

New Peritoneal Traction Device for Laparoscopic Paraaortic Lymphadenectomy

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ABSTRACT

Background: The development of devices that can be used to tract organs or other structures and secure an appropriate surgical field during laparoscopic surgery is clinically important.

Methods: We developed a novel traction stitch, the *Laptraction*, which can be used to achieve peritoneal traction during laparoscopic surgery. This study examines the utility and safety of using the *Laptraction* to achieve peritoneal traction during laparoscopic transperitoneal paraaortic lymphadenectomy (as part of comprehensive staging surgery) in seven endometrial cancer patients.

Results: Peritoneal traction was successfully and safely achieved using the *Laptraction* in all cases, without causing any complications. In all cases, time to deploy *Laptraction* was <5 min.

Conclusions: *Laptraction*, a newly developed stitch, allows peritoneal traction to be achieved easily and facilitates the identification of essential landmarks during robotic-assisted laparoscopic hysterectomy, which helps to save time and prevent surgical complications.

Key Words: peritoneal traction, laparoscopic surgery, paraaortic lymphadenectomy, pledget.

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INTRODUCTION

Minimally invasive surgery has various benefits over laparotomy, i.e., it causes fewer surgical complications and is associated with a reduced requirement for analgesics, shorter hospital stays, and an earlier return to normal activities. However, achieving appropriate traction of the organs and other structures surrounding the surgical field can be challenging during laparoscopic surgery.

Childers et al. and Nezhat et al. were the first to describe the performance of laparoscopic transperitoneal paraaortic lymphadenectomy as part of comprehensive staging surgery for invasive gynecological malignancies.¹ Since then, an increasing number of reports have demonstrated that laparoscopic paraaortic lymphadenectomy is safe and feasible in gynecological cancer patients.¹⁻³ Accumulating evidence suggests that laparoscopic approach is associated with a reduced risk of postoperative complications, including abdominal incisional pain, infections, and bowel obstruction, compared with open abdominal surgery requiring a large skin incision.⁴⁻⁵ However, laparoscopic surgery is more complicated than open abdominal surgery, mainly because of the limited surgical space and associated technical problems. Thus, the development of new devices or instruments that can be used for the traction of organs or other structures and secure an appropriate surgical field during laparoscopic surgery is clinically important for both patients and surgeons.⁶

In the current study, we examined the safety and utility of a newly developed surgical suturing tool, the *Laptraction*, which has been developed to facilitate peritoneal traction during laparoscopic transperitoneal paraaortic lymphadenectomy.

MATERIALS AND METHODS

Patients

The newly developed peritoneal traction-inducing suturing tool, the *Laptraction*, was used during laparoscopic transperitoneal paraaortic lymphadenectomy in seven endometrial cancer patients who underwent comprehensive staging surgery. Appropriate written in-

formed consent for the use of the *Laptraction* during surgery and the publication of a case report and accompanying images was obtained from all patients. Permission to proceed with the data acquisition and analysis was obtained from Nara Medical University Hospital's Institutional Review Board.

A New Surgical Stitch, *Laptraction*

The *Laptraction* was jointly developed by Dr. Seiji Mabuchi and AKIYAMA MEDICAL MFG, CO., LTD. (Tokyo, Japan) in 2019. As shown in **Figure 1A**, the *Laptraction* consists of a round-bodied needle (65-mm, straight), 2–0 nylon sutures (suture length: 75 cm) and a Teflon pledget (10-mm circle; AKIYAMA MEDICAL MFG, CO., LTD.). The *Laptraction* has been developed to facilitate the traction of the peritoneum (both the visceral and parietal peritoneum) during laparoscopic surgery (Trademark registration 2018–168481).

Paraaortic Lymphadenectomy

All procedures were performed under general anesthesia, with the patients placed in the Trendelenburg position. After performing total laparoscopic hysterectomy, bilateral salpingo-oophorectomy, and pelvic lymphadenectomy, paraaortic lymphadenectomy was conducted using 5–6 small trocars (**Figure 1B**). The intraabdominal pressure was kept below 12 mm Hg using carbon dioxide.

A zero-degree laparoscope was used for the inspection and dissection of the retroperitoneal space, whereas a 30-degree laparoscope was used for the dissection of

the lymph nodes above the inferior mesenteric artery. The procedure started with an incision in the posterior peritoneum over the lower aspects of the aorta and vena cava. After subjecting the rectosigmoid colon to left upper traction, a peritoneal incision was made in the peritoneum overlying the right common iliac artery while being careful to avoid the right ureter. Once fenestration had been performed, the peritoneal incision was extended for approximately 8–10 cm toward the aortic bifurcation while placing gentle upward traction on the peritoneal surface. After dissecting the subperitoneal loose areolar tissue, the peritoneum was freed and suspended on the anterior abdominal wall (using peritoneal traction sutures with either a 65-mm needle with 2–0 nylon sutures or the *Laptraction*). The resultant peritoneal tent prevented the small bowel from sliding into the surgical field.

The essential landmarks, including the bilateral ureters, psoas muscles, renal veins, gonadal veins, the inferior mesenteric artery, and the superior hypogastric plexus overlying the aorta and sacral promontory, were identified. Then paraaortic lymphadenectomy was performed from the level of the renal veins to the bifurcation of the aorta, medial to the ureters on each side (**Figure 1C**). To prevent chylous ascites, we applied Hem-o-lok clips (Weck Surgical Instruments, Research Triangle Park, NC, USA) or the LigaSure device (Medtronic, Minneapolis, MN, USA) to the upper parts of the infrarenal and aortocaval lymph nodes. The presacral lymph nodes were removed. All dissected lymph nodes were enveloped in sterilized

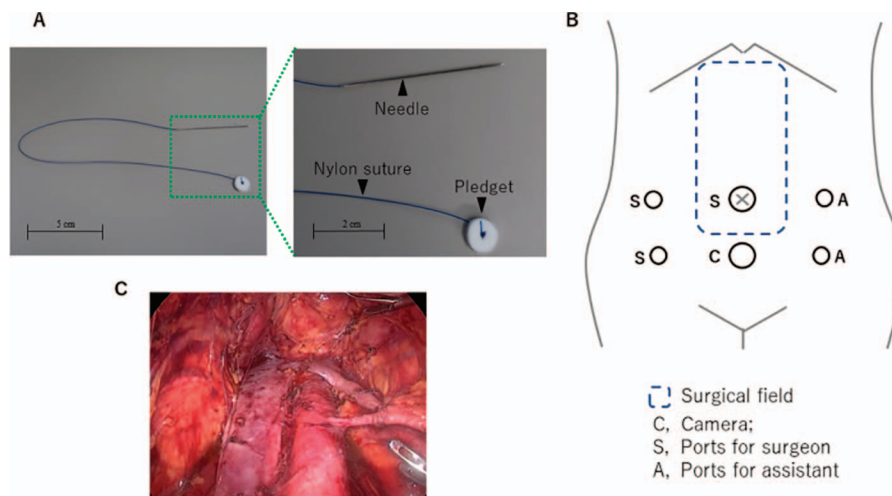


Figure 1. A: Pictures showing the *Laptraction*. B: Trocar placement for laparoscopic transperitoneal paraaortic lymphadenectomy. C: Postoperative view after transperitoneal para-aortic lymphadenectomy.

plastic bags and removed through the 12-mm port or vagina.

RESULTS

Conventional Procedure of Peritoneal Traction During Laparoscopic Paraaortic Lymphadenectomy

In the conventional procedure, a straight needle and monofilament sutures (e.g., nylon or polypropylene sutures) have been used to achieve peritoneal traction during laparoscopic paraaortic lymphadenectomy. As shown in **Figure 2A**, a straight needle with sutures is inserted through the anterior abdominal wall at the level of the peritoneal incision. The needle is held intraperitoneally with a laparoscopic needle holder and is passed posteroanteriorly through the posterior peritoneum. Then the needle is pulled back through the abdominal wall near the initial entry point. Two to three additional sutures are inserted over the length of the peritoneal incision to create a peritoneal tent. Different degrees of suture suspension can be achieved by holding the sutures at the desired level outside the abdomen, which results in good exposure of the retroperitoneal space.

However, this procedure is very complicated because it requires the insertion and removal of the needle through the anterior abdominal wall during the creation of the peritoneal tent, and it is necessary to flip the needle and move it back and forth in a limited surgical space. Moreover, monofilament sutures sometimes cause the tearing of or damage to the peritoneum during lymphadenec-

tomy, leading to the collapse of the peritoneal tent (**Figure 2B**). In such cases, repeated peritoneal suturing is required to secure an adequate surgical field. Thus, we have developed a new surgical suturing tool, the *Laptraction*, for achieving peritoneal traction during laparoscopic transperitoneal paraaortic lymphadenectomy.

Patients

The utility and safety of using the *Laptraction* to achieve peritoneal traction during laparoscopic transperitoneal paraaortic lymphadenectomy were evaluated in seven endometrial cancer patients. **Table 1** lists the demographic information, operative details, and surgical outcomes for each case. Conversion to open surgery was not required in any case. No patients experienced intraoperative or postoperative complications, and no tissue tearing or other damage was noted after the removal of the *Laptraction*.

Achieving Peritoneal Traction Using the *Laptraction*

Peritoneal traction was achieved using the *Laptraction* during laparoscopic paraaortic lymphadenectomy in seven endometrial cancer patients. As shown (**Figure 3, 4A**, and Supplemental **Figure 1**), using atraumatic forceps, the *Laptraction* was introduced into the abdominal cavity via a trocar. The needle was held with a laparoscopic needle holder and was passed posteroanteriorly through the posterior peritoneum, before being removed from the abdomen. Then the 2-0 nylon sutures were pulled upward until adequate traction of the *Laptraction*

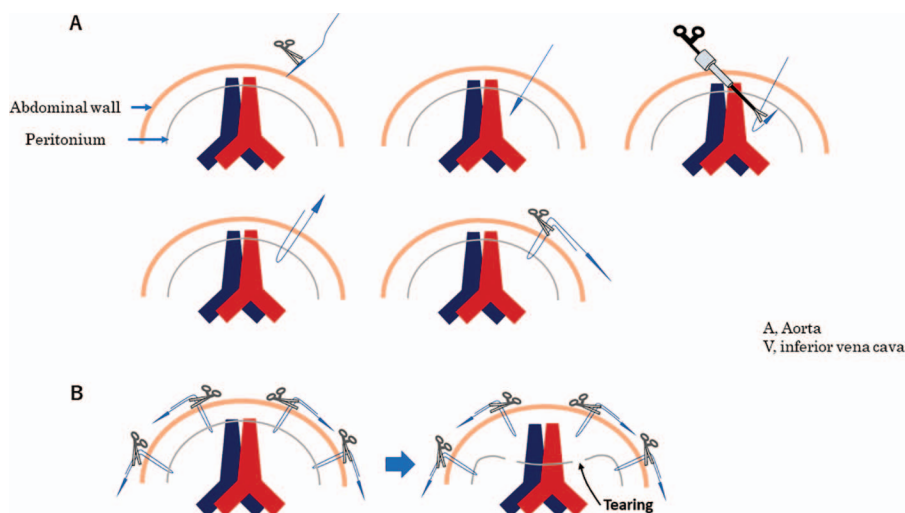


Figure 2. A: Conventional method for achieving peritoneal traction during laparoscopic transperitoneal paraaortic lymphadenectomy. B: Collapse of the peritoneal tent caused by tearing of or damage to the peritoneum.

Table 1. Demographic Information, Operative Details, and Surgical Outcomes of Patients Included in this Study

Variables	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
Age (years)	59	66	69	66	70	54	43
BMI (kg/m ²)	20.2	21.2	30.5	21.3	23.2	21.6	17.8
Clinical stage (TNM)	T1bN1M0	T1aN0M0	T1bN0M0	T1bN0M0	T1bN1M0	T1aN0M0	T1aN0M0
Histology	EM, G1	Serous	EM, G2	EM, G1	EM, G2	Serous	Carcinosarcoma
Surgery	LH+BSO+PLN+PALN+PALN	LH+BSO+PLN+PALN+OM	LH+BSO+PLN+PALN+OM	LH+BSO+PLN+PALN	LH+BSO+PLN+PALN	LRH+BSO+PLN+PALN+OM	LH+BSO+PLN+PALN+OM
Blood loss (ml)	Zero	430	150	120	Zero	50	Zero
Operative time (min)	535	518	518	499	409	425	372
Complications	None	None	None	None	None	None	None

EM, endometrioid carcinoma; BMI, body mass index; LH, laparoscopic simple hysterectomy, LRH, laparoscopic radical hysterectomy; BSO, bilateral salpingo-oophorectomy; PLN, pelvic lymphadenectomy; PALN, paraaortic lymphadenectomy; OM, omentectomy.

was achieved, which resulted in good exposure of the retroperitoneal space. The 2–0 nylon sutures were secured with hemostatic forceps outside the abdomen. Then lymphadenectomy was initiated. The procedure was safely performed in all cases without causing any surgical complications. The mean time required was <1 min for a suturing and 5 min for the creation of the peritoneal tent.

DISCUSSION

Laparoscopic paraaortic lymphadenectomy is a technically difficult procedure. One of the major difficulties with this procedure is the limited surgical field, in which the surgeon needs to perform complicated procedures.^{7–10} Thus, the development of novel instruments that facilitate the traction of the surrounding organs and increase the surgical field is of great importance.

Straight needles and monofilament sutures (e.g., nylon or polypropylene sutures) have been reported to be useful for peritoneal suspension.^{7–10} However, as shown in **Figure 2**, the associated procedure is very complicated, i.e., the surgeon needs to flip the needle and move it back and forth in a limited surgical space. Moreover, such sutures frequently cause the peritoneum to tear during lymphadenectomy. In such cases, repeated peritoneal suturing is required.

To solve this problem, we have recently developed a novel suturing, the *Laptraction*, for achieving peritoneal traction, which can be used during laparoscopic paraaortic lymphadenectomy. In the current study, we have shown that peritoneal suspension can be safely and easily performed within 5 min by using the *Laptraction*.

We consider that the use of the *Laptraction* during transperitoneal laparoscopic paraaortic lymphadenectomy might have important clinical implications. The first is that this stitch eliminates the need for an assistant during peritoneal traction. Second, because of the unidirectional nature of the associated needle manipulation, peritoneal suspension can be performed safely and easily using this stitch, and thus, the procedure is reproducible. In our experience, it took only <1 min to perform a suturing and 5 min to create the peritoneal tent. Because the area supporting the peritoneum is wider than that created with the conventional approach using a monofilament suture, the use of the *Laptraction* rarely results in tearing of or damage to the peritoneum (**Figure 4B**). Thus, repeated peritoneal suturing is not required. Moreover, the *Laptraction* can be used for the

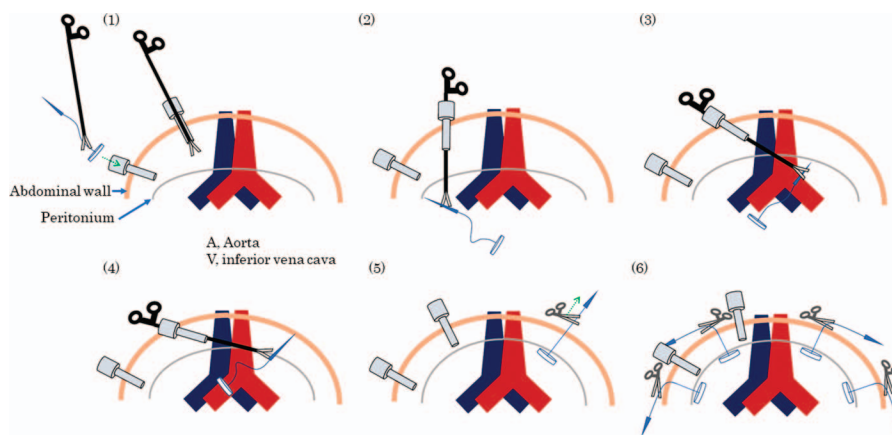


Figure 3. Schematic illustrations of peritoneal traction using the *Laptraction* during laparoscopic transperitoneal paraaortic lymphadenectomy.

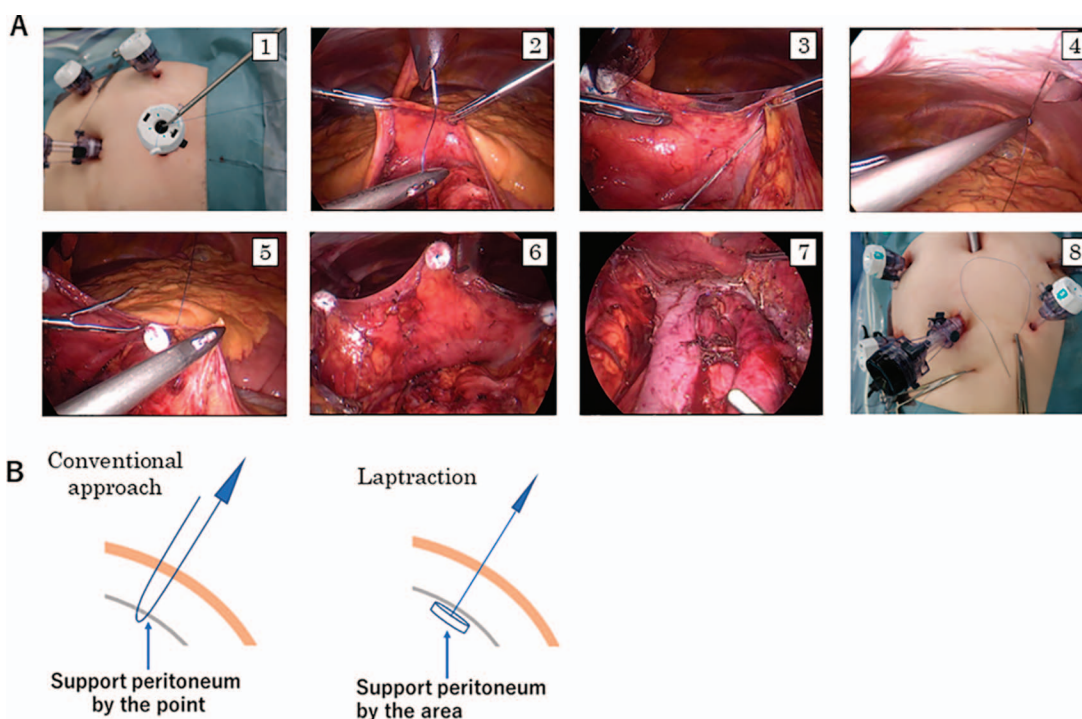


Figure 4. Peritoneal traction using the *Laptraction* during laparoscopic transperitoneal paraaortic lymphadenectomy. A: Representative images. B: A difference between conventional approach using a monofilament suture and *Laptraction*.

traction of both the visceral and parietal peritoneum. Thus, it can be used for other purposes, e.g., for the traction of the bladder during laparoscopic or robotic hysterectomy. When the *Laptraction* is used during robotic surgery, it results in a free robotic arm, which can then be used for the traction of other organs, or the number of robotic arms can be reduced. This stitch also has the potential to increase patient safety as well as to

eliminate the need for an assistant. We hope that the utility of this novel traction stitch will be investigated further in future clinical studies.

CONCLUSION

We have developed a novel peritoneal traction-inducing stitch, the *Laptraction*, which can be used during

laparoscopic transperitoneal paraaortic lymphadenectomy. This new instrument helps surgeons to obtain an optimal surgical field, which can aid endoscopic surgeons.

References:

1. Childers JM, Hatch K, Surwit EA. The role of laparoscopic lymphadenectomy in the management of cervical carcinoma. *Gynecol Oncol.* 1992;47:38–43.
2. Childers JM, Hatch KD, Tran AN, Surwit EA. Laparoscopic para-aortic lymphadenectomy in gynecologic malignancies. *Obstet Gynecol.* 1993;82:741–747.
3. Nezhat CR, Nezhat FR, Burrell MO, et al. Laparoscopic radical hysterectomy and laparoscopically assisted vaginal radical hysterectomy with pelvic and paraaortic node dissection. *J Gynecol Surg.* 1993;9:105–120.
4. Fader AN, Java J, Tenney M, et al. Impact of histology and surgical approach on survival among women with early-stage, high-grade uterine cancer: An NRG Oncology/Gynecologic Oncology Group ancillary analysis. *Gynecol Oncol.* 2016;143:460–465.
5. Bishop EA, Java JJ, Moore KN, et al. Surgical outcomes among elderly women with endometrial cancer treated by laparoscopic hysterectomy: a NRG/Gynecologic Oncology Group study. *Am J Obstet Gynecol.* 2018;218:109.e1–109.e11.
6. Vargas-Palacios A, Hulme C, Veale T, Downey CL. Systematic review of retraction devices for laparoscopic surgery. *Surg Innov.* 2016;23:90–101.
7. Kusunoki S, Huang KG, Magno A, Lee CL. Laparoscopic technique of para-aortic lymph node dissection: a comparison of the different approaches to trans- versus extraperitoneal para-aortic lymphadenectomy. *Gynecol Minim Invasive Ther.* 2017;6: 51–57.
8. Abu-Rustum NR, Chi DS, Sonoda Y, et al. Transperitoneal laparoscopic pelvic and para-aortic lymph node dissection using the argon-beam coagulator and monopolar instruments: an 8-year study and description of technique. *Gynecol Oncol.* 2003; 89:504–513.
9. Huang MC, Wang KL, Chen HS, Yang YC, Su TH. A modified suspension technique for better exposure of the retroperitoneal space during laparoscopic lymphadenectomy. *J Am Assoc Gynecol Laparosc.* 2002;9:531–535.
10. Martel-Billard C, Goillot V, Jacquin A, et al. Laparoscopic transperitoneal para-aortic lymphadenectomy in 10 steps. *J Minim Invasive Gynecol.* 2018;25:386–387.