

Introduction to Anaesthesia Monitoring

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Purpose: To ensure patient safety, maintain physiological stability, and detect problems early during the peri-operative period.

1. Why Monitoring Is Essential

Reason	Explanation
Safety	Detects hypoxia, hypotension, arrhythmias, and other life-threatening events before they become irreversible.
Depth of anaesthesia	Prevents awareness and excessive drug dosing that can cause delayed recovery or toxicity.
Physiologic balance	Maintains oxygen delivery, ventilation, circulation, temperature, and metabolic homeostasis.
Legal/ethical standards	Documentation of continuous monitoring meets professional guidelines and accreditation requirements.

2. Core Monitoring Modalities (Standard ASA/ESA Requirements)

Parameter	Typical Device	Key Variables Displayed	Normal Range (adults)
Electrocardiogram (ECG)	3-lead or 5-lead monitor	Heart rate, rhythm, ST-segment, QRS morphology	HR 60-100 bpm; sinus rhythm
Non-invasive blood pressure (NIBP)	Oscillometric cuff	Systolic, diastolic, MAP	90-140 mmHg / 60-90 mmHg / MAP 70-105 mmHg
Pulse oximetry (SpO ₂)	Finger probe, transmission or reflectance sensor	Oxygen saturation, pulse rate, perfusion index	SpO ₂ > 95%

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Parameter	Typical Device	Key Variables Displayed	Normal Range (adults)
Capnography (ETCO₂)	Mainstream or sidestream infrared sensor	End-tidal CO ₂ , waveform, respiratory rate	ETCO ₂ 35-45 mmHg
Temperature	Skin probe, esophageal or nasopharyngeal probe	Core temperature	36.5-37.5°C
Neuromuscular monitoring (when muscle relaxants used)	TOF (train-of-four) or EMG device	TOF ratio, fade	TOF ratio > 0.9 for adequate recovery
Depth of anaesthesia (optional but increasingly standard)	BIS, entropy, or processed EEG	Index (0-100)	BIS 40-60 for surgical anaesthesia

3. Additional / Situation-Specific Monitors

Situation	Monitor(s)	Rationale
Major cardiac surgery	Invasive arterial line, pulmonary artery catheter, transesophageal echo (TEE)	Precise MAP, cardiac output, mixed venous O ₂ sat
Neurosurgery	Invasive ICP monitor, cerebral oximetry (NIRS)	Detect intracranial hypertension, cerebral desaturation
Obstetric anaesthesia	Continuous fetal heart rate monitoring (if applicable)	Assess fetal well-being during maternal anaesthesia
Pediatric cases	Small-cuff pulse oximeter, pediatric capnography, temperature probe	Adjust for lower body mass, higher metabolic rate
Regional anaesthesia	Sensory level testing, hemodynamic monitoring	Detect high spinal/epidural spread, sympathetic block effects

4. Principles of Effective Monitoring

1. Continuous vs. Intermittent

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- Critical parameters (ECG, SpO₂, ETCO₂, NIBP) are observed continuously; NIBP may be measured every 3–5 min unless instability warrants more frequent checks.

2. Redundancy