Reconstruction of the Uterine Round Ligament During Laparoscopic Totally Extraperitoneal Inguinal Hernia Repair

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ABSTRACT

Objective: To evaluate the safety and feasibility of a new technique for preserving the uterine round ligament (RL) during laparoscopic totally extraperitoneal (TEP) repair in female patients with inguinal hernias.
Study Design: Observational study.
Place and Duration of the Study: Department of General Surgery, Baoji People's Hospital, Baoji, China, from January 2019 to January 2023.
Methodology: A total of 27 female patients with a primary inguinal hernia who underwent laparoscopic TEP were included in the study. During the surgical procedure, the technique of RL reconstruction following to its division was adopted. Clinical data of the enrolled patients were retrieved through medical record review, surgical video analysis, and telephone or outpatient follow-up. The Shapiro-Wilk test was used to assess the distribution of sample data. Measurement data with normal distribution were expressed as mean ± standard deviation (SD), non-normal distribution data as median (interquartile range, IQR), and categorical data as frequencies and percentages.
Results: All the participants underwent the operation successfully, without the need for conversion. Peritoneal rupture occurred in 11.1% of cases (3/27). The mean operation times were 53.5 ± 9.2 minutes for unilateral and 85.8 ± 7.3 minutes for bilateral. Each RL took 2-6 minutes for suture reconstruction, and the intraoperative blood loss ranged from 0 to 4 millilitres. The visual analogue scale (VAS) score was 1-3 at 24 hours after surgery. Postoperative follow-up lasted for at least 12 months. Seroma was detected in five (18.5%) patients. One case (3.7%) of chronic inguinal pain, inguinal nerve paraesthesia, and labia majora oedema was observed for each condition. No instances of urinary retention, pelvic pain, dyspareunia, uterovaginal prolapse, infection, and recurrence were documented.
Conclusion: The RL reconstruction technique applied during laparoscopic TEP in female patients with inguinal hernias is safe and feasible. However, further investigation should be carried out.

Key Words: *Uterine round ligament, Reconstruction, Laparoscopic totally extraperitoneal, Female, Inguinal hernia.*

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INTRODUCTION

The prevalence of inguinal hernia in females is significantly lower than in males, accounting for only 8% of all cases.[1] Research data on female populations remain scarce, and current treatment protocols are predominantly derived from studies conducted on male populations. Clinical guidelines recommend laparoscopic totally extraperitoneal (TEP) repair as one of the preferred surgical approaches for female inguinal hernias.[2] The key advantage of TEP lies in its minimally invasive nature, which minimises trauma to abdominal organs and reduces trocar-related complications, while typically need for peritoneal closure.[3,4]

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No consensus has been achieved regarding the management of the round ligament (RL) during laparoscopic inguinal hernia repair (LIHR).[2] It is well acknowledged that achieving complete deperitonealisation of the RL is challenging owing to anatomical constraints. Transection of the RL is considered feasible as no serious complications have been reported, thereby facilitating surgical procedures and enabling smooth mesh placement.[5] Nevertheless, the preservation of the RL has gradually emerged as a focal point, with its significance being increasingly recognised.[6] The principal techniques for RL preservation are the longitudinal incision of peritoneum and keyhole approach. Each of these techniques presents distinct surgical trade-offs, and an optimal selection remains to be determined.[7-9]

In laparoscopic TEP repair, the keyhole approach is conventionally employed for RL preservation to minimise the risk of peritoneal breach. This approach, however, necessitates the creation of an extensive mesh fenestration, which compromises mesh integrity — a factor that may potentially detrimental to surgical outcomes, while simultaneously increasing procedural complexity. In circumstances where complete deperitonealisa-

tion of the RL proves unattainable during laparoscopic TEP repair, the transection-reconstruction technique of the RL emerges as a clinically optimal strategy. The primary objective of this study was to evaluate the safety profile and technical feasibility of the implemented methodology through a retrospective observational cohort analysis of patients who underwent the described intervention.

METHODOLOGY

This retrospective analysis included female patients who were treated between January 2019 and January 2023. Ethical approval was obtained from the Ethics Committee of the Baoji People's Hospital. The inclusion criteria comprised female patients diagnosed with inguinal hernia who underwent laparoscopic TEP repair with concomitant RL reconstruction. The exclusion criteria included incarcerated hernia, recurrent hernia, RL pathology, prior gynaecological surgery, coagulopathy, and psychiatric disorders.
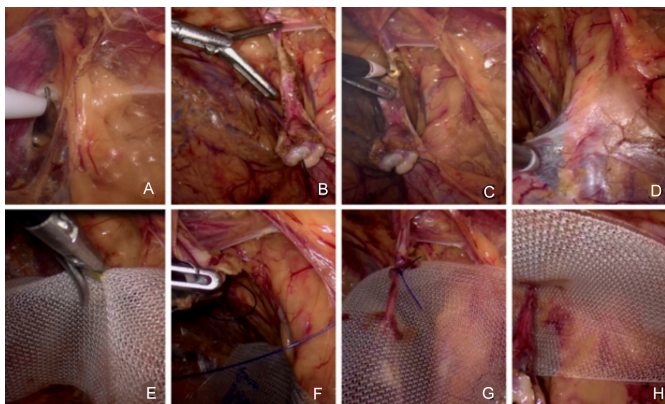

Figure 1: The procedure of the RL reconstruction technique. (A) Initial dissection of preperitoneal space followed by the concurrent management of the hernia sac and the RL. (B) Large sacs are transected with proximal ligation and 2-4 cm RL deperitonealisation. (C) RL transection 1 cm proximal to the internal inguinal ring. (D) Preperitoneal dissection extended to predefined anatomical boundaries. (E) Fenestration created at the pre-marked anatomical landmark on the mesh. (F) Re-anastomosis of ligament stumps using 2-0 polypropylene sutures. (G) Reconstructed segment secured between the mesh and the abdominal wall. (H) The mesh was adjusted to cover the MPO completely.

All procedures were performed under general anaesthesia using a midline three-trocar approach infraumbilically. The patient was positioned supine, and pneumoperitoneum was maintained at 10-12 mmHg. The midline loose connective tissue was meticulously dissected using a laparoscopic push technique, followed by preliminary sequential separation of the affected-side Retzius and Bogros spaces *via* electrosurgical instrumentation (Figure 1A). A surgical deperitonealisation spanning 2-4 cm was meticulously executed along the RL, while in cases of large irreducible hernia sacs, transection of the sac was undertaken, preserving the distal segment *in situ* and achieving definitive closure of the proximal end with sutures (Figure 1B). The pneumoperitoneum pressure was adjusted to 6-8 mmHg, followed by transection of the RL *via* an electrosurgical hook at a site approximately 1 cm proximal to the internal ring (Figure 1C). The preperitoneal space was

further dissected approximately 2 cm inferior to the pectineal ligament and 6-8 cm inferolateral to the deep inguinal ring (Figure 1D). This was followed by the meticulous placement of an appropriately sized 3DMAX mesh (BD, USA; polypropylene). A small fenestration was created at the pre-marked site of the RL passage on the mesh (Figure 1E). Through this opening, the severed RL ends were reapproximated anterior to the mesh using a figure-of-eight suture (2-0 Prolene) (Figure 1F, G). The mesh was then confirmed in a tension-free, flat positioning, without necessitating adjunctive fixation modalities between the mesh and the abdominal wall (Figure 1H). Carbon dioxide was evacuated under laparoscopic guidance. The posterior sheath of the rectus abdominis and the peritoneum below the observation hole were incised under direct vision. A trocar and laparoscope were reintroduced to inspect the contralateral myopectineal orifice (MPO). If identified, contralateral hernias were managed using the same technique. Oral intake and ambulation were initiated six hours after recovery from anaesthesia. The use of a hernia support belt was recommended for at least three months postoperatively.

Clinical data were retrospectively collected through medical record review, surgical video analysis, and outpatient or telephone follow-up. Patients were followed up for a minimum of 12 months. Hernias were classified based on intraoperative findings. Safety outcomes included intraoperative blood loss, iatrogenic injuries, and postoperative complications. Feasibility outcomes comprised operation time, RL reconstruction time, visual analogue scale (VAS) score at 24 hours postoperatively, and postoperative hospital stay.

Statistical analysis was performed using SPSS version 26.0 (IBM, USA). The Shapiro-Wilk test was used to assess the distribution of sample data. Normally distributed continuous variables were expressed as mean ± standard deviation (SD), while non-normally distributed variables were summarised as median (interquartile range, IQR). Categorical data were presented as frequencies and percentages.

RESULTS

A Cohort of 27 patients presenting 31 inguinal hernia was included in the study, with a mean age of 41.4 ± 10.2 years and a median symptomatic history duration of 10 (IQR 6-24) years.

Surgery was successfully performed in all patients, without the need for conversion to other surgical procedures. Intraoperative exploration identified three cases of occult groin hernias, contralateral direct hernia, contralateral femoral hernia, and ipsilateral femoral hernia. Additionally, one case of indirect hernia was converted to direct hernia during repair. The duration of surgical procedures spanned from 39 to 97 minutes. Each RL reconstruction time was 2-6 minutes. Intraoperative blood loss ranged from 0 to 4 millilitres. Postoperative hospitalisation was 20-125 hours, with a median of 48 (IQR 30-80) hours. The VAS score was 1-3 at 24 hours after the surgery.

Postoperative clinical seroma was observed in five patients (18.5%), stratified as Type I (n = 2), Type II (n = 2), and Type III (n = 1) according to the classification of seroma.[10] Clinical manifestations were limited to mild inguinal oedema, which resolved completely with topical traditional Chinese medicine, without any functional impairment. Chronic inguinal pain was documented in one case (3.7%). However, the resolved by the second postoperative month through a combination of oral neurotrophic agents and non-steroidal anti-inflammatory analgesics. A single case (3.7%) of inguinal nerve paraesthesia, presenting hypoaesthesia and intermittent numbness, gradually improved after two weeks of oral neurotrophic drugs and resolved completely within four postoperative months. Transient labia majora oedema occurred in one patient (3.7%), presenting non-tender swelling that resolved within three weeks without any intervention. No urinary retention, pelvic pain, dyspareunia, uterovaginal prolapse, infection, or recurrence were observed during the follow-up period. The comprehensive outcomes are shown in Table I.

Table I: Patients' surgical outcomes.

Variables	Outcomes
Hernia types	
Compound hernia	1 (3.7%)
Bilateral hernia	4 (14.8%)
Indirect inguinal hernia	13 (48.2%)
Direct inguinal hernia	6 (22.2%)
Femoral hernia	3 (11.1%)
Unilateral operation time, minutes[a]	53.5 ± 9.2
Bilateral operation time, minutes[a]	85.8 ± 7.3
Each RL reconstruction time, minutes[b]	4 (3.5-4.0)
Intraoperative blood loss, ml[b]	3 (2.0-3.0)
VAS score[b]	2 (1.0-2.0)
Peritoneal rupture	3 (11.1%)
Clinical seroma	5 (18.5%)
Chronic groin pain	1 (3.7%)
Groin nerve paraesthesia	1 (3.7%)
Labia majora oedema	1 (3.7%)

[a] Normally distributed variables were expressed by mean ± SD.
[b] Not-normally distributed variables were expressed by median (IQR).

DISCUSSION

Achieving the anticipated deperitonealisation of the RL remains challenging due to its dense adhesion with the peritoneal layer. Current techniques for RL preservation during laparoscopic TEP procedures significantly increase surgical complexity; however, no serious complications have been documented following RL transection in the existing literature.[11-13] To ensure mesh integrity and complete coverage of the MPO, RL transection is generally considered mandatory.[14,15] Consequently, RL preservation has historically been underestimated in female inguinal hernia repair. Scholarly debates persist regarding potential sequelae of RL transection, including uterine prolapse, dyspareunia, dysmenorrhoea, menstrual reflux, endometriosis, pelvic inflammatory disease, and impaired fertility, potentially arising from altered uterine retroversion.[16,17] Given these theoretical risks, particularly in younger female patients, RL preservation becomes critically important.[18] This concern has stimulated substantial academic interest in developing techniques for anatomical reconstruction or functional preservation of this structure.[19]

In this study, the reconstruction technique for the RL was employed to achieve complete MPO dissection while preserving anatomical continuity and physiological functionality. All procedures were successfully concluded without significant postoperative morbidity. The incidence of postoperative seroma following LIHR demonstrates considerable variability, ranging from 5.7 to 66.7%, with spontaneous resolution reported in most documented cases.[20,21] The current study recorded an 18.5% seroma incidence, predominantly associated with hernia sac dissection. These collections demonstrated gradual resolution within 1 to 6 months through conservative management or physiotherapeutic intervention. Anatomical studies confirm the convergence of the genital branch of the genitofemoral nerve with the RL at the internal inguinal ring,[14] rendering this neural structure vulnerable during RL manipulation. Surgical transection of the RL, therefore, requires precise execution approximately 1cm proximal to the internal ring to minimise neurological complications. Postoperative neural sequelae were documented in two cases: chronic groin pain in one patient and regional paraesthesia in another — both potentially attributable to intraoperative neural manipulation. Complete symptom resolution was achieved in both instances through pharmacological management. Kleppeet et al.[22] identified lymphatic vessels within the RL architecture, notably devoid of lymph nodes. These vessels facilitate lymphatic drainage from the reproductive organs to regional nodal basins, including external iliac, obturator, and inguinal lymph nodes. A single case of labial oedema was observed, potentially reflecting impaired lymphatic or vascular flow.

The principal limitation of this technique lies in the obligatory transection of the RL. Although anatomical continuity is restored through surgical reconstruction, postoperative tissue remodelling may induce ligamentous laxity, potentially compromising transient physiological function. Critical technical details to address this issue include, as following. First, reducing pneumoperitoneum pressure to 6-8 mmHg after the separation of the preperitoneal space serves to minimise tissue distension while enabling precise identification of anatomical landmarks, which is critical for accurately locating RL transection site. Creating of a 3-5 mm mesh fenestration, corresponding to the RL diameter, is performed using endoscopic scissors after complete coverage of the MPO. This ensurs unobstructed passage of the ligament. Reconstructing round ligament continuity involves suturing through the mesh fenestration, securing it between the abdominal wall and the prosthesis. The anterior anastomosis is positioned to allow early oedema-induced expansion at the reconstructed site, which promotes peritoneal convexity of the mesh, thereby lowering hernia recurrence rates. Suturing is performed employing 2-0 non-absorbable polypropylene, based on orthopaedic evidence suggesting 12-16 week helding period for ligamentous sutures.[23] A figure-of-eight suturing technique with distal anchoring is employed to prevent retraction. The procedure concludes with thorough haemostatic verification. These refinements collectively

address both anatomical preservation and biomechanical stability considerations in RL reconstruction protocols.

The generalisability of this study is constrained by methodological limitations, including its non-prospective, non-randomised, single-centre design, as well as the absence of a power analysis due to restricted sample size. These limitations underscore the need for external validation of the findings.

CONCLUSION

RL reconstruction offers a clinically viable alternative in cases where obligatory transection is required during laparoscopic TEP repair and complete deperitonealisation cannot be achieved. This technically efficient approach preserves ligamentous continuity and functional integrity while ensuring complete MPO coverage. The favourable operative outcomes validate its clinical safety and procedural feasibility.

ETHICAL APPROVAL:
This study received approval from the Ethics Committee of Baoji People's Hospital (Approval Number: 2024010).

COMPETING INTEREST:
The authors declared no conflict of interest.

AUTHORS' CONTRIBUTION:
HC: Data curation, investigation, and writing of the original draft.
SZ, ZJ: Data collection, follow-up, and writing of the original draft.
XL: Conception and design, manuscript writing, and modification.
ZJ: Methodology, project administration, supervision, reviewing, and editing.
All authors approved the final version of the manuscript to be published.

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