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# CTEP Versus LESS Totally Extraperitoneal Hernioplasty

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## ABSTRACT

**Background and Objectives:** The authors sought to assess and compare the surgical outcomes of laparoendoscopic single-port surgery (LESS) for totally extraperitoneal (LESS-TEP) hernioplasty and conventional totally extraperitoneal (CTEP) hernioplasty.

**Methods:** From March 2015 through May 2018, a retrospective analysis of postoperative outcomes was conducted that included 81 cases of LESS-TEP and 88 cases of CTEP hernioplasty patients. For postoperative indicator comparisons, a visual-analog pain scale and 5-level cosmesis evaluation sheet were applied. In addition, complications on postoperative outcomes following inguinal hernia repair surgery are discussed based on our analysis and surgical experience.

**Results:** All operations were successfully performed at different hospitals. Compared with the CTEP group, the operative time in the LESS-TEP group increased significantly ($P < .05$). However, the cosmetic outcome in the LESS-TEP group was rated higher than that in the CTEP group ($P < .05$). There was no significant difference between the 2 groups in hospitalization time, the incidence of complications, postoperative pain levels, or medical costs ($P > .05$).

**Conclusion:** LESS-TEP is as feasible and safe as CTEP. The use of LESS-TEP successfully improved the cosmetic outcomes of inguinal hernia repair surgery with smaller and fewer scars for patients. As a new surgical treatment approach for inguinal hernias, the LESS-TEP technique is still not a necessary or efficacious surgical alternative strategy for CTEP, especially for surgeons who are less experienced in the technique.

**Key Words:** Laparoendoscopic single-port surgery (LESS), Totally extraperitoneal (TEP), Hernioplasty.

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## INTRODUCTION

In what is one of the most common surgical procedures, inguinal hernia repair methods continue to be debated among surgeons regarding which is the best surgical approach.[1] It is reported that the total number of inguinal hernia repairs is approximately 20 million worldwide.[2] Therefore, the choices of operative approach could significantly affect both the patient's quality of life and health care expenditures. The traditional surgical strategy for reparation is through an open approach, but this is associated with significant surgical morbidity. In 1993, the conventional totally extraperitoneal (CTEP) approach of laparoscopic inguinal hernia repair was performed for the first time.[3] Following this, laparoscopic repair has been widely reported and increasingly adopted for complicated inguinal hernias such as hernias that are recurrent, sliding, or incarcerated.[4] A recent meta-analysis showed that compared with the traditional open approach, the laparoscopic choice can decrease the hospital stay and incidence of complications and urinary problems as well as reduce the length of the recovery period.[5–8].

With the development of medical surgical technology, efforts to improve the recovery period with less injury have led to the development of more minimally invasive surgical techniques such as laparoendoscopic single-port totally extraperitoneal repair (LESS-TEP). It was introduced by Dr. Cugura in 2008[9] and gained wide attention among experienced laparoendoscopic surgeons. Compared with the traditional 3 holes in general CTEP surgeries, LESS-TEP facilitates early recovery, offers improved cosmesis, and results in fewer port-related complications.[10] Although the successful use of LESS-TEP has been reported in a number of surgical procedures, as have the potential benefits versus the earlier CTEP approach, LESS-TEP also faces many challenges. Because of the need for further validation, multi-institutional clinical trials of short- and long-term outcomes are still required for further comparisons.[10–12] To gain adequate insight into the use of LESS-TEP compared with CTEP, we compared the outcomes of these 2 types of surgical approach for inguinal hernia repair and present this retrospective study.

## MATERIALS AND METHODS

### Patients and assessments

In our retrospective study, consecutive patients who underwent LESS-TEP hernioplasty between March 2015 and May 2018 were compared with patients who underwent CTEP hernioplasty at the same time in The Second Hospital of Shandong University, The People's Hospital of Linyi City, or the Qilu Hospital in Shandong Province of China. A total of 169 patients were enrolled in this study—81 patients in the LESS-TEP group and 88 patients in the CTEP group. All included valid cases were detected based on both physical examination and ultrasonography with a clinical diagnosis of unilateral inguinal hernia. Before the operations, all patients were informed about the available surgical approaches in detail by the operating surgeons and jointly decided which surgical approach to choose.

We had strict exclusive and inclusive standards for the enrolled patients to reduce bias. For a more accurate comparison, the patients who had bleeding disorders or a strangulated, obstructed, incarcerated, recurrent, or bilateral inguinal hernia were excluded. Patients who had previous lower abdominal surgery on the same side as the hernia were also excluded. In addition, at 12 hours after surgery, discomfort was evaluated with a visual-analog pain scale (VAS) that contained 6 levels of pain: 0 (no pain), 2 (least pain), 4 (mild pain), 6 (moderate pain), 8 (severe pain), and 10 (worst pain possible). Because cosmesis was also a major concern that both surgeons and patients considered, we adopted a 5-item scale form for evaluation 1 month after the operations.[13] Scoring was set at 5 (very satisfied), 4 (satisfied), 3 (acceptable), 2 (dissatisfied), and 1 (very dissatisfied).

### Surgical procedures

For patients from the CTEP group, the standard repair surgeries were performed as described by Lai et al. with 3 midline ports (one 10 mm and two 5 mm).[14] Under general anesthesia, the patient was placed in the supine position. The 10-mm cannula with the Hasson self-retaining device was placed at the level of the semicircular line of Douglas and fixed to the anterior rectus sheath by using stay sutures; the two 5-mm operating ports were placed in the midline. For the LESS-TEP group, the positions of patients were the same as for the CTEP group. A 2.0-cm midline infraumbilical incision was made, followed by dissection of the subcutaneous tissue down to the rectus abdominis sheath. The anterior sheath was incised, and small S-shaped retractors were then used to retract the rectus muscle laterally. A preperitoneal space between the muscle and the posterior sheath was created via blunt dissection (**Figure 1** and **Figure 2**). The preperitoneal space was insufflated with $CO_2$ to 6 mm Hg. Later, the 10-mm laparoscope and conventional instruments were introduced and we continued to dissect the preperitoneal space. The anatomical landmarks (Cooper ligament, the iliopubic tract, and inferior epigastric vessels) were identified (**Figure 3**). Finally, the Retzius and Bogros spaces were revealed fully. The hernia sac was freed from the spermatic cord to the peritoneal reflection. In some patients, when the sac was excessive, it was divided and ligated with premade, nonabsorbable surgical loop. After adequate space was created, 15 × 10-cm 3-dimensional

**Figure 1.** Self-made glove for LESS-TEP.

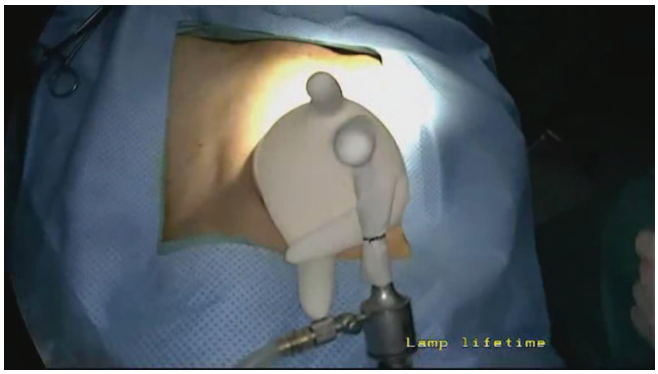


**Figure 2.** Single-port device for LESS-TEP.

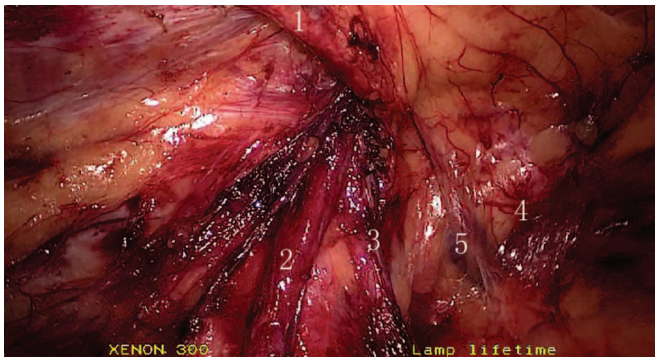


**Figure 3.** Incision for LESS-TEP.

Max mesh (Bard Corporation, USA), curled tightly, was inserted in the preperitoneal space. When the mesh was satisfactorily arranged in the suitable place, deflation was performed under direct vision. After removal of the single-port device, the rectus sheath, subcutaneous layer, and skin incision were closed (**Figure 4**).

For both surgical approaches, the pain level was assessed and scored 12 hours after the operation. Patients were instructed to wear suspensory underpants for 10 days, and any strenuous physical exercise was discouraged during the first postoperative month. All enrolled patients were given serial follow-up, which ranged from 2 to 38 months (mean 19.6 months). They were also visited and physically examined at the outpatient clinic at the time points of 10 days, 1 month, 6 months, 1 year, and subsequently on an as-needed basis.

### Statistical analysis

Statistical analysis was performed with the use of R 3.1.3 (R Development Core Team, 2015) software. All the results are presented as mean ± standard deviation. A $\chi^2$ test, Mann-Whitney *U* test, and unpaired *t*-test were adopted to evaluate the statistically significant differences, which we considered was a *P*-value


**Figure 4.** Graph in the period of LESS-TEP: (1) inferior epigastric vessels; (2) spermatic vessels; (3) vas deferens; (4) Cooper ligament; (5) corona mortis.

## RESULTS

As shown in **Table 1**, the 88 CTEP patients and the 81 LESS-TEP patients were successfully evaluated during the follow-up period. The younger patients preferred the LESS-TEP surgical approach. In both groups, the most frequent patients were male patients with an indirect hernia on the right side. However, there were no statistically significant differences in body mass index, hernia type, and hernia side ($P > .05$).

All LESS-TEP procedures were performed with instruments inserted through the transumbilical port without a conversion to conventional laparoscopic or open surgery. The operation results and postoperative surgical parameters of both groups are presented in **Table 2**. The mean

**Table 1.**
Patient and Inguinal Hernia Characteristics

| Variable | CTEP (n = 88) | LESS-TEP (n = 81) | *P* value |
|---|---|---|---|
| Age, y | 48.6 ± 11.4 | 41.7 ± 10.6 | >.05 |
| Sex (male:female) | 72:16 | 69:12 | >.05 |
| Body mass index, kg/m$^2$ | 25.4 ± 4.4 | 24.1 ± 3.7 | >.05 |
| Hernia type, n | | | |
| Indirect | 64 | 59 | >.05 |
| Direct | 24 | 22 | >.05 |
| Hernia site (right: left), n | 59:29 | 53:28 | >.05 |

**Table 2.**
Perioperative Data of CTEP Group Versus LESS-TEP Group

| Variable | CTEP | LESS-LTEP | *P* value |
|---|---|---|---|
| Operative time, min | 25.6 ± 8.4 | 50.4 ± 16.3 | <.05* |
| Postoperative Hospital stay, day | 2.2 ± 0.8 | 2.3 ± 0.6 | >.05 |
| Complications, n (%) | 5 (5.7) | 5 (6.2) | >.05 |
| Hematoma/seroma | 2 | 1 | |
| Peritoneal tearing | 3 | 4 | |
| Urinary retention | 0 | 0 | |
| Recurrence | 0 | 0 | |
| Pain score (12 h) | 3.1 ± 0.9 | 2.8 ± 1.0 | >.05 |
| Cosmetic result, 1–5 | 3.2 ± 0.8 | 4.3 ± 0.7 | <.05* |
| Medical cost, $ | 2000 ± 210 | 2000 ± 210 | >.05 |

*$P < .05$ means the data for the 2 groups have significant differences.

operative time for the LESS-TEP procedure was significantly longer than that or the standard TEP technique ($P < .05$); the CTEP group required 25.6 ± 8.4 minutes, whereas the LESS-TEP group required 50.4 ± 16.3 minutes. Regarding the postoperative surgical parameters, the cosmetic results were significantly better in the LESS-TEP group than in the CTEP group (4.3 ± 0.7 vs. 3.2 ± 0.8, $P < .05$). This parameter was considered an important factor when the patients chose the surgical approach. However, there was no significant difference between the 2 groups in hospitalization time, incidence of complications, postoperative pain score (VAS), and medical costs ($P > .05$). In addition, 3 patients in the standard TEP group and 4 patients in the LESS-TEP group had intraoperative peritoneal tearing, which was closed by hemolock[B] (5 mm). Postoperative hematoma and seroma were managed with conservative treatment. In terms of surgical complications such as mesh infection, acute urinary retention, injury to cord structures and iliac vessels, recurrence, and ischemic orchitis, no cases were observed in either group.

## DISCUSSION

Since the development of LESS-TEP, the safety, feasibility, and efficacy of LESS-TEP inguinal hernia repair have been assessed in a few clinical studies.[6, 14] However, the outcome comparisons between the approaches of LESS-TEP and CTEP are still controversial.[15] With increased surgical experience and the advancement of endoscopic equipment skills, we provide more useful and clear indications when we inform patients of surgical suggestions based on their personal situation. This retrospective, multicenter study could afford more reference information to compare the advantages and disadvantages when making the surgical choices. In our study, the mean operative time for the LESS-TEP procedure was significantly longer than that for the standard TEP technique. This result matched the outcomes of a previous study.[13] This could because, as for our original 40 patients in the LESS-TEP group, the surgeons required more time to ensure the surgical procedures were completely satisfactory. This time requirement will decrease with operative experience. Although LESS-TEP took longer, the significantly improved and satisfying cosmesis outcome in the LESS-TEP group highlighted the superiority of the surgical technique. The overall satisfactory rate for LESS-TEP was higher than in the CTEP group ($P < .05$). The LESS-TEP method reduced 2 additional incisions in the abdominal wall, which meant reducing the incidence of scars. Based our patients' age range, it is obvious that younger patients preferred the LESS-TEP approach. This indicates possible use in the further development of this latest surgical method, because it is better accepted in a demanding society. Regarding the surgeons, LESS-TEP showed some technical advantages, including less conflict of the suprapubic trocar during placement of the mesh and mirror image. Current efforts for inguinal hernia repair are aimed at further reducing the recurrence associated with minimally invasive surgery. It is also reported that a standardized training program and improved instruments could help reduce the time of the laparoscopic surgery.[16]

However, our study did not identify any pain reduction for the LESS-TEP group compared with the TEP group (according to the VAS). Thai et al reported that LESS-TEP could decrease the immediate postoperative pain score.[13] These different results might be because the inguinal dissection area was the same in the 2 groups. Moreover, our observation showed that some technical disadvantages of LESS-TEP could result in steep learning curves. Other disadvantages of triangulation, collision of instruments, and in-line vision might induce some confusion and extra work for surgeons during surgical procedures. Therefore, more randomized controlled trial studies are warranted. Moreover, previous relevant research still doubts whether LESS-TEP is a valid alternative approach to TEP. According to the research by Cugura et al. and Thai et al., they believed that the LESS-TEP might not be an efficacious surgical alternative to CTEP .[9, 13] Therefore, on this point of no pain reduction, our results proved that the LESS-TEP might not be a necessary succedaneum of CTEP.

The impact of intraoperative complications on postoperative outcome following inguinal hernia repair surgery is also a significant concern for surgeons and patients. From our current observation and analysis, there was no major intraoperative complication that adversely affected our patients' recoveries, such as major bleeding or bowel or bladder injury. Generally, the majority of intraoperative complications were due to unintentional tearing of the peritoneum or the hernia sac. It was reported that the peritoneum- and sac-tearing rate was around 10%–47% on CTEP.[17–19] In those studies, the peritoneum tearing occurred in 2 patients from the CTEP group and 3 patients in the LESS-TEP group. They indicated that the peritoneum tearing mainly occurs at the start of the Bogros space dissection. It requires careful examination of the correct plane before the entry layer and more gentle and elaborate dissection. From our clinical surgical experience in this study, we believe that 2 maneuvers are extremely important for this problem. The first one is the inline dissection, which means 2 instruments moved back and forth separately. The successful surgeries indicated that it is especially useful for hernia sac dissection. The other one is the vertical dissection technique that is especially useful for dissecting the Bogros space. It requires the 2 instruments to go vertically in opposite directions on either side of the laparoscope. Moreover, if the size of peritoneum tearing was large (1 cm), the peritoneum can be closed by hemolock[B] (5 mm) easily.

Our study differed from the previous study by adding more information about the comparisons of medical devices and instruments and the medical cost of a hernia operation. Medical cost is always a concern for patients at different financial levels. Our results demonstrated that there was no significant difference between the medical costs in the 2 groups in the end. In our surgeries, we used the self-made glove, single-port device to complete LESS-TEP, which is much more cost-effective than a costly single-port access device. All in all, when introducing the choices of different surgical approaches, the medical cost issue for LESS-TEP and CTEP would not affect the patients' choices at this current stage. Limitations of this study included that the Level I and II clinical data on the benefits of LESS-TEP surgery are still lacking.[10]. Further randomized controlled clinical trials or prospective cohort studies are needed for later research. Moreover, for a multicenter study, different surgeons operating on the patients might affect many of the perioperative outcomes to some extent.

## CONCLUSION

Our study demonstrated that LESS-TEP can be performed safely and efficiently and can yield a more satisfactory cosmetic outcome. However, it is not a necessary replacement of CTEP, based on the current technique and surgical knowledge, especially for surgeons who are less experienced in the technique. With regard to the further validation comparison between CTEP and LESS-TEP, such as recurrence rate and quality of life, large-scale prospective controlled studies and long-term follow-up periods are required.

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