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Effect of hernia sac transection on the outcomes of laparoscopic hernia repair for unilateral Gilbert type-III inguinal hernia

Chunpeng Pan, Shoulian Wang, Chihao Zhang, Xiaochun Ni, Haibo Wang, Jiwei Yu

Abstract

BACKGROUND: To investigate the effect of laparoscopic herniorrhaphy on the treatment of unilateral Gilbert type-III inguinal hernia.

METHODS: This study retrospectively reviewed medical records of 325 individuals who underwent minimally invasive laparoscopic surgery for unilateral Gilbert type-III inguinal hernias at the Ninth People's Hospital affiliated with Shanghai Jiaotong University Medical College, with data collection occurring between January 2021 and May 2024. The cohort was stratified into two surgical groups: Partial resection ($n = 180$) receiving transection procedures versus radical resection ($n = 145$) undergoing complete sac dissection, determined by intraoperative decision-making. The ages, body mass index values, operation modes, operation times, intraoperative bleeding levels, postoperative pain scores, postoperative hospital stays, postoperative seroma rates, postoperative chronic pain levels, postoperative hematoma rates, incision infection rates, and hernia recurrence rates of the patients in the two groups were analyzed and compared.

RESULTS: The transection group demonstrated a marked reduction in postoperative seroma occurrence relative to the complete dissection cohort, with statistical significance confirmed ($P < 0.05$). There were no significant differences between the two groups in intraoperative bleeding, operation times, postoperative hospital stays, postoperative pain scores, postoperative chronic pain levels, postoperative hematoma rates, or incision infection rates ($P > 0.05$). Continuous surveillance spanning 12 months revealed equivalent therapeutic durability across both treatment arms, with no hernia reappearance detected.

CONCLUSION: For patients requiring laparoscopic repair of unilateral Gilbert type-III inguinal hernias, intraoperative sac transection is an effective strategy, particularly in cases where the hernia sac is long and complete dissection is difficult, as it may be the preferable option and can significantly reduce the risk of postoperative seroma formation.

Keywords:

Gilbert type-III, inguinal hernia, laparoscopes, seroma, transection, unilateral

Department of General Surgery, Shanghai Ninth People's Hospital, School of Medicine, Shanghai Jiao Tong University, Shanghai, China

Address for correspondence:

Prof. Jiwei Yu, Department of General Surgery, Shanghai Ninth People's Hospital, School of Medicine, Shanghai Jiao Tong University, 639 Zhizaoju Road, Huangpu District, Shanghai 200011, China.
E-mail: jenniferyu919@126.com

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Introduction

In recent years, laparoscopic inguinal hernia repair has become the main surgical method in inguinal hernia surgery. Compared with open surgery, laparoscopic inguinal hernia repair has the advantages of lower postoperative pain levels, faster

recovery rates, shorter hospital stays, and lower recurrence rates.^[1-7] The management of hernia sacs is a very important part of surgery. Whether transection of the hernia sac or complete dissection of the hernia sac during surgery will have a certain impact on the postoperative outcomes of patients has not been unanimously decided, and it is a focus of controversy among scholars.

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This retrospective cohort investigation evaluated laparoscopic management strategies for unilateral Gilbert type-III inguinal hernias, systematically comparing perioperative outcomes between sac transection and complete dissection approaches to establish procedural optimization criteria.

Materials and Methods

Objectives and study design

The clinical data of 325 patients with unilateral Gilbert type-III inguinal hernia treated by laparoscopic inguinal hernia repair at the Ninth People's Hospital Affiliated with the Medical College of Shanghai Jiaotong University from January 2021 to May 2024 were analyzed retrospectively. According to the hernia sac treatment method, surgical allocation protocols segregated participants into intervention arms – transection ($n = 180$) and radical dissection ($n = 145$) – reflecting differential intraoperative decision pathways. Clinical parameters were systematically retrieved from Institutional Electronic Health Records by the surgical team. Longitudinal monitoring protocols maintained 12-month postoperative surveillance, enabling quantitative evaluation of minimally invasive repair efficacy in Gilbert type-III hernial management.

Inclusion criteria were as follows: referral to Gilbert classification standard,^[8] Gilbert type-III inguinal hernia: indirect inguinal hernia, which has a large internal ring, two finger breadths or larger (>4 cm); presence of unilateral inguinal hernia; the therapeutic efficacy of laparoscopic herniorrhaphy can be systematically compared using two established approaches: Totally extraperitoneal (TEP) versus transabdominal preperitoneal (TAPP) techniques; and being a male adult. The criteria for exclusion included the following: recurrent hernias, incarcerated hernias, strangulated hernias, and various other hernia types; bilateral inguinal hernia; as well as individuals who had either open surgery or were suggested open surgery in comparison to laparoscopy.

Surgical technique

In this study, all patients included in both groups were operated on by experienced senior surgeons, each possessing considerable expertise in the technique of laparoscopic inguinal hernia repair. This ensured that the surgical procedures were conducted with a high level of skill and proficiency. Furthermore, every patient underwent endotracheal intubation along with general anesthesia, which is a standard practice for ensuring optimal surgical conditions and patient safety during the procedure. Due to the relatively short operative duration, the surgery performed under general anesthesia required neither preoperative antibiotics nor urinary catheter placement. The operation was performed by

TAPP: the pneumoperitoneum was established using the direct trocar insertion technique. A 10-mm trocar was placed supraumbilically for the 30-degree laparoscope as the observation port. On the affected side, a 5-mm trocar was positioned at the umbilical level lateral to the rectus abdominis muscle as the operating port, while on the contralateral side, another 5-mm trocar was placed below the umbilical level lateral to the rectus abdominis muscle. The operation was performed by TEP: The preperitoneal space was established via blunt dissection under direct visualization through a 10-mm infraumbilical port (1 cm below the umbilicus) housing a 30-degree laparoscope, which served as the observation port. Two additional 5-mm operating trocars were placed at approximately the proximal and distal thirds of the axis connecting this initial port and the symphysis pubis. Pneumoperitoneum parameters were precisely regulated to 13 mm Hg pressure and 13 L/min gas exchange. Intraoperatively, if dense adhesions of the hernia sac are identified and complete dissection is assessed to require prohibitively prolonged operative time, we would opt to transect the hernia sac. In the complete dissection group [Figures 1 and 2] (the hernia sac was loosely adherent to the surrounding tissue), the hernia sac was carefully separated from both the vas deferens and testicular vessels, ensuring that these important structures were not damaged during the procedure. Once isolated, the sac was completely reduced in size. In the case of the transection group

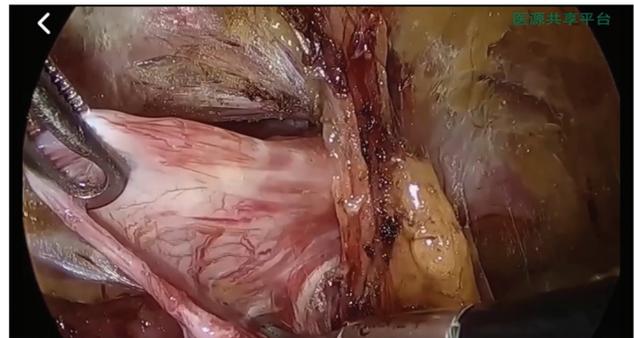


Figure 1: Before complete dissection of the hernia sac



Figure 2: After complete dissection of the hernia sac

[Figure 3 and 4], where the hernia sac exhibited significant adherence to the surrounding tissue, the same isolation technique was employed for the vas deferens and testicular vessels. However, in this group, the hernia sac was circumferentially transected 2 cm distal to the internal ring. The proximal sac remnant was subsequently ligated with sutures or secured with hemostatic clips. For the procedure, a UMM3 mesh, produced by Johnson Medical Equipment Co., Ltd., and measuring 15 by 15 cm, was utilized. This mesh was securely fixed in place using a permanent adhesive, ensuring stability and support for the surrounding tissues. Patients in the two groups were fed a semifluid meal 6 h after the operation, and the operation side was compressed with an ice pack for 6 h.

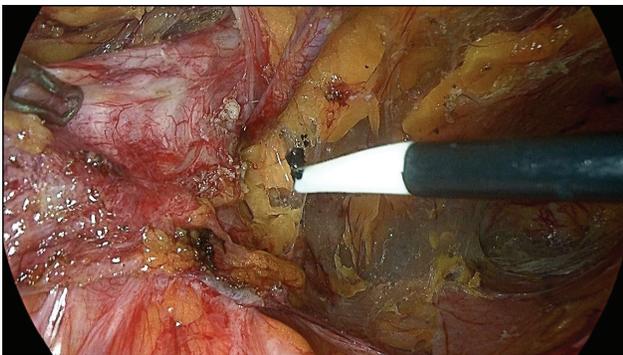


Figure 3: Before transection of the hernia sac



Figure 4: Transection of the hernia sac

Statistical analysis

The data analysis was conducted using SPSS version 23.0, a software developed by SPSS Inc. in Chicago, Illinois, USA. For the evaluation of continuous variables, independent-sample t tests were utilized, while the Wilcoxon rank-sum test was employed when appropriate. In contrast, categorical variables were assessed through various statistical tests, including the Pearson chi-square test, Fisher's exact test, or the Cochran–Mantel–Haenszel chi-square test, depending on the specific circumstances of the data. Dichotomous outcome classification utilized a *P* value cutoff of 0.05, with values below this threshold indicating statistically meaningful differences warranting further consideration.

Results

The analytical outcomes demonstrated statistically comparable profiles in age ($P = 0.169$), body mass index ($P = 0.827$), hernia sac length ($P = 0.167$), hernia duration ($P = 0.515$), scar tissue ($P = 0.820$), and surgical approach ($P = 0.519$) between the two groups. Additionally, hernia ring diameter ($P = 0.908$) showed no significant difference. Collectively, these results indicate no statistically significant differences in baseline characteristics, hernia morphology, or operative factors between the transection and complete dissection groups [Table 1].

The examination of surgical data from both groups indicated no notable differences in operation duration ($P = 0.052$), intraoperative blood loss ($P = 0.694$), or length of postoperative hospital stay ($P = 0.058$) [Table 2].

The analysis of postoperative complication-related data between the two groups showed that the incidence of postoperative seroma in the transection hernia sac group was significantly lower than that in the complete dissection hernia sac group ($P < 0.001$). There were no significant differences in postoperative chronic pain levels ($P = 0.809$), postoperative hematoma rates ($P = 0.568$), incision infection rates (0.940), pain scores on the first day after surgery ($P = 0.210$), or pain scores

Table 1: Baseline clinical characteristics of patients

Group	Cases (n)	Age (years)	Body mass index (kg/m ²)	Surgical approach [n(%)]		Hernia ring diameter (cm)	Hernia sac length (cm)	Protrusion area (cm ²)	Hernia Duration (years)	Scar Tissue [n(%)]
				TEP	TAPP					
Transection Group	180	60.20 ± 10.78	23.21 ± 2.68	89(59.3)	61(40.7)	3.85 ± 0.42	6.42 ± 1.18	14.85 ± 3.50	5.20 ± 0.40	105(58.3)
Complete Dissection Group	145	61.86 ± 9.14	23.14 ± 2.43	75(55.6)	60(44.4)	3.80 ± 0.40	6.18 ± 1.12	14.20 ± 3.30	5.15 ± 0.38	85(58.6)
Statistical Value	-	-1.378	0.219	0.219	0.415	0.115	1.382	0.250	0.115	0.05
<i>P</i> value	-	0.169	0.827	0.827	0.519	0.908	0.167	0.803	0.908	0.820

Note: TEP = totally extraperitoneal repair; TAPP = transabdominal preperitoneal repair; protrusion area was calculated as (major axis × minor axis × π)/4

Table 2: Comparison of perioperative indicators

Group	Number	Operation time (min)	Bleeding (mL)	Length of stay (day)
Transection hernia sac group	180	58.33 ± 14.87	4.06 ± 1.35	1.85 ± 0.80
Complete dissection hernia sac group	145	61.41 ± 11.52	4.16 ± 2.51	2.02 ± 0.76
Statistical value		-1.961	-0.394	-1.901
P value		0.052	0.694	0.058

Table 3: Postoperative complications

Group	Number	Seroma (%)	Postoperative chronic pain (%)	Incision infection (%)	Postoperative seroma (%)	Pain score on the first day after surgery (points, $\bar{x} \pm s$)	Pain score on the second day after surgery (points, $\bar{x} \pm s$)
Transection hernia sac group	180	7(4.0)	5(2.7)	1(0.7)	2(1.3)	1.46 ± 0.59	1.25 ± 0.43
Complete dissection hernia sac group	145	30(21.5)	3(2.2)	1(0.7)	3(2.2)	1.56 ± 0.69	1.23 ± 0.42
Statistical value		20.157	0.059	0.006	0.326	-1.255	0.336
P value		<0.001	0.809	0.940	0.568	0.210	0.737

on the second day after surgery ($P = 0.737$) between the two groups [Table 3].

The complete cohort demonstrated sustained therapeutic success with 100% recurrence-free status during the 12-month postoperative surveillance window.

Discussion

Herniorrhaphy constitutes a fundamental aspect of global general surgical workloads, consistently ranking among the top five elective procedures in international surgical registries.^[9] More than 20 million patients worldwide undergo inguinal hernia surgery each year.^[10] In recent years, with the continuous development of laparoscopic technology, laparoscopic inguinal hernia repair has been widely used because of its advantages of less trauma, less pain, faster recovery, and shorter hospital stay^[11-13] for the patient, and current surgical protocols provide two distinct approaches for this intervention: the TAPP technique versus the TEP methodology.^[14,15] Hernial sac disposition remains a pivotal technical challenge in endoscopic herniorrhaphy, with persistent disagreement among surgical societies regarding optimal management protocols.^[16-18] In individuals diagnosed with Gilbert type-III inguinal hernia, a significant defect is present in the internal ring, accompanied by substantial adhesion at the neck of the hernia sac. In some cases, hernia sacs may even completely descend into the scrotum prior to surgical intervention, complicating the management of the hernia sac further. Numerous researchers have deliberated on various techniques for managing the hernia sac in laparoscopic indirect inguinal hernia operations. The most frequently debated methods include either a complete dissection of the hernia sac or

its transection, particularly concerning which approach results in fewer complications after surgery; the discussion primarily examines if seroma formation after operation is linked to the two approaches for managing the hernia sac. Li and Ruze *et al.* advocated complete dissection of the hernia sac^[19,20] due to their belief that cutting the hernia sac might increase the likelihood of postoperative seroma; some researchers also argue that this procedure can shorten the operation time, minimize surgical trauma, and decrease the occurrence of complications. However, some scholars have reached completely contrasting conclusions. Li *et al.* advocated transection of the hernia sac because forced dissection of the hernia sac would increase the risk of vas deferens, testicular vessel, and peripheral vascular injury, and clinical evidence suggested a significant reduction in post-surgical seroma rates with intentional hernia sac transection during laparoscopic procedures.^[21] It is also believed that the incidence of seroma would be lower if the sac could be completely removed without causing any trauma, but the problem is that no surgeon can do so perfectly. No evidence-based guidelines currently exist to definitively correlate sac transection techniques with improved clinical trajectories in laparoscopic Gilbert III hernia management. Transection of the hernia sac seems to be a simple and effective treatment of the hernia sac. However, its feasibility and effectiveness still need to be studied further.

Seroma is among the most frequently occurring complications following laparoscopic inguinal hernia repair and refers to an aseptic fluid mass formed by the accumulation of exudates in the tissue space, the potential space, and the space formed after surgery. Kockerling *et al.*^[22] proposed that larger defects in hernia rings are potentially more prone to resulting in postoperative seroma following laparoscopic inguinal

hernia repair. In simpler terms, seroma tends to occur more frequently in individuals diagnosed with Gilbert type-III inguinal hernia. Several researchers have observed that the occurrence of seroma is a natural phenomenon that cannot be entirely averted after laparoscopic inguinal hernia repair, particularly among patients with indirect inguinal hernias featuring significant defects in the fascial hernia ring, which are primarily linked to the extensive dissection of the hernia sac during the procedure.

Among the 37 patients with seroma, 35 patients underwent spontaneous resolution of seroma within 3 to 6 weeks after the operation, but some patients still misinterpreted it as hernia recurrence, resulting in varying degrees of anxiety. In one patient, the swelling and pain were still obvious after 3 weeks of follow-up, and the effusion did not subside in an obvious manner. After three punctures and fluid extractions, the seroma did not subside until 2 and a half months later. Another patient developed redness, swelling, and heat pain after 2 weeks of conservative treatment. Purulent effusion was extracted by puncture and drainage, and the redness and swelling subsided after anti-inflammatory treatment. In addition, chronic pain in this patient was not relieved until nearly 2 years later. Seroma seems to be a slightly self-limited complication, but it still causes much pain in some patients. Effectively preventing the formation of seroma following inguinal hernia surgery has proven to be a significant challenge for surgeons. The occurrence of seroma can complicate recovery and potentially lead to further medical interventions, emphasizing the necessity for improved strategies in surgical practice. As such, addressing this issue is crucial not only for enhancing patient outcomes but also for optimizing overall surgical techniques. Surgeons continuously seek innovative solutions and methods to mitigate this complication, demonstrating a commitment to advancing postoperative care and ensuring a smoother recovery process for patients.

The findings of this research indicate that utilizing laparoscopic techniques for the repair of unilateral Gilbert type-III inguinal hernias, along with the intraoperative cutting of the hernia sac, can notably decrease the occurrence of postoperative seroma. Additionally, there are no significant differences observed in terms of postoperative pain scores, chronic pain, hematoma, or surgical site infections between the two groups. This may be because early hernia sac transection reduces excessive tissue damage caused by repeated dissection of the sac wall, which in turn reduces the depth of the tissue, thereby reducing the incidence of postoperative seroma. It can also be seen from this study that the operation time, intraoperative blood loss, and intraoperative hospital stay in the transection hernia sac group were slightly less than those in the complete dissection hernia sac group.

This indicates that in the case of laparoscopic repair of Gilbert type-III inguinal hernia, transecting the hernia sac serves as an effective and straightforward therapeutic approach.

When choosing transection of the hernial sac, we suggest that the hernial sac distal margin must be hemostatic, and in the area near the inner ring across from the break in the hernial sac (distal not ligation), before the cross-section of the hernial sac, it must be thoroughly dissected clear of the spermatic veins, vas deferens, and structural relationships of the hernial sac. A certain tension must be maintained to avoid the spermatic cord blood vessels and the vas deferens for hernial sac transection.

Conclusion

In summary, laparoscopic inguinal hernia repair for patients with Gilbert type-III inguinal hernia is both a safe and practical surgical option. This approach not only demonstrates a high level of effectiveness but also significantly lowers the likelihood of postoperative seroma occurrence. The findings indicate that utilizing this laparoscopic technique can enhance patient outcomes by minimizing complications associated with traditional surgical methods.

Author contributions

JY: Study design, data collection, and manuscript drafting. CP: Statistical analysis and critical revision. SW, CZ, XN, and HW: Surgical procedures and supervision.

Ethical policy and Institutional Review Board statement

This study had been performed in accordance with the Declaration of Helsinki and approved by the institutional ethical review board of Shanghai Ninth People's Hospital, School of Medicine, Shanghai Jiao Tong University, approval number SH9H-2025-T149-1 (2025-4-25).

Declaration of patient consent

All the patients had given their written informed consent.

Data availability statement

The data that support the findings of this study are not publicly available due to their containing information that could compromise the privacy of research participants but are available from the corresponding author upon reasonable request.

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Nil.

Conflicts of Interest

There are no conflict of interest.

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