

Intraoperative guidance refers to the use of various technologies and techniques during surgery to provide real-time information, aiding the surgical team in making accurate decisions and improving patient outcomes. It encompasses a wide range of modalities that enhance precision during procedures, such as:

### 1. Imaging Technologies:

1. **Fluoroscopy:** Used for real-time X-ray imaging, often for procedures involving bones or the spine.
2. **CT (Computed Tomography) and MRI (Magnetic Resonance Imaging):** Provide detailed, 3D imaging to help guide surgeons in complex surgeries, particularly in neurosurgery or tumor resections.
3. **Ultrasound:** Can offer real-time feedback, often used in neurosurgery or cardiology to guide catheter placements or assess soft tissues.

### 2. Navigation Systems:

1. These systems often combine real-time imaging with computer-assisted tools to create a detailed map of the anatomy. Surgeons can track instruments in real-time, which is particularly useful in procedures like spinal surgery, brain tumor removal, and orthopedic surgeries.
2. Examples include the use of **stereotactic navigation** or **robot-assisted surgery**.

### 3. Electrophysiological Monitoring:

1. **Intraoperative neurophysiological monitoring (IONM):** Provides real-time feedback about nerve function during surgeries, especially in spinal, brain, and peripheral nerve surgeries. It helps avoid injury to critical neural structures.
2. **Motor evoked potentials (MEPs)** and **somatosensory evoked potentials (SSEPs)** are common modalities used in this context.

### 4. Fluorescence-guided Surgery:

1. In some procedures, **fluorescent dyes** are used to highlight specific tissue types or abnormalities. For instance, **5-ALA** is used in brain tumor surgeries to help differentiate tumor tissue from normal brain tissue.

### 5. Robotic Surgery Systems:

1. Robotics, like the **da Vinci Surgical System**, offer surgeons enhanced precision, control, and visualization through minimally invasive techniques. This can reduce recovery times and improve surgical outcomes.

Incorporating intraoperative guidance improves surgical precision, minimizes complications, shortens recovery time, and enhances overall patient safety.

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