Remote Telesurgery

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What is Remote Telesurgery?

- Any surgery in which the surgeon and the patient are not in the same location

- Acts as a sort of telepresence, or the ability to effect a location different than one’s own
  - Phones calls
  - Video conference calls
  - Home climate changing apps (turn on/off lights from phone)

- Remote Telesurgery allows for patients to receive care from specialized surgeons from their local hospital
What is Needed?

1. One or more arms
   a. Many different instruments can be connected to the arms depending on the surgery
   b. Endoscopic camera

2. Master Controller (Console)
   a. Allows for surgeon’s input commands
   b. Displays view of operation

3. Sensory Response System
   a. **Haptic technology**
How Does it Work?

- There are two subsystems:
  - “Surgeon-side”
    - Console with a few input devices (usually two arm-like controllers) and at least once screen showing the real-time footage of the surgery
  - “Patient-side”
    - At least two robotic arms translating the surgeon’s inputs into mechanical movements
    - A robotic arm with a camera (generally endoscopic) to allow the surgeon to view the operation
    - Has a variety of surgical instruments for different purposes
    - Some robots could utilize up to 28 different medical devices
Asynchronous Transfer Mode (ATM) technology is the way in which data and communications between the two subsystems are linked.

A switching technique used by telecommunication networks that uses asynchronous time-division multiplexing to encode data into small, fixed-sized cells.

Different from Ethernet or internet which use variable packet sizes for data or frames.

Lag time should fall between 0ms - 200ms for a fully independant remote telesurgery.
The Lindbergh Operation

- September 7, 2001 - the first remote telesurgery
- Performed by Dr. Jacques Marescaux on the ZEUS Robot Surgical System
- Remote robot-assisted laparoscopic cholecystectomy on a 68-year-old woman
- Surgeons were in New York City and the patient in Strasbourg, France
- France Telecom provided High-speed terrestrial network (ATM service)
  - Redundant fiber optic ATM lines
- Mean time lag was 155 ms
Da Vinci Surgical Systems

- Not telesurgery - could theoretically be used as a telesurgical device
- Intuitive Surgical Inc.
  - Sunnyvale, California
- First robot assisted surgical system cleared by the FDA
- Has between 3-4 arms and allows the surgeon to have HD 3-D visuals of the surgery
- Used in close proximity to the operations
- Used for many different types of surgery
Concerns

- Reliability
  - Who will take responsibility for mishaps and accidents?
    - Robotic System
    - Operating Surgeon
    - Physicians Present
    - Network Servicing Company

- Cost Effectiveness
  - ZEUS Robot Surgical System: $975,000
  - da Vinci Surgical System: $1 million
  - Annual ATM service: $100,000-$200,000

- Accessibility
  - Requires specialized training as a robot surgeon
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<tr>
<th>Pros</th>
<th>Cons</th>
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<td>- Allows remote locations better access to healthcare</td>
<td>- Very expensive</td>
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<td>- Improved the dexterity, control, and precision compared to traditional surgery</td>
<td>- Performance affected by lag time and internet connections</td>
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<td>- Allows for more procedures to be classified as minimally invasive</td>
<td>- Requires specialized robotics training for surgeons</td>
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<td>- Procedures utilizing robotic systems have been deemed safe</td>
<td>- Lack of randomized controlled trials in comparison to traditional surgery</td>
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Conclusion

- Robotic surgery, although not a new technology still has much research to be completed before being accepted as the norm
- Will allow for more precise, less invasive surgeries
- Can be used in many different situations in which the available health care is not sufficient
  - War time (Trauma Pods)
  - Space
  - Remote areas
- New technology will allow for an even more interactive and realistic look at telesurgery
  - virtual reality, haptics, and telementoring
Citations


Image Citations


