SCIENTIFIC PAPER JSLS

Robot-Assisted Transabdominal Preperitoneal Ventral Hernia Repair

Gainosuke Sugiyama, MD, Sitaram Chivukula, BS, Paul J. Chung, MD, Antonio Alfonso, MD

ABSTRACT

Background and Objectives: We believe that complications due to the mesh used in ventral hernia repairs can be reduced by using the natural barrier afforded by the peritoneum. This can be challenging to do laparoscopically, however we felt that the robot-assisted laparoscopic approach reduces the difficulty in placing the mesh in the preperitoneal space, and we want to share our early experiences with this approach. We describe the surgical technique used in robot-assisted laparoscopic transabdominal preperitoneal (TAPP) ventral hernia repair with mesh. In addition, we evaluate its feasibility and present preliminary perioperative results.

Methods: We performed robot-assisted laparoscopic TAPP ventral hernia repairs in 3 patients in the spring of 2015. Demographic information and defect size were measured. Conversion from a laparoscopic to an open procedure was the primary outcome variable.

Results: There were 3 cases of robot-assisted TAPP ventral hernia repair with mesh. The mean age of the patients was 49 years, the mean body mass index was 32.6 kg/m^2, and the mean operative time was 163.7 minutes. The mean defect size was 1219.0 mm^2. There were no conversions to open during this early learning phase. All patients were discharged home within the 24-hour postoperative period. No complications were noted during a mean follow-up of 3 months.

Conclusions: We present our early experience with robot-assisted TAPP ventral hernia repair. We note that because of improved ergonomics and wristed instrumentation, the robotic platform enabled creation of peritoneal flaps and complete coverage of mesh with peritoneum after primary closure of the defect. The robotic approach is feasible and may provide a better environment for mesh integration and protection. Further investigations with long-term follow-up are needed to verify that this technique is effective in reducing mesh-related intra-abdominal complications.

Key Words: Herniorrhaphy, Laparoscopy, Robotic herniorrhaphy, Robotic TAPP, Ventral hernia.

INTRODUCTION

Since its introduction in 1993 by LeBlanc, the laparoscopic approach to ventral hernia repair has enabled patients to return to normal activity earlier and has reduced the need for postoperative pain medications.[1–3] Traditionally, intraperitoneal mesh placement has been used for its ease, but the approach has associated risks.[4–8] Newer meshes have antiadhesive barriers to prevent postoperative infections and adhesions. Despite this improvement, there have been reports of mesh erosion to the bowel, as well as mesh-related infection.[8–10] An alternative is to dissect and establish the preperitoneal space in which to place mesh and avoid exposure to intra-abdominal structures. This method is customary in an open technique; however, modern robotic platforms, which use 3-D cameras and wristed movement, have the potential to facilitate the creation of this space intraperitoneally in a minimally invasive manner.

MATERIALS AND METHODS

We conducted a retrospective study, reviewing outcomes in 3 patients who underwent robot-assisted TAPP ventral hernia repair in the spring of 2015. Demographic information and size of the hernia defect were obtained. Conversion to open and length of stay were the primary outcome variables of interest.

Surgical Technique

The patient was positioned supine. An initial 12-mm port was placed in the left upper quadrant with an optical trocar. Subsequently, 2 lateral 8-mm ports were placed, 1 in the left lower quadrant and the other on the left side

Department of Surgery (Drs Sugiyama, Chung, and Alfonso) and the College of Medicine (Mr Chivukula), State University of New York, Downstate Medical Center, Brooklyn, Brooklyn, New York, USA.

Address correspondence to: Paul Chung, MD, Department of Surgery, Downstate Medical Center, 450 Clarkson Avenue, Brooklyn, NY 11203. Telephone: (718) 270-1421, Fax: (718) 270-2826, Email: paul.chung@downstate.edu

DOI: 10.4293/JSLS.2015.00092

© 2015 by *JSLS, Journal of the Society of Laparoendoscopic Surgeons.* Published by the Society of Laparoendoscopic Surgeons, Inc.

Figure 1. Preperitoneal placement of the mesh.

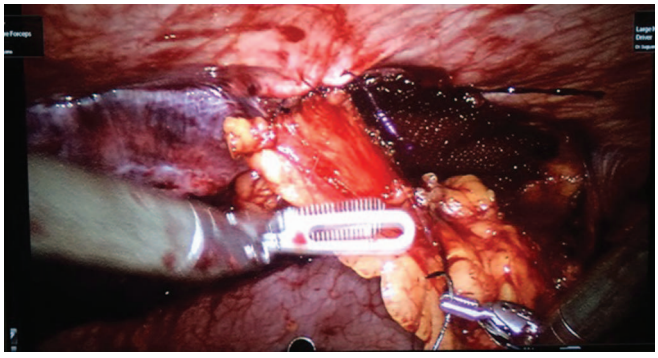

Figure 2. Primary closure of the peritoneum over the mesh.

between the lower and upper trocars. The robot was then docked. Any intra-abdominal content within the hernia sac was reduced. The edge of the hernia sac was used as the starting point for peritoneal dissection. The right peritoneal flap was carefully created laterally ~8 cm from the hernia sac. Upon completion of the flap, three 8-mm ports were situated on the right side, mirroring the placement of the ports on the left. The left peritoneal flap was then created. After the peritoneal flaps were created, any preperitoneal fat found within the defect was reduced, and the defect was primarily closed with locking sutures. Once the redundant edges of the hernia sac were primarily closed, the mesh was placed in the abdomen and secured to the abdominal wall with absorbable tacks. After the mesh was secured in the preperitoneal space (**Figure 1**), the peritoneal flap was closed with running locking sutures, fully covering the mesh (**Figure 2**). This method ensured that the mesh would be completely covered with the native peritoneum, creating a physiologic barrier (**Figure 3**).

RESULTS

Three patients underwent robot-assisted ventral hernia repair. The mean age was 49 years, mean BMI was 32.67 kg/m^2, the mean operative time was 163.7 minutes, and the mean defect size of the hernia was 1219.00 mm^2 (**Table 1**). No intraoperative complications were encountered in any of the cases. There were no intraoperative events and no conversions to open repair. All 3 patients were discharged home within the 24-hour postoperative period, and postoperative pain was adequately treated with oral analgesics. No postoperative complications were encountered during the 30 days after the procedures, including seroma, hematoma, or deep or superficial surgical wound infection. During a maximum of 3 months follow-up, there were no recurrences.

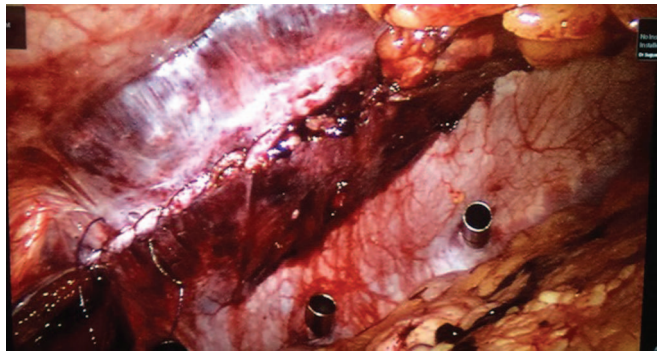

Figure 3. View of mesh fully covered by the peritoneum.

Table 1.
Patient Demographics

Patient	Age	Sex	BMI (kg/m^2)	Operative Time (min)	Defect Size (mm^2)
1	43	Female	22.4	155	900
2	50	Female	34.2	202	1500
3	55	Male	41.3	134	1257
Mean (SD)	49.3 (6.0)	–	32.6 (9.5)	163.7 (34.8)	1219.0 (301.8)

DISCUSSION

Although there have been many studies examining the utility of ventral hernia repair with preperitoneal mesh placement via the open approach, there are few studies in which a minimally invasive procedure was used. In 1997, Sarli et al[5] compared laparoscopic TAPP hernia repair to the intraperitoneal onlay mesh (IPOM) approach, showing that the TAPP approach had significantly fewer instances of recurrence, with similar rates of complications when compared to the IPOM technique. In 2011, Prasad et al[4] compared the TAPP and

IPOM laparoscopic techniques and found that although the TAPP method had a longer mean operative time, it reduced the risk of complications related to the intraperitoneal placement of mesh. The authors concluded that the TAPP approach should be the first choice for ventral hernia repair. More cases and a longer follow-up are needed, to determine whether robot-assisted TAPP ventral hernia repair reduces the risk of seroma and mesh-related infection.

We used primary closure of the hernia defect, because the obliteration of dead space theoretically results in less likelihood of seroma formation. Furthermore, closure of the midline enables adequate overlap of the mesh (5–6 cm) within the limited confines of the preperitoneal space.[11] Finally, there is the added benefit of improved cosmesis for the patient. However, we acknowledge that in defects larger than 3 to 5 cm, primary closure may not be feasible. A larger mesh would be necessary, which would translate into a more extensive peritoneal flap dissection and may be technically challenging. Furthermore, the remaining sac may serve as a source of seroma formation, all of which may necessitate a different approach to the repair of ventral hernia defect.

The modern robotic surgery system allows increased mobility within the working space via wristed movement, affording better ergonomics for the surgeon, and visualization is improved by its 3-D camera system. All these features facilitate the fine dissection of the preperitoneal space and repair of the peritoneum. Despite these many benefits, the use of robot-assisted TAPP ventral hernia repair has not yet been investigated. We acknowledge that our technique, which involves docking on both sides, results in higher operative costs, and we are currently looking into ways to create the peritoneal flaps with a single dock. We present our early experiences with this technique and believe that these cases demonstrate its feasibility and safety.

Limitations of this study include a small sample size and short follow-up period. We noted that descriptions of the robot-assisted technique are lacking; therefore, we wanted to present our early experiences and evaluate the feasibility of the robotic approach. These early results are encouraging, and a prospective trial comparing outcomes between robot-assisted TAPP, laparoscopic TAPP, and the IPOM techniques, with long-term follow-up, are warranted.

CONCLUSION

Robot-assisted TAPP ventral hernia repair is a feasible and safe therapeutic option when performed by an experienced surgeon. The improved dexterity and visualization afforded by the robotic platform simplify a challenging procedure and provide a viable alternative to the more invasive open technique.

References:

1. Goodney PP, Birkmeyer CM, Birkmeyer JD. Short-term outcomes of laparoscopic and open ventral hernia repair: a meta-analysis. *Arch Surg*. 2002;137:1161–1165.

2. Lomanto D, Iyer SG, Shabbir A, Cheah WK. Laparoscopic versus open ventral hernia mesh repair: a prospective study. *Surg Endosc*. 2006;20:1030–1035.

3. Carbajo MA, Martín del olmo JC, Blanco JI, et al. Laparoscopic treatment vs open surgery in the solution of major incisional and abdominal wall hernias with mesh. *Surg Endosc*. 1999;13:250–252.

4. Prasad P, Tantia O, Patle NM, Khanna S, Sen B. Laparoscopic ventral hernia repair: a comparative study of transabdominal preperitoneal versus intraperitoneal onlay mesh repair. *J Laparoendosc Adv Surg Tech A*. 2011;21:477–483.

5. Sarli L, Pietra N, Choua O, Costi R, Cattaneo G. Laparoscopic hernia repair: a prospective comparison of TAPP and IPOM techniques. *Surg Laparosc Endosc*. 1997;7:472–476.

6. Chelala E, Debardemaeker Y, Elias B, Charara F, Dessily M, Allé JL. Eighty-five redo surgeries after 733 laparoscopic treatments for ventral and incisional hernia: adhesion and recurrence analysis. *Hernia*. 2010;14:123–129.

7. Conze J, Rosch R, Klinge U, et al. Polypropylene in the intra-abdominal position: influence of pore size and surface area. *Hernia*. 2004;8:365–372.

8. Franklin ME, Gonzalez JJ, Glass JL, Manjarrez A. Laparoscopic ventral and incisional hernia repair: an 11-year experience. *Hernia*. 2004;8:23–27.

9. Leblanc KA. Laparoscopic incisional and ventral hernia repair: complications-how to avoid and handle. *Hernia*. 2004;8:323–331.

10. Hawn MT, Snyder CW, Graham LA, Gray SH, Finan KR, Vick CC. Long-term follow-up of technical outcomes for incisional hernia repair. *J Am Coll Surg*. 2010;210:648–655, 655–657.

11. Palanivelu C, Jani KV, Senthilnathan P, Parthasarathi R, Madhankumar MV, Malladi VK. Laparoscopic sutured closure with mesh reinforcement of incisional hernias. *Hernia*. 2007;11:223–228.