ROBOTIC SURGERY

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Robotic surgery is the use of robots in performing surgery.
It is used as a tool to extend the surgical skills of a trained surgeon.
Basic SETUP for Robotic Surgery consists of:

- Surgeon Console
- Image Processing Equipment
- Endowrist Instruments
- Surgical Arm Cart
- Hi-Resolution 3D Endoscope
Operating Room

1. Surgeon Console
2. Image Processing Equipment
3. Endowrist Instruments
4. Surgical Arm Cart
5. Hi-Resolution 3-D Endoscope
SUR GEON CONSOLE

- Surgeon situated at this console.
- Several feet away from the patient operating table.
- Highly-sensitive motion sensors.
IMAGE PROCESSING EQUIPMENT

- 3D reconstruction of important anatomical structures.
- Display the microsurgical anatomy of various internal operations.
ENDOWRIST INSTRUMENTS

- Allow robotic arms to animate human movements.
- Function of each instrument is switched from one to the other using quick-release levers on each robotic arm.
- Instrument has abilities to rotate in full circles
- Intuitive Masters technology has ability to filter out hand tremors.
Surgical Arm Cart

- Consists of two or three instrument arms and one endoscope arm.
- Handles motions are sensed by high-resolution motion sensors.
- Unintended movements caused by human tremor are filtered.
Hands position corresponds to instrument tip orientation
HI-RESOLUTION 3D ENDOSCOPE

- Endoscope arm provides enhanced three-dimensional images.
- Endoscope is programmed to regulate the temperature of the endoscope tip automatically to prevent fogging during the operation.
- Enables the surgeon to quickly switch views through the use of a simple foot pedal.
Steps involved in Robotic Surgery

- Planning Stage
- Registration Stage
- Navigation Stage
PLANNING STAGE

- Surgeons take images of the patient's body to determine the right surgical approach.
- Common imaging methods
  - **Computer tomography** (CT) scans,
  - **Magnetic resonance imaging** (MRI) scans
  - **X-ray** scans
- Determine the surgical pathway the robot will take.
Registration Stage

Surgeon finds the points on the patient's body that correspond to the images created during the planning phase.
NAVIGATION STAGE

Involves the actual surgery.
Types Of Robotic Surgery Systems

- Supervisory-controlled Robotic Surgery Systems
- Shared-control Robotic Surgery Systems
- Telesurgery
Supervisory-controlled Robotic Surgery Systems

- Follow a specific set of instructions when performing a surgery.
- Human surgeon must input data into the robot.
- Robot initiates a series of controlled motions and completes the surgery.
- Robots can't make adjustments in real time if something goes wrong.
SUPERVISORY-CONTROLLED ROBOTIC SURGERY SYSTEMS
**Shared-control Robotic Surgery Systems**

- Surgeons must operate the surgical instruments themselves.
- Robotic system monitors the surgeon's performance.
- Shared-control system robots don't automatically know the difference between a safe region versus a forbidden region.
Shared-control Robotic Surgery Systems
TELESURGERY

- Allows surgeons to operate on people who are physically separated from them.
- Done through a master-slave robot, with imaging supplies through video cameras configured to provide a stereoscopic view.
- Surgeon relies on a 3D virtual representation of the patient.
MAJOR ADVANCES AIDED BY SURGICAL ROBOTS

- Remote Surgery
- Robotically Assisted Minimally Invasive Surgery
- Unmanned Surgery
Remote Surgery: Ability for a doctor to perform surgery on a patient even though they are not physically in the same location.

Robotically Assisted Minimally Invasive Surgery: Consists of a planning, validation and simulation phase in order to propose optimal incisions sites for the robot.

Unmanned Surgery: Unmanned Surgery is a future prospect of Robotic Surgery in which surgery is supposed to be done without any human involvement i.e. it is done by robots having artificial intelligence.
ADVANTAGES

- Patient side benefits include

  - Reduced pain and trauma
  - Fewer complications
  - Less blood loss and need for transfusions
  - Less post-operative pain and discomfort
  - Less risk of infection
  - Faster recovery and shorter hospital stay
  - Less scarring and improved appearance
Surgeon side benefits include

- Surgery is easier and more accurate
- Robotic assistants can also decrease the fatigue that doctors experience during surgeries that can last several hours.
- Compensate hand tremors of surgeon.
LIMITATIONS

- Major obstacle in telesurgery-latency.
- Surgeons and staff need special training.
- Hand-eye coordination is compromised.
- Instruments are not in the surgeon's direct control, being manipulated by assistants.
- Expensive to obtain, maintain, and operate.
APPLICATION

- General surgery
- Cardiothoracic Surgery
- Cardiology and Electrophysiology
- Gastrointestinal surgery
- Gynecology
- Neurosurgery
- Orthopedics
CONCLUSION

- Gives greater vision, dexterity and precision than possible with standard minimally invasive surgery.
- Current practical uses are mostly confined to smaller surgical procedures.
- Some major disadvantages-latency, high cost.
- Robotic surgery is still in its infancy and its niche has not yet been well defined.
THANK YOU