4. Sangyaharana (Anaesthesia)

Unit 4. Sañjñāharaṇa (Anaesthesia)

This chapter gives you an exam-ready, clinically usable view of local, regional, and general anaesthesia; pre-operative assessment; CPR; basic airway/intubation skills; and principles of safe surgery and surgical ethics. Modern topics—no ślokas required.

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1) Concept & Scope

Sañjñāharaṇa literally means "removal of consciousness/sensation." In today's practice this spans:

- **Sthānīya (Local anaesthesia, LA)** — loss of sensation in a small area; patient fully conscious.
- **Kṣetriya (Regional anaesthesia, RA)** — loss of sensation in a larger anatomical field by blocking nerves/neuraxis; variable sedation.
- **Sāmānya (General anaesthesia, GA)** — controlled unconsciousness with analgesia, amnesia, and often muscle relaxation.

Safety = **right patient + right technique + right drug + right monitoring**.

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2) Sthānīya Sañjñāharaṇa (Local Anaesthesia)

2.1 Medicines (commonly used; typical max doses)

Drug (Indian usage)	Conc.	Onset	Duration	Max dose mg/kg (w/o / with adrenaline*)	Notes
Lidocaine (Lignocaine)	1–2%	2–5 min	45–90 min	**3 / 7**	Versatile; adrenaline 1:200,000 (5 µg/mL) prolongs effect
Bupivacaine (0.25–0.5%)	0.25–0.5%	5–10 min	3–8 h	**2 / 3**	Long-acting; cardiotoxic in overdose
Levobupivacaine	0.25–0.5%	5–10 min	3–8 h	**2**	Less cardiotoxic than racemic bupivacaine
Ropivacaine	0.2–0.75%	5–10 min	3–6 h	**3**	Good motor-sparing at lower conc.
Prilocaine	1–2%	5–10 min	1–2 h	**6**	Risk of **methemoglobinaemia** (esp. high dose)

*Adrenaline **contraindicated** in end-artery fields (digits, penis, ear, nose tip) and when severe peripheral vascular disease exists.

2.2 Techniques (with indications)

- **Topical** (EMLA, viscous lignocaine): minor dermal, ENT/oral mucosa.
- **Infiltration**: simple laceration repair, skin biopsy, incision & drainage.
- **Field block**: larger skin areas (e.g., hernia incision line).
- **Ring/Digital block**: finger/toe procedures (use **plain** LA).
- **Tumescent**: dermatologic/plastic surgery (very dilute lidocaine + adrenaline).

Indications: Minor skin/soft tissue surgery; analgesia around wound; adjunct to RA/GA.
Contraindications: Patient refusal; true **amide-LA allergy** (rare); infection at site; distorted anatomy; severe coagulopathy near neurovascular bundles.

2.3 Complications & Management

- **Pain on injection** → warm solution, small gauge needle, buffer with sodium bicarbonate (1 mL 8.4% in 10 mL lidocaine).
- **Hematoma/vascular injection** → aspirate before injecting, compress.
- **Nerve injury** → avoid intraneural injection (paresthesia pain = reposition).
- **Methemoglobinaemia** (prilocaine, benzocaine): cyanosis with normal PaO_2 → **methylene blue 1–2 mg/kg IV**.
- **Local Anaesthetic Systemic Toxicity (LAST):**
  - **Early CNS**: tinnitus, circumoral numbness, metallic taste, agitation → seizures.
  - **CVS**: hypotension, arrhythmia, cardiac arrest (bupivacaine).
  - **Management (core points):** Stop LA; call help; **100% O_2**, airway support; **benzodiazepine** for seizures; **small-dose adrenaline** for hypotension; **avoid** vasopressin, large propofol boluses. **Intralipid 20%**: **1.5 mL/kg IV bolus**, then **0.25 mL/kg/min** infusion; repeat bolus q3–5 min if unstable; **max ~10 mL/kg in 30 min**.

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3) Kṣetriya & Sāmānya Sañjñāharaṇa (Regional & General)

3.1 Regional Anaesthesia (RA)

(A) Neuraxial — Spinal, Epidural, CSE

- **Spinal**: small volume into subarachnoid space (e.g., 1.6–3 mL **0.5% heavy bupivacaine**).
  - **Indications:** Infra-umbilical, lower limb, obstetrics (C-section with additives).
  - **Contraindications:** Refusal, **infection at site**, **coagulopathy/anticoagulation**, **hypovolaemia**, **raised ICP**, severe aortic stenosis.
  - **Complications: Hypotension/bradycardia** (treat fluids + **phenylephrine 50–100 µg** or **ephedrine 5–10 mg**, **atropine 0.6 mg** if needed); **high/total spinal** (airway/ventilate, vasopressors); **PDPH** (fluids, caffeine; **epidural blood patch** if severe); urinary retention, TNS (rare).
- **Epidural**: catheter in epidural space; incremental dosing (test dose e.g., **3 mL 1.5% lidocaine + adrenaline 1:200,000**).
  - **Uses:** Labour analgesia; thoraco-abdominal/lower limb surgery; post-op analgesia.
  - **Complications:** Intravascular/intrathecal misplacement (dose incrementally, frequent aspiration), **epidural hematoma/abscess** (new neuropathy → **urgent MRI + neurosurgical consult**).

(B) Peripheral Nerve & Truncal Blocks

- **Upper limb:** interscalene, supraclavicular, infraclavicular, axillary.
- **Lower limb:** femoral, adductor canal, popliteal sciatic, ankle block.
- **Truncal:** TAP, rectus sheath, PECS, erector spinae plane (ESP).
- **Techniques:** Landmark, nerve stimulator, **ultrasound-guided** (preferred for safety/accuracy).
- **Indications:** As sole anaesthesia or multimodal analgesia; reduces opioids.
- **Contraindications:** Refusal; infection at site; distorted anatomy; **anticoagulation**—weigh per site.
- **Complications:** Hematoma, pneumothorax (supraclavicular), nerve injury, **LAST** (see above). Use **incremental aspiration**, lowest effective dose, US to visualise spread.

3.2 General Anaesthesia (GA)

Core steps: Pre-oxygenation → **induction** (IV/inhalational) → **airway secured** (ETT/LMA) → **maintenance** (volatile + O_2/air + analgesia ± muscle relaxant) → **emergence** and recovery.

Common drugs (adult, typical doses):

- **Induction:** Propofol **2 mg/kg** (hypotension), Thiopentone **3–5 mg/kg**, Ketamine **1–2 mg/kg** (maintains BP, bronchodilation), Etomidate **0.2–0.3 mg/kg** (CV stability).
- **Opioids:** Fentanyl **1–2 µg/kg**, Morphine **0.1 mg/kg**.

- **NMBDs:** Succinylcholine **1–1.5 mg/kg** (RSI), Rocuronium **0.6–1.2 mg/kg**, Vecuronium **0.1 mg/kg**.
- **Maintenance volatiles:** Sevoflurane, Isoflurane, Desflurane; **TIVA** (propofol infusion) as alternative.
- **Reversal:** Neostigmine **0.05 mg/kg** + Glycopyrrolate **0.01 mg/kg**, or **Sugammadex** (for rocuronium).

Indications: Major surgery; uncooperative/paediatric patients; procedures needing absolute immobility or long duration.
Relative cautions: Predicted **difficult airway**, **full stomach** (aspiration risk—**RSI**), severe cardiorespiratory compromise, **malignant hyperthermia (MH) susceptibility**.

Complications & Management

- **Airway trauma/aspiration:** RSI with cricoid (centre-specific), cuffed tube; **suction**, PEEP, bronchoscopy if needed.
- **Hemodynamic instability:** Titrate induction; vasopressors/fluids.
- **Anaphylaxis: Adrenaline 10–100 µg IV**, fluids, antihistamine, steroids; stop offending agent.
- **Awareness:** Adequate end-tidal MAC/processed EEG (where available).
- **PONV:** Risk stratify; **ondansetron 4 mg**, **dexamethasone 8 mg** (at induction), multimodal.
- **MH:** Stop triggers; **dantrolene 2.5 mg/kg IV** (repeat to control), active cooling, treat hyperkalaemia/acidosis.

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4) Principles of Pre-operative Assessment

1. **Confirm procedure** & side; **informed consent**.
2. **History**: comorbidities (cardiac, pulmonary, renal, liver, endocrine), prior anaesthesia issues, allergies, medications (anticoagulants, antiplatelets, SGLT2 inhibitors), OSA symptoms.
3. **Functional capacity (METs)** & **ASA** class (I–VI).
4. **Airway assessment:** Mallampati, inter-incisor gap, thyromental distance, neck mobility, dentures/loose teeth.
5. **Examination**: vitals, cardiorespiratory; fasting status.
6. **Labs** when indicated: Hb, renal function, sugar; ECG, CXR/echo case-by-case.
7. **Optimisation:** control DM/HT; smoking cessation ≥4 weeks; treat anaemia; stop **SGLT2** 3 days pre-op; manage anticoagulation per guideline.
8. **Fasting** (adults): **clear fluids 2 h; breast milk 4 h; light solids 6 h**.
9. **Prophylaxis:** antibiotics within **60 min** of incision (agent per procedure), DVT measures, multimodal analgesia plan.
10. **Plan & backup:** primary technique + rescue airway/analgesia; document risk discussion.

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5) Demonstration / Hands-on: CPR (Adult, single & team rescuer)

BLS sequence (memorise this order):

1. **Safety** → 2) **Response** (tap & shout) → 3) **Call for help / activate code** & **get AED** → 4) **Check breathing & carotid pulse ≤10 s** →
2. **If no pulse**: start **CPR 30:2**, **rate 100–120/min**, **depth 5–6 cm**, full recoil, change compressor every 2 min.
3. **AED arrives**: attach pads, **follow prompts**, **shockable?** deliver shock and resume compressions immediately.
4. **Healthcare provider with advanced airway**: continuous compressions **100–120/min** + **1 breath every 6 s**.
5. **ACLS drugs (team setting)**: Adrenaline **1 mg IV q3–5 min**; **amiodarone 300 mg** (then 150 mg) for refractory VF/pVT.
6. **Post-ROSC**: airway, oxygenation, BP ≥90 mmHg systolic, targeted temperature management per protocol.

Quality points: Minimise pauses; ensure chest recoil; confirm $EtCO_2$ if advanced airway (target ≥10–20 mmHg during CPR).

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6) Demonstration / Hands-on: Airway Maintenance & Intubation (Mannequin)

Basic airway

- **Head-tilt chin-lift** (no trauma) or **jaw thrust** (suspected C-spine).
- **OPA** size: corner of mouth → angle of mandible; insert with curve to palate then rotate.
- **NPA** size: nostril → tragus; lubricate; avoid if base of skull fracture suspected.
- **Bag-Valve-Mask (BVM)**: **E-C clamp**, two-hand seal if possible; deliver visible chest rise.

Endotracheal intubation (ETT)

1. **Pre-oxygenate** 3–5 min. Prepare suction, laryngoscope (Mac 3–4), ETT (**male 8.0–8.5**, **female 7.0–7.5**), stylet, syringe, capnograph.
2. **Induction & paralysis** (centre-specific).
3. **Laryngoscopy**: open mouth, insert blade to sweep tongue, lift along handle axis; **see epiglottis → cords**.
4. **Pass ETT** through cords; remove stylet; inflate cuff. **Depth** at teeth: **~21 cm (male), ~19 cm (female)**.
5. **Confirm**: bilateral chest rise, **$EtCO_2$ waveform (≥3–5 consistent waves)**, equal air entry; secure tube; note depth.
6. **If cannot intubate, can ventilate** → LMA, wake-up or alternate plan. **Cannot intubate, cannot oxygenate** → front-of-neck access (cricothyrotomy) per algorithm.

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7) Principles of Safe General Surgery & Surgical Ethics

7.1 Safety systems

- **WHO Surgical Safety Checklist** (sign-in, time-out, sign-out).
- **Antibiotic prophylaxis** timing; **DVT prophylaxis**; **thermal** and **glycaemic** control.
- **Counting** sponges/needles; labelling specimens; safe energy device use.
- **Asepsis**: zones, hand hygiene, sterilisation validation; **no jewellery**, minimal traffic.
- **Handover communication** (SBAR), documentation, incident reporting & learning.

7.2 Surgical ethics (remember the four pillars)

- **Autonomy** (informed consent, respect choices).
- **Beneficence** (do good): choose technique that maximises benefit.
- **Non-maleficence** (do no harm): avoid unsafe shortcuts; disclose and rectify errors.
- **Justice** (fair access, triage by need).
  Plus: confidentiality, transparency, avoidance of conflicts of interest, competence & supervision of trainees, end-of-life sensitivity, truthful certification.

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8) High-Yield Revision (60-second whip-round)

- **LA max doses:** Lido **3/7**, Bupiv **2/3**, Ropi **3**, Prilo **6** mg/kg.
- **LAST**: stop LA → O_2 → benzo → **Intralipid 1.5 mL/kg bolus**, then **0.25 mL/kg/min** (max ~10 mL/kg/30 min).
- **Spinal CIs**: refusal, infection, coagulopathy, hypovolaemia, raised ICP, critical valve lesions.
- **Epidural test dose**: **3 mL 1.5% lidocaine + adrenaline**.
- **GA quick set**: Propofol 2 mg/kg; Rocuronium 1 mg/kg (RSI 1.2); Fentanyl 1–2 µg/kg; Sevo maintenance; Neostigmine + Glycopyrrolate for reversal.
- **Fasting**: 2–4–6 rule (clear fluids–breast milk–solids).
- **CPR**: 100–120/min, 30:2, AED ASAP; $EtCO_2$ monitoring if advanced airway.
- **Intubation confirmation**: **$EtCO_2$ waveform** is king.

Assessment

A. MCQs (Single Best Answer)

1. Maximum safe **lidocaine** dose **with adrenaline** is approximately:
   a) 3 mg/kg b) 5 mg/kg c) **7 mg/kg** d) 9 mg/kg
2. **Absolute** contraindication to **spinal** anaesthesia:
   a) Mild anaemia b) **Infection at puncture site** c) Controlled HTN d) Previous LSCS
3. **Best immediate test** for correct ETT placement:
   a) Chest rise only b) Auscultation only c) **Continuous capnography waveform** d) Mist in tube
4. First-line drug for **LA-induced seizures** in LAST:
   a) Phenytoin b) **Benzodiazepine (e.g., midazolam)** c) Large propofol bolus d) Haloperidol
5. **PDPH** is most likely after:
   a) Epidural with large Tuohy b) **Spinal with large cutting needle** c) Peripheral nerve block d) LMA use
6. For **RSI** in a full-stomach patient, the preferred NMBD is:
   a) Atracurium b) **Succinylcholine** c) Pancuronium d) Doxacurium
7. **Anaphylaxis** during induction—first drug:
   a) Chlorpheniramine b) Hydrocortisone c) **Adrenaline** d) Dopamine
8. In **MH**, the specific therapy is:
   a) Amiodarone b) **Dantrolene** c) Atropine d) Adenosine
9. Which block carries risk of **pneumothorax** if misdirected?
   a) Axillary b) **Supraclavicular brachial plexus** c) Femoral d) Adductor canal
10. **Adult CPR** compression rate and depth are:
    a) 80–100/min; 3–4 cm b) **100–120/min; 5–6 cm** c) 120–140/min; 7–8 cm d) 60–80/min; 4–5 cm

B. SAQs (3–5 lines each)

1. Outline the **pre-operative assessment** for a diabetic hypertensive scheduled for hernia repair.
2. List **four complications** of spinal anaesthesia and their **immediate** management.
3. Write the **LA toxicity (LAST)** treatment algorithm including lipid therapy.
4. Enumerate the **steps of adult BLS** in order.
5. Compare **supraclavicular** and **interscalene** brachial plexus blocks (indications, key risks).

C. LAQs

1. Discuss **Regional Anaesthesia** under headings: types (neuraxial/peripheral), indications, contraindications, drugs & dosing principles, techniques (landmark, nerve stimulator, ultrasound), complications (hypotension, PDPH, nerve injury, LAST) and their management.
2. Write a detailed note on **General Anaesthesia**: pre-oxygenation, induction choices, airway devices and confirmation, maintenance strategies, emergence, common complications (aspiration, anaphylaxis, PONV, MH) with management, and outline **ethical & safety** pillars including the WHO checklist.

End of Unit 4 — Sañjñāharaṇa (Anaesthesia)