Journal of Institute of Medicine Nepal
Institute of Medicine, Kathmandu, Nepal

OPEN ACCESS

Case Report

JIOM Nepal. 2023 Apr;45(1):61-64.

Surgeon-Powered Robotics in Minimally Invasive Surgery: Case Report from Nepal

Sujan Shrestha[1,2], Sujan Gautam[1], Sandip Shrestha[1], Sushil K Subedi[1], Ajay KC[1], Susan Pradhan[1]

Author(s) affiliation

[1]*Pokhara Academy of Health Sciences, Western Regional Hospital, Pokhara, Nepal*

[2]*Department of Surgical Gastroenterology, Maharajgunj Medical Campus, Tribhuvan University Teaching Hospital, Institute of Medicine, Maharajgunj, Kathmandu, Nepal*

Corresponding author

Sujan Shrestha, MS, MCh
shresthasujan18@gmail.com

ABSTRACT

Minimally-invasive surgery is the standard of care in many surgical diseases. Robotic surgery has mitigated nearly all limitations of laparoscopic surgery but with a big cost tag. Surgeon-powered robotic instruments were developed with the concept of providing similar advantages to the robotic platforms but with affordable costs. We report three cases of hernia, one hiatus hernia, and two inguinal hernias managed using surgeon-powered robotics platform. It provides additional maneuverability in minimal invasive surgical dissection and suturing. Surgeon powered robotic surgery may be a cost-effective viable alternative to robotic surgery in developing country like Nepal.

Keywords

Hiatus hernia; inguinal hernia; Nissen fundoplication; robotic surgery; surgeon-powered robotic surgery

INTRODUCTION

Minimal invasive surgery (MIS) was introduced in 1980s and since has evolved over the following years to become standard of care for many surgical diseases.[1] The initial era of laparoscopic surgery suffered skepticism, criticism and censorship.[2] The next revolution in MIS surgery was the introduction of video laparoscopy.[3]

The limitations of laparoscopic surgery, such as tremors, hand instrument ergonomics and vision, were minimized by introduction of robotic surgery.[4] The disadvantage of classical robotic surgical platform was its cost, increased time for docking the instruments and main surgeon not being by the side of patient.[5]

Robotic-like wristed instruments were created to have the dexterity and instrumental ergonomic of classical robotic surgery.[6] By placing the robotic-like wristed instruments, a concept call surgeon-powered robotics (SPR), the benefits of robotic surgery can be achieved by the patient's side.[7] We hereby discuss our early experience with surgeon powered robotic assisted surgery in Western Regional Hospital (WRH), Pokhara, Nepal.

Submitted
Feb 11, 2023

Accepted
Mar 25, 2023

CASE 1

A 65 years old male presented with bilateral direct inguinal hernia to WRH, Pokhara. The patient underwent transabdominal preperitoneal inguinal hernia repair. For dissection and mesh fixation laparoscopic grasper on the left hand and laparoscopic Maryland dissector were used on right hand (Figure 1).

The peritoneal closure was done with 2-0 polyglactin suture using laparoscopic Maryland dissector and SPR needle driver on left and right hand respectively (Figure 2).

The total operative time was 100 minutes and there were no immediate post-operative complications. The patient was discharged on next day and had no complications during last follow up.

CASE 2

A 35 years old male presented with right indirect inguinal herniaWRH, Pokhara.The patient underwent transabdominal preperitoneal inguinal hernia repair. For dissection and mesh fixation laparoscopic grasper on the left hand and laparoscopic Maryland dissector were used on right hand (Figure 3).

The peritoneal closure was done with 2-0 polyglactin suture using laparoscopic Maryland dissector and SPR needle driver on left and right hand respectively (Figure 4).

The total operative time was 60 minutes. The patient was discharged on next day and had no complications during last follow up.

CASE 3

A 52 years old female presented with chronic heartburn, regurgitation and dysphagia. The patient was diagnosed with type 1 hiatus hernia with Barrett esophagus (Figure 5-6).

She underwent minimal invasive Nissen fundoplication. The dissection of the esophageal hiatus area and gastric fundus mobilization was done with normal laparoscopic hand instruments and

Figure 1. *Surgeon by the side of the patient with surgeon-powered robotic instrument (white arrow head).*

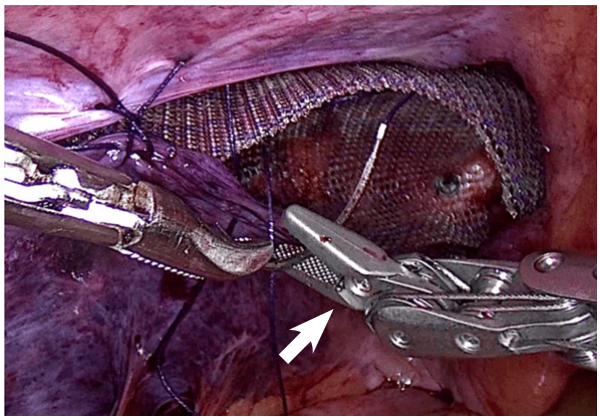

Figure 2. *Peritoneal closure with the help of SPR needle driver (white arrow).*

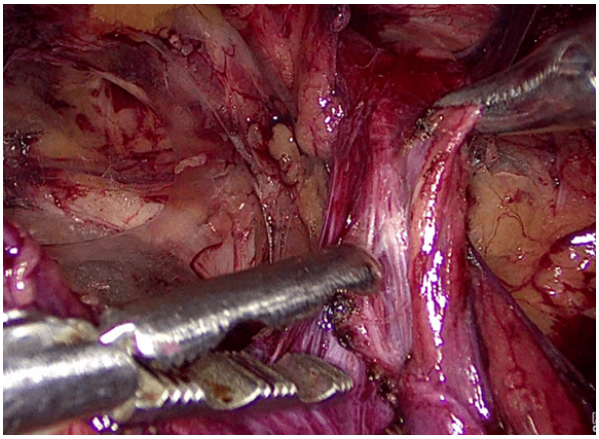

Figure 3. *Dissection of hernia with laparoscopic instruments.*

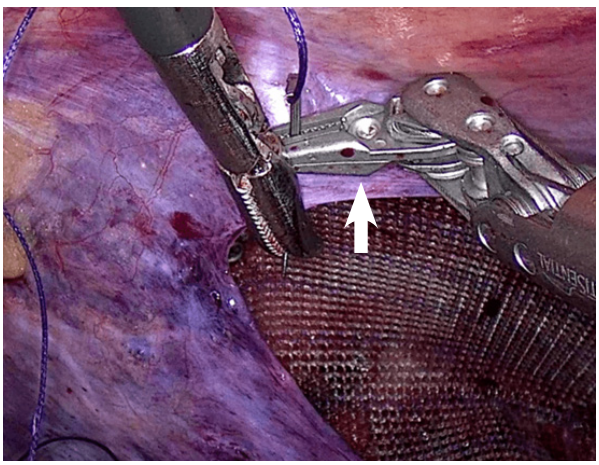

Figure 4. *Peritoneal flap closure using SPR needle driver (white arrow).*

Ligasure (Medtronic) device. Crural approximation and fundal wrap was done with 2-0 silk with SPR bipolar grasper on left hand, SRP needle driver and normal laparoscopic needle driver on the right hand as required (Figure 7-9).

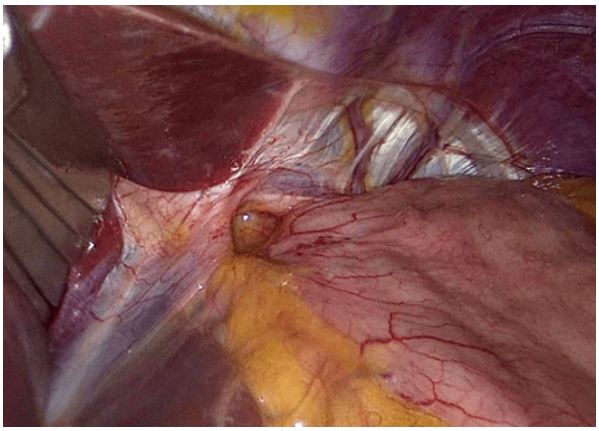

Figure 5. Type one sliding hiatus hernia

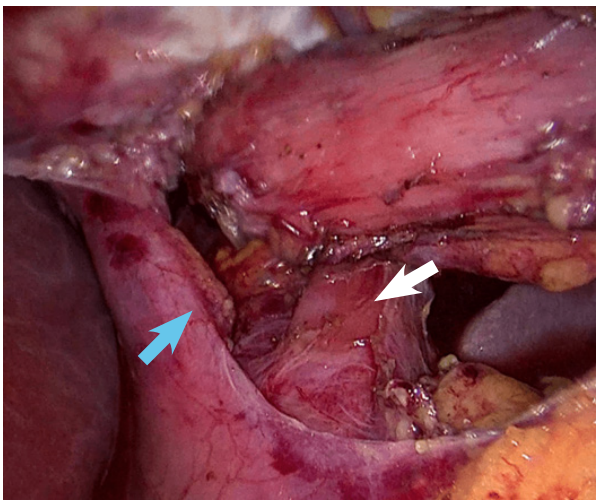

Figure 6. Widely separated right (blue arrow) and left crus (white arrow) of diaphragm

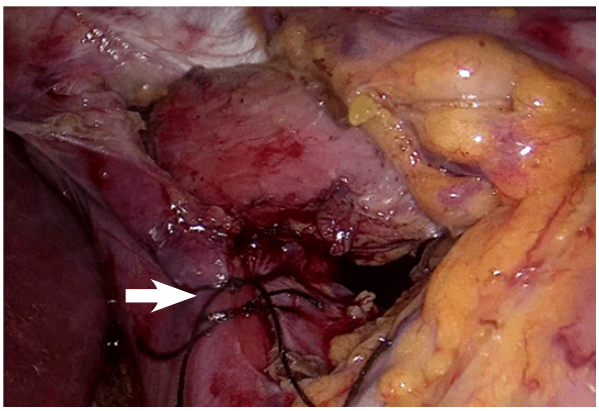

Figure 7. Approximation of crus of diaphragm with interrupted silk sutures (white arrow)

DISCUSSION

Minimal invasive surgery (MIS) has evolved over the years. The limitations of laparoscopic instruments were overcome by the introduction and development of robotic surgery.[5] The dexterity, enhanced vision and ergonomic advantage of robotic surgery came with unaffordable cost, at least in our scenario.

Conventional laparoscopic instruments lack dexterity and has limited range of motion, which is reflected by long learning curve for dissection and suturing during MIS.

The introduction of wristed laparoscopic, so called surgeon powered robotic instruments was solely based on the concept to provide similar dexterity and ergonomic advantage as provided by robotic instruments.[8] The advantages of SPR instruments, compared to the robotic platform is the main surgeon at the bed side rather than at a distant

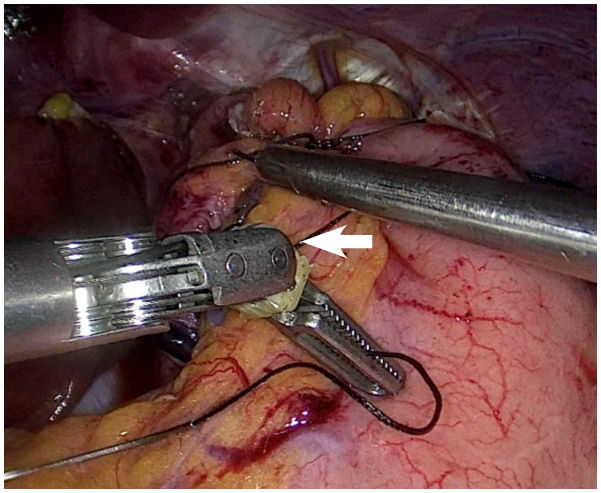

Figure 8. Fundal wrapping with SPR grasper (white arrow) and laparoscopic needle driver

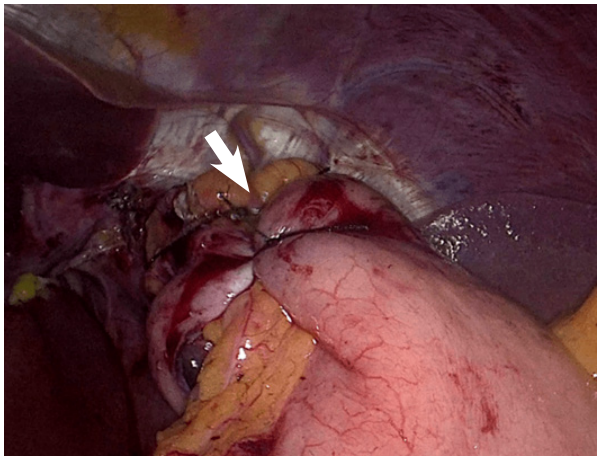

Figure 9. Completed Nissen 360-degree wrap (white arrow) using interrupted silk sutures

console and the cost of these SPR instruments. This idea of operating surgeon by the side is very important from safety and technical point of view. Rescue conversion is one of the important aspects in MIS surgery and operating surgeon by the side and scrubbed will save important golden time for rescue intraoperative complications.[6] SPR instruments have better haptic feedback than robotic instruments.[9] There are few to none reports on use of SPR instruments in MIS from our part of world including Nepal and India.

The main challenges with these SPR instruments are related to its technicality. The need for 8 mm trocar and cannula was a big challenge for us. We had to preorder 12 mm universal port from outside the country for the purpose of its use. Second challenge was on its fulcrum effect movements, which is in contrast to laparoscopic instruments. These port related issue with these instruments can be overcome by making 5mm or 10 mm size SPR instruments. Dedicated training and number of surgeries will improve the precision and easiness with the instrument.

CONCLUSION

Surgeon powered robotic instruments are emerging tool in minimal invasive surgery. Our early experiences with these instruments showed their potential and affordability in minimal invasive surgery in Nepal.

CONSENT

Written informed consent was obtained from the patients for publication of this case report.

FINANCIAL SUPPORT

The author(s) did not receive any financial support for the research and/or publication of this article.

CONFLICT OF INTEREST

The author(s) declare that they do not have any conflicts of interest with respect to the research, authorship, and/or publication of this article.

REFERENCES

1. Melmer PD, Chaconas C, Taylor R, et al. Impact of Laparoscopy on Training: Are Open Appendectomy and Cholecystectomy on the Brink of Extinction? Am Surg. 2019 Jul 1;85(7):761–3.
2. Vecchio R, MacFayden BV, Palazzo F. History of laparoscopic surgery. Panminerva Med. 2000 Mar;42(1):87–90.
3. Dubois F, Icard P, Berthelot G, et al. Coelioscopic cholecystectomy. Preliminary report of 36 cases. Ann Surg. 1990 Jan;211(1):60–2.
4. George EI, Brand TC, LaPorta A, et al. Origins of Robotic Surgery: From Skepticism to Standard of Care. JSLS. 2018;22(4):e2018.00039.
5. Schreuder H, Verheijen R. Robotic surgery. BJOG Int J Obstet Gynaecol. 2009 Feb 1;116:198–213.
6. Trevis J, Chilvers N, Freystaetter K, et al. Surgeon-Powered Robotics in Thoracic Surgery; An Era of Surgical Innovation and Its Benefits for the Patient and Beyond. Front Surg. 2020 Nov 26;7:589565.
7. Parente G, Thomas E, Cravano S, et al. ArtiSential® Articulated Wrist-Like Instruments and Their First Application in Pediatric Minimally Invasive Surgery: Case Reports and Literature Review of the Most Commonly Available Robot-Inspired Devices. Child Basel Switz. 2021 Jul 17;8(7):603.
8. Anderson PL, Lathrop RA, Webster RJ. Robot-like dexterity without computers and motors: a review of hand-held laparoscopic instruments with wrist-like tip articulation. Expert Rev Med Devices. 2016 Jul;13(7):661–72.
9. Min SH, Cho YS, Park K, et al. Multi-DOF (Degree of Freedom) Articulating Laparoscopic Instrument is an Effective Device in Performing Challenging Sutures. J Minim Invasive Surg. 2019 Dec 15;22(4):157–63. 10.7602