Intracranial Pressure Monitoring Techniques

Invasive Techniques (Gold Standard)

Intraventricular Catheter (EVD – External Ventricular Drain)

- **Location**: Lateral ventricle
- **Advantages**:
  - Gold standard – measures true ICP
  - Allows cerebrospinal fluid (CSF) drainage
  - Can be recalibrated and zeroed
- **Disadvantages**:
  - Requires anatomical precision
  - Risk of infection and hemorrhage

Intraparenchymal Monitor (e.g., Codman, Camino)

- **Location**: Frontal white matter (brain parenchyma)
- **Advantages**:
  - Easier and faster to place than EVD
  - Lower infection rate
- **Disadvantages**:
  - Cannot drain CSF
  - Cannot be recalibrated – may drift over time

Subdural / Epidural Sensors

- **Location**: Subdural or epidural space
- **Advantages**:
  - Less invasive
- **Disadvantages**:
  - Less accurate
  - Rarely used today

Subarachnoid Bolt

- **Location**: Subarachnoid space
- **Advantages**:
  - Moderate accuracy
- **Disadvantages**:
  - Cannot drain CSF

Non-Invasive Techniques (Adjuncts or Experimental)

Transcranial Doppler Ultrasonography (TCD)

- Measures cerebral blood flow velocity and pulsatility index
- Indirect correlation with ICP

Optic Nerve Sheath Diameter (ONSD) via Ultrasound

- Detects optic nerve sheath dilation due to raised ICP
- Rapid bedside screening tool

MRI / CT-Based Morphometrics

- Measures ventricular size and brain shifts
- Not continuous monitoring

Tympanic Membrane Displacement

- Measures displacement due to CSF pressure transmission to cochlea
- Experimental

Comparative Table

Parameter	Intraventricular	Intraparenchymal	Non-Invasive
Accuracy	High	High	Low–Medium
CSF drainage	Yes	No	No
Infection risk	High	Moderate	None
Recalibration possible	Yes	No	No
ICU use	Yes	Yes	Rare/Adjunct only