

# The Effect of Tension-Free Herniorrhaphy in the Preperitoneal Space on the Treatment of Hernia

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**Abstract:** *Objective:* To explore the clinical effect of tension-free herniorrhaphy in the preperitoneal space in patients with hernia. *Methods:* The study period was from January 2020 to December 2022. 198 samples of hernia patients admitted to our hospital were selected and divided into a research group ( $n = 99$ ) and a control group ( $n = 99$ ). Patients in the control group underwent tension-free herniorrhaphy with plain films, and patients in the study group underwent tension-free herniorrhaphy in the preperitoneal space. The surgical and postoperative recovery-related indicators, incidence of complications, and recurrence rate were compared between the two groups. *Results:* The intraoperative and postoperative recovery indexes of the study group were better than those of the control group ( $P < 0.05$ ); the incidence of complications in the study group was lower than that of the control group ( $P < 0.05$ ), and there was no significant difference in the recurrence rate between the two groups ( $P > 0.05$ ). *Conclusion:* Tension-free herniorrhaphy in the preperitoneal space shortens the operation and postoperative recovery time of hernia patients and reduces the incidence of postoperative complications, so it should be popularized.

**Keywords:** Tension-free herniorrhaphy in the preperitoneal space; Plain film tension-free herniorrhaphy; Hernia

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## 1. Introduction

Hernia is a prevalent clinical condition in the field of general surgery. Its main characteristic is the displacement of internal organs from their regular anatomical positions, protruding into other areas through either congenital or acquired weak points, openings, or defects. One of the most common types of hernia is inguinal hernia <sup>[1]</sup>. The main clinical manifestation of a hernia is that there is a protruding mass on the body surface that can be retracted, and it can cause symptoms such as swelling and pain. Surgery is the best treatment option for hernia, and the surgery performed is usually plain film tension-free herniorrhaphy. However, the postoperative recovery time is long, with a high incidence of complications <sup>[2]</sup>. Tension-free herniorrhaphy in the preperitoneal space is a brand-new surgical method for the treatment of hernia, and it has been shown to be effective for some patients <sup>[3]</sup>. This study included 198 samples of hernia patients admitted to our hospital to explore the clinical effect of tension-free herniorrhaphy in the preperitoneal space.

## 2. Materials and methods

### 2.1. General information

The samples included in this study and the specific surgical procedures were submitted to the Medical Ethics Committee for approval, and the study period ranged from January 2020 to December 2022. In this study, 198 hernia patients admitted to our hospital were drawn and divided into a research group ( $n = 99$ ) and a control group ( $n = 99$ ). The research group consisted of 89 males and 10 females, aged 33–68 years old, with an average of  $50.42 \pm 2.95$  years old, and the course of the disease was seven months to 3 years, with an average of  $1.48 \pm 0.45$  years. The control group consisted of 91 males and 8 females, aged 35–67 years old, with an average of  $50.38 \pm 2.99$  years old, and the course of the disease was five months to 3 years, with an average of  $1.42 \pm 0.53$  years.

Inclusion criteria: (1) diagnosed with inguinal hernia, (2) met the surgical indications, (2) signed an informed consent.

Exclusion criteria: (1) presence of heart, lung, kidney, and other major organ diseases, (2) unable to tolerate surgical treatment, (3) presence of mental or psychological diseases.

### 2.2. Methods

The patients in the control group underwent tension-free herniorrhaphy on plain films. The patients were maintained in a supine position and received general anesthesia or epidural anesthesia. The line connecting the anterior superior iliac spine and the pubic tubercle was marked, and the distance from the midpoint of the line was selected to be about 1.5 cm. The 2 cm point was the starting point, and a 5–6 cm incision was made towards the pubic tubercle. The skin and subcutaneous tissue, the external oblique aponeurosis were incised accordingly, and the hernia sac was fully exposed. The doctor observed the condition of the patient's hernia sac by lifting the hernia sac below the transverse fascia and separating it. If the patient had a large hernia sac, the hernia sac was transected, and it was sutured with a purse string, and the neck of the hernia sac was ligated. The spermatic cord was elevated, to keep it free and create a gap. The patch was cut longitudinally, and a small hole with a diameter of about 3 cm was made to allow the passage of the spermatic cord. The patch was then positioned in front of the transverse fascia and laid flat. Post-surgery, the patient was checked for any signs of active bleeding, and the surgical incision was closed layer by layer, followed by the application of pressure bandaging. Additionally, antibiotics were administered after the surgery to prevent infection.

The patients in the study group underwent tension-free herniorrhaphy in the preperitoneal space. Patients were kept in the supine surgical position and underwent general anesthesia or epidural anesthesia. The line connecting the anterior superior iliac spine and the pubic tubercle was marked. The distance from the midpoint of the line was approximately 1.5–2 cm, which was the starting point, and the surgical incision was made towards the pubic tubercle. The length of the incision was 3–5 cm. The skin and subcutaneous tissue, the external oblique aponeurosis was incised, and the external oblique aponeurosis was separated to fully expose the hernia sac. Since the hernia sac was located below the transverse fascia tissue, the doctors lifted the hernia sac, transected the large volume of the hernia sac, and performed a purse-string suture to ligate the neck of the hernia sac. Physicians bluntly dissected the preperitoneal fat layer and peritoneum between the peritoneal fascia to fully expose the inguinal ligament tissue. A crimped patch was placed in the preperitoneal space, and 2–3 pieces of interrupted sutures were performed on the incised transverse fascia in the inner ring area. The front layer of the patch was unfolded like a petal, laid flat, and fixed above the transverse fascia. After the surgery, the patient was checked for any signs of active bleeding. Then, the surgical incision was closed layer by layer,

and pressure bandaging was performed. After the procedure, antibiotics were given to prevent infection.

### 2.3. Evaluation criteria

(1) The intraoperative and postoperative recovery indicators of the two groups of patients were recorded, including intraoperative blood loss, duration of surgery, ambulation time, duration of incision pain, and hospital stay. (2) The incidence of complications and recurrence rates of patients in the two groups were recorded.

### 2.4. Statistical analysis

SPSS23.0 was used to analyze the research data. The measurement data was expressed as (mean  $\pm$  standard deviation) and analyzed by a *t*-test; the count data was expressed as percentages and analyzed by a  $\chi^2$  test, with  $P < 0.05$  indicating statistical significance.

## 3. Results

### 3.1. Recovery indicators during and after the surgery

Table 1 shows that the intraoperative and postoperative recovery indexes of the patients in the study group were better than those in the control group ( $P < 0.05$ ).

**Table 1.** Comparison of intraoperative and postoperative recovery indicators between the two groups (mean  $\pm$  standard deviation)

Group	Intraoperative blood loss (mL)	Duration of surgery (min)	Ambulation time (h)	Duration of incision pain (d)	Length of hospital stay (d)
Research group ( <i>n</i> = 99)	25.02 $\pm$ 1.18	38.15 $\pm$ 2.96	22.81 $\pm$ 1.25	1.04 $\pm$ 0.33	4.11 $\pm$ 0.86
Control group ( <i>n</i> = 99)	27.94 $\pm$ 1.85	42.77 $\pm$ 3.98	25.96 $\pm$ 1.97	1.89 $\pm$ 0.57	6.75 $\pm$ 1.49
<i>t</i>	13.241	9.268	13.434	12.841	15.269
<i>P</i>	0.000	0.000	0.000	0.000	0.000

### 3.2. Complication and recurrence rate

Table 2 shows that the incidence of complications in the study group was lower than that in the control group ( $P < 0.05$ ), and there was no significant difference in the recurrence rate between the two groups ( $P > 0.05$ ).

**Table 2.** Comparison of the incidence of complications and recurrence rate between the two groups (*n* [%])

Group	Surgical site infection	Scrotal edema	Urinary retention	Complication rate	Recurrence rate
Research group ( <i>n</i> = 99)	1	2	2	5 (5.1)	2 (2.0)
Control group ( <i>n</i> = 99)	3	6	4	13 (13.1)	4 (4.0)

$\chi^2$	3.911	0.687
$P$	0.047	0.407

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#### 4. Discussion

Inguinal hernia is the most common type of hernia. The primary lesion feature is that internal organs of the abdominal cavity enter other anatomical positions through congenital or acquired weak areas, forming protruding masses in the body surface area. In the initial stage of the onset of hernia patients, only an absorbable bump appears on the body surface. The prolongation of the disease can cause local pain and difficulty in movement, which will severely hamper the ability of the patient to perform daily activities <sup>[4]</sup>.

Clinical studies have demonstrated that hernias cannot self-heal, necessitating surgical intervention to rectify the defect and return abdominal organs to their normal anatomical position <sup>[5]</sup>. The Bassini technique involves tension suture, and the patients often suffer from severe postoperative pain and a high recurrence rate. Therefore, plain film tension-free herniorrhaphy has become the preferred technique in repairing inguinal hernia in recent years. Compared to the Bassini technique, the defect area is repaired with a mesh, and the suture is completed in a tension-free state. This approach reduces postoperative pain and prevents recurrence. Some studies have shown that the implanted materials in plain film herniorrhaphy can lead to the formation of hypertrophic scar tissues, making the inguinal area of patients too stiff, causing complications such as chronic pain and foreign body sensation, thereby affecting postoperative recovery <sup>[6]</sup>. Tension-free herniorrhaphy in the preperitoneal space is a novel surgical procedure for treating a hernia. Its main feature is that a patch is placed in the preperitoneal space area during the surgery according to the patient's physiological structure. This approach fully covers the pubic muscle foramen area and efficiently addresses ipsilateral concealed hernias. By addressing indirect inguinal hernias comprehensively, it can also help prevent direct and femoral hernias <sup>[7]</sup>. Besides, tension-free herniorrhaphy in the preperitoneal space has little impact on the anatomical structure of the patient, and the patient will not experience foreign body sensation after the surgery. When in the upright position, the contents of the abdominal cavity can exert pressure on the mesh, creating a secure seal between the tissue and the mesh without the need for sutures, thereby preventing issues like displacement.

The results of this study showed that the duration of surgery and postoperative recovery of the patients in the study group were significantly shorter and better than those in the control group, suggesting that tension-free herniorrhaphy in the preperitoneal space requires less time and leads to better postoperative recovery. This is because, in plain film tension-free herniorrhaphy, the procedure begins at the surface area of the transversal fascia to. The surface nerve tissue of the internal oblique muscle is easily damaged during the freeing process of the mesh, which in turn leads to prolonged duration of surgery, increased blood loss, and slow postoperative recovery <sup>[8]</sup>. Tension-free herniorrhaphy in the preperitoneal space does not require a free spermatic cord. The procedure starts at the posterior aspect of the transversal fascia, leading to a notable reduction in surgical trauma, blood loss, postoperative incision pain, and a quicker recovery period. Tension-free herniorrhaphy in the preperitoneal space can dramatically reduce the interference to the nerve tissue and body surface, help reduce the risk of surgery, and accelerate postoperative recovery <sup>[9,10]</sup>. The results of this study showed that the incidence of complications in the study group was lower than that in the control group, and there was no significant difference in the recurrence rate between the two groups, suggesting that tension-free herniorrhaphy in the preperitoneal space can reduce the incidence of postoperative complications in patients with hernia, with a low recurrence rate. This is because in plain film tension-free herniorrhaphy, synthetic composite materials

are employed to reinforce the posterior groin region, effectively decreasing groin pressure and lowering the postoperative recurrence rate while meeting biomechanical demands. However, it can result in more pronounced nerve tissue damage, leading to noticeable postoperative pain and foreign body sensations, potentially giving rise to complications like urinary retention and scrotal edema<sup>[11]</sup>. Preperitoneal space tension-free herniorrhaphy does not require large-scale dissection of the groin area, which can reduce the degree of local tissue damage. The procedure strategically utilizes the preperitoneal space and leverages abdominal pressure to secure the patch without the need for sutures, preventing local tension and reducing postoperative pain<sup>[12]</sup>. Tension-free herniorrhaphy in the preperitoneal space ensures a complete repair of the pubic muscle foramen region and the entire groin area. The surgical plan aligns with the body's natural structure, and follows basic biomechanical principles, which help lower the risk of postoperative complications<sup>[13]</sup>.

Through this study, we believe that tension-free herniorrhaphy in the preperitoneal space is superior to plain film tension-free herniorrhaphy in treating hernia. To ensure the best outcome of tension-free herniorrhaphy in the preperitoneal space, surgeons will need to master several points. The incision of the transversal fascia should be performed using the shoulder neck technique. The inferior abdominal wall vessels should be identified carefully to avoid damaging the vessels. The preperitoneal space should be separated in the region behind these vessels. As the preperitoneal space is being released, the relatively loose tissue in front of the peritoneum can be gently pushed using gauze, rather than forcefully pulling it, thereby minimizing intraoperative blood loss<sup>[14]</sup>. The peritoneal tissue should be taken care of during the process, and if the tissue is damaged, it needs to be sutured as soon as possible. Adequate hemostasis must be ensured during the procedure, with special attention paid to separating the vas deferens from the spermatic cord in the abdominal wall. When positioning the mesh, it should be laid flat, with the lower part covering the femoral ring. After confirming there are no issues, the tissue of the transverse fascia should be closed<sup>[15]</sup>.

## 5. Conclusion

In summary, tension-free herniorrhaphy in the preperitoneal space was faster and resulted in better postoperative recovery. Besides, it reduced the incidence of postoperative complications. Therefore, this method should be applied more extensively. However, the sample size of this study was small, and the mechanism of tension-free herniorrhaphy in the preperitoneal space still needs to be studied.

## Disclosure statement

The authors declare no conflict of interest.

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