
SVR	Increase	Mechanical compression & catecholamine release

B. Reverse Trendelenburg Position

Used during sleeve gastrectomy to shift abdominal contents away from the surgical site.

- **Benefit:** Improves lung compliance.
- **Risk:** May decrease venous return and cardiac output.

4. Postoperative Management

- **Multimodal Analgesia:** The goal is to **minimize opioids** to prevent respiratory depression.
    - Use Acetaminophen, NSAIDs, and **TAP blocks** (Transversus Abdominis Plane).
- **OSA Care:** Resume the patient's home **CPAP** immediately in the PACU.
- **Early Ambulation:** Mandatory to prevent **DVT** and improve respiratory recovery.

MCQs

1) When calculating the pharmacological dose for the induction agent Propofol in an obese patient, which weight metric should be used?
A)Ideal Body Weight (IBW)

B)Total Body Weight (TBW)
C)Lean Body Weight (LBW)
D) Adjusted Body Weight
E. BMI-corrected weight

2) During laparoscopy (CO_2 insufflation), which of the following physiological changes is expected?
A)Increase in Functional Residual Capacity (FRC)
B) Decrease in Peak Airway Pressure
C)Decrease in Systemic Vascular Resistance (SVR)
D)Decrease in $PaCO_2$ due to hyperventilation
E) Increase in Peak Airway Pressure due to decreased compliance

3) During preoperative evaluation, a patient receives a STOP-BANG score of (6) How is this patient categorized regarding their risk for Obstructive Sleep Apnea (OSA)?
A)Low Risk
B)Intermediate
Risk
C) High Risk
D)Negative for OSA
E)Needs immediate OHS evaluation
4) What is the primary benefit of using the Reverse Trendelenburg position during a sleeve gastrectomy?
A)It increases venous return and cardiac output.
B) It shifts abdominal contents away from the surgical site and improves lung compliance.
C)It decreases the risk of deep vein thrombosis (DVT).
D)It prevents the absorption of CO_2 into the bloodstream.
E)It eliminates the need for PEEP (Positive End-Expiratory Pressure).