TELESURGERY

By Amirali Banani

What is Telesurgery?

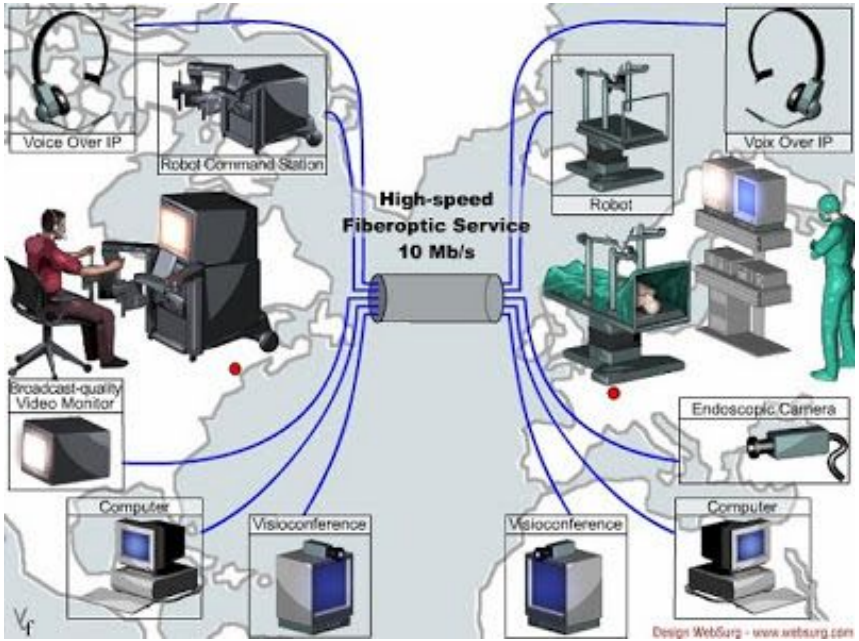
- Branch of Telemedicine
- Surgeon operates remotely in CR
- Robot performs surgery in OR
- Connects surgeons and patients who can not meet physically
- Becoming more prevalent with new wireless and robotic technology

Healthcare Benefits

- Significant reduction in healthcare and travel costs
- More timely access to emergency care
- Greater efficiency during surgery
- Allows healthcare services to be provided in underserved areas
- More sanitary

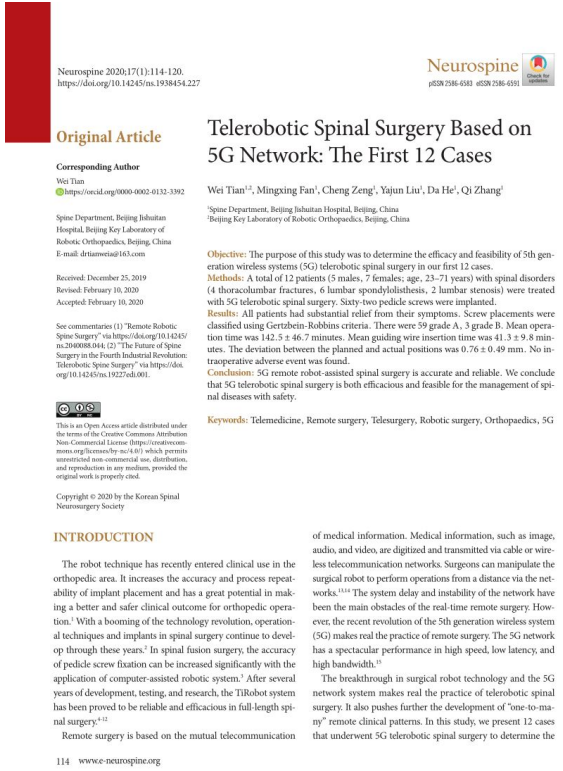
The Lindbergh Operation – 2001

- First successful telesurgery operation
- Surgeons in New York treated patient with cholelithiasis in France
- Two-hour-long laparoscopic cholecystectomy
- ZEUS Robotic Surgical System (ZRSS) was used
- Average lag time: 0.155 seconds
- No complications encountered



“One-to-many” Telerobotic Spinal Surgeries in China – 2019

- Surgeries performed on 12 patients with spinal injuries across 6 different cities
- Use of 5G network technology substantially reduced lag times → down to nearly **zero**
- 62 pedicle screws implanted by robot
- Concept of “one-to-many” explored
- These clinical series demonstrated that this concept is feasible



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Telerobotic Spinal Surgery Based on 5G Network: The First 12 Cases

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Objective: The purpose of this study was to determine the efficacy and feasibility of 5th generation wireless systems (5G) telerobotic spinal surgery in our first 12 cases.
Methods: A total of 12 patients (5 males, 7 females; age, 23–71 years) with spinal disorders (4 thoracolumbar fractures, 6 lumbar spondylolisthesis, 2 lumbar stenosis) were treated with 5G telerobotic spinal surgery. Sixty-two pedicle screws were implanted.
Results: All patients had substantial relief from their symptoms. Screw placements were classified using Gertzbein-Robbins criteria. There were 59 grade A, 3 grade B. Mean operation time was 142.5 ± 46.7 minutes. Mean guiding wire insertion time was 41.3 ± 9.8 minutes. The deviation between the planned and actual positions was 0.76 ± 0.49 mm. No intraoperative adverse event was found.
Conclusion: 5G remote robot-assisted spinal surgery is accurate and reliable. We conclude that 5G telerobotic spinal surgery is both efficacious and feasible for the management of spinal diseases with safety.

Keywords: Telemedicine, Remote surgery, Telesurgery, Robotic surgery, Orthopaedics, 5G

INTRODUCTION

The robot technique has recently entered clinical use in the orthopedic area. It increases the accuracy and process repeatability of implant placement and has a great potential in making a better and safer clinical outcome for orthopedic operation.[1] With a booming of the technology revolution, operational techniques and implants in spinal surgery continue to develop through these years.[1] In spinal fusion surgery, the accuracy of pedicle screw fixation can be increased significantly with the application of computer-assisted robotic system.[1] After several years of development, testing, and research, the TiRobot system has been proved to be reliable and efficacious in full-length spinal surgery.[4-12]

Remote surgery is based on the mutual telecommunication of medical information. Medical information, such as image, audio, and video, are digitized and transmitted via cable or wireless telecommunication networks. Surgeons can manipulate the surgical robot to perform operations from a distance via the networks.[13,14] The system delay and instability of the network have been the main obstacles of the real-time remote surgery. However, the recent revolution of the 5th generation wireless system (5G) makes real the practice of remote surgery. The 5G network has a spectacular performance in high speed, low latency, and high bandwidth.[15]

The breakthrough in surgical robot technology and the 5G network system makes real the practice of telerobotic spinal surgery. It also pushes further the development of “one-to-many” remote clinical patterns. In this study, we present 12 cases that underwent 5G telerobotic spinal surgery to determine the

Dr. Howard A. Paul – A Pioneer of Telerobotic Surgery

- Performed research on applying 3D imaging and robotics in the OR → the result was **Robodoc**
- Converted CT Scans into 3D virtual images
- Used primarily in complex knee and hip surgeries
- Operated in over 28,000 surgical procedures worldwide with a very high success rate
- Only robotic surgical device approved by the FDA

Robodoc

Key Takeaways

- As wireless and robotic technology improves, so does telesurgery
- Surgeons and therefore surgery can become more accessible
- Greater precision = more successful operations
- Many more lives can be saved in a shorter amount of time
- Automated robotic surgery → the next frontier?