Cyber Route 66 Wet-lab Over 2000 Miles

Telerobotic Surgical Procedures Between CA and IL Brings Future of Surgical Practice Closure to the Present

Yanghee Woo [1*], Francesco Maria Bianco[2], Yasmin Zerhouni[3], Clayton Lau[4], Dennis Fowler[5], Piet Hinoul[6], and Yuman Fong[1]

1. Division of Surgical Oncology, Department of Surgery, City of Hope Comprehensive Cancer Center,* Duarte, CA USA.; 2. Division of General Minimally Invasive & Robotic Surgery, Department of Surgery, University of Illinois, Chicago, IL USA; 3. Division of Colorectal Surgery, Department of Surgery, City of Hope Comprehensive Cancer Center, Duarte, CA USA; 4. Division of Urologic Oncology, Department of Surgery, City of Hope Comprehensive Cancer Center, Duarte, CA USA; Sovato Health Inc CA USA; Virtual Incisions Inc, NE, U.S.A.

INTRODUCTION

Tele-robotics promises enormous advancements in the field of surgery by providing remote surgeon expertise to save more lives and eliminate the need to travel for both the patient and the surgeon. However, several challenges to successful implementation of remote tele-robotic surgery including the optimal speed of wireless transmission (lag time <100ms), cybersecurity, technology affordability, and patient acceptance. We evaluated two novel surgical platforms that enable high-speed tele-robotic surgery to overcome these barriers.

METHODS AND PROCEDURES

The Sovato Platform (Connectivity System/Orchestration App) and Virtual Incision's MIRA (mini-single arm robotic surgical platform) were integrated to perform remote telesurgery between CA and IL (Figure 1). The procedures included cholecystectomy, colectomy, nephrectomy, gastric mobilization/gastrostomy&closure. Experienced robotic surgeons were seated at the console stationed in Santa Barbara, CA and the MIRA robot was deployed in the animals in an OR with two surgeons at the bedside in Chicago, IL. Network performance of latency time and bandwidth usage for all procedures and reliability of audio/visual communication were collected and analyzed. Questionnaires to evaluate surgeon perception about the telerobotic process were completed for each procedure.

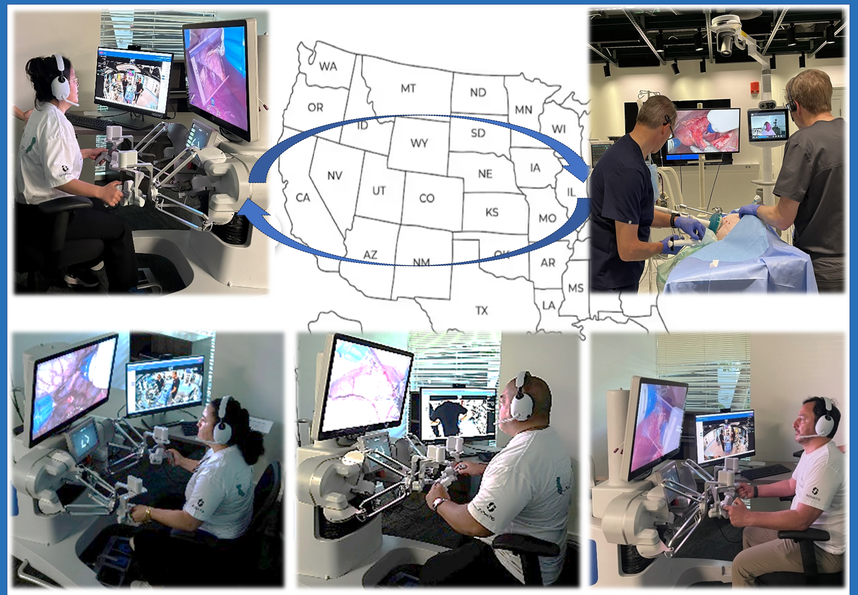


Figure 1. Remote Tele-Surgery Wet Lab Between CA and IL.
Surgeons on the console in Santa Barbara, CA controlling the robotic platform in Chicago, IL with two bedside surgeon assistants to perform 20 surgical procedures across 2000 miles per case.

RESULTS

We successfully completed 20 separate telerobotic operations between Santa Barbara, CA and Chicago, IL.

- Four console surgeons with 2 bedside assistants performed
  - ✓ 5 cholecystectomies
  - ✓ 5 gastrostomy and sutured repair
  - ✓ 5 colectomies
  - ✓ 5 nephrectomies
- No loss of robot instrument control or audio/visual communication.
- Total of 32,000 (one way) tele-surgical miles were achievd in 2 days.
- Network performance had exceptional :
  - ✓ **average latency of 58ms**
  - ✓ **peak latency of 65ms**
  - ✓ 0% packet loss over 2000 miles.

The robot intraoperative view to surgeon's console utilized 17.21 MBPS, from surgeon's console movement control to the robot (0.2999 Mbps) and bi-directional audio and video (3.3 Mbps).

Compared to conventional robotic surgery, the surgeons perceived "no difference" in 82% of the telerobotic procedures and "easier" (6%), "slightly easier" (6%), and "more difficult" (6%) with no procedure telerobotic procedure being "significantly more difficult".

CONCLUSION

We report for the first time a successful remote telerobotic operations with a lag time less than 100ms within the U.S. There were little to no surgeon perceived differences between tele-surgery and traditional in same room robotic procedures. Seamless wireless network integration of two cutting-edge surgical technologies, Sovato Platforms and Virtual Incision's MIRA brings remote tele-surgery closer to real-time surgical practice.

*yhwoo@coh.org