ORIGINAL RESEARCH

Efficacy and Long-Term Effect of Transabdominal Preperitoneal Prosthesis for Unilateral Inguinal Hernia

Xiaoyong Liu, MM; Xiaohong Zhan, MM; Pingbin Liu, MM; Ling Chen, MM

ABSTRACT

Objective • To investigate the efficacy and long-term results of transabdominal preperitoneal prosthesis (TAPP) in the treatment of patients with unilateral inguinal hernia (UIH).

Methods • Ninety-two patients with UIH admitted to our hospital from January 2017 to August 2021 were selected to be the study subjects of this trial. They were divided into two groups with 46 patients in each, based on whether they were treated with a transabdominal preperitoneal prosthesis (TAPP group) or an open Bassini repair (OBR group). The clinical data of both groups were compared in terms of surgery (time and bleeding), postoperative (length of stay and costs), postoperative (near and far) complications, visual analog (VAS) score within 6 months after surgery, and postoperative SF-36 health survey scale.

Results • The mean operative time and intraoperative bleeding were lower in the TAPP group than in the OBR group ($P < .05$), the postoperative hospital stay was shorter in the TAPP group than in the OBR group ($P < .05$), and the hospital costs were markedly higher in the TAPP group than in the OBR group ($P < .05$). There was no remarkable difference in the occurrence of postoperative complications between the two groups. The mean VAS score and SF-36 score profiles were better in the TAPP group than in the OBR group at 3 and 14 days after surgery ($P < .05$), and there were no marked differences in VAS score and SF-36 score profiles between both groups at 2-month and 6-month postoperative follow-up ($P > .05$).

Conclusion • TAPP is effective in treating patients with UIH, improving their pain and quality of life, and safeguarding their health. (*Altern Ther Health Med.* [E-pub ahead of print.])

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INTRODUCTION

An inguinal hernia is a hernia that appears around patients' intra-abdominal organs and is formed because a partial defect of the groin protrudes from the surface of the abdominal wall.[1] As reported in the national and international literature,[2] inguinal hernia is a common clinical condition, with a higher percentage of men per capita suffering from this condition than women. The clinical diagnosis of the disease is mainly analyzed by taking patients' medical history, clinical manifestations, and physical examination. Inguinal hernias have an insidious onset and slow progression, and often patients themselves do not pay attention to them.[3] If left untreated, it is prone to various complications, developing into complex hernia, incarcerated hernia, and eventually into acute intestinal obstruction causing ischemic strangulation of the intestine.[4]

The common treatment for this disease is the surgical consultation technique, and open Bassini repair (OBR) is a tension-free representative hernia repair technique used for the clinical treatment of inguinal hernia.[5] However, traditional treatment methods have a high risk of scrotal bleeding, hematoma, and incisional hematoma during surgery,[6] and patients present with pain complications up to 43% after surgery, and persistent tension pain is reported.[7] This results in a deviation from the expected clinical outcome, which is detrimental to patients' health recovery and prognosis. Therefore, there is an urgent clinical need to find a more effective surgical treatment for patients with unilateral inguinal hernia (UIH) to safeguard their lives.

In recent years, with the rapid advancement and improvement of minimally invasive techniques such as laparoscopic techniques, television laparoscopic devices, and biopatch materials, a transabdominal preperitoneal prosthesis (TAPP) has been widely used in the treatment of patients with inguinal hernia.[8] The TAPP procedure involves entering the abdominal cavity and dissecting the anterior peritoneal

space under direct vision to allow for the management of the hernia sac. A patch of equal or greater size is then placed over the preperitoneal space using it to cover the entire pubococcygeal muscle foramen. Depending on the type and size of patients' hernias, the decision to fix the patch is made, and finally the peritoneal closure is manipulated.[9] This minimally invasive procedure has helped patients recover physically by reducing their problems of high trauma and intraoperative bleeding associated with surgery.[10]

However, there is not enough literature to support this view, and there is insufficient information related to studies on the impact of laparoscopic TAPP compared to OBR on patients' quality of life. Therefore, the main objective of our study was to achieve an analysis and comparison of the postoperative clinical outcomes of patients with UIH treated surgically with laparoscopic TAPP and OBR procedures through this study. Follow-up records were recorded to compare and assess the improvement of patients' postoperative quality of life and to provide reliable ideas and methods for future clinical treatment of patients with UIH.

MATERIALS AND METHODS

Data collection

With the approval of our ethics committee, 92 patients with UIH admitted to our hospital from January 2017 to August 2021 were selected to be the study subjects of this trial and were divided into 46 patients each treated with a transabdominal preperitoneal prosthesis (TAPP group) and open Bassini repair procedure (OBR group).

Scope of inclusion: All patients selected met the guidelines for the diagnosis of UIH.[11] There was no history of serious cardiopulmonary disease, and all patients gave informed consent to the study and signed informed consent forms for general anesthesia and surgical treatment. There was no history of lower abdominal surgery. Complete medical records must be available.

Scope of exclusion: Loss of normal communication skills and somatosensory perception disorders. History of other major diseases. Patients with pre-existing inguinal hernia complications and congenital inguinal hernias.

In the TAPP group, there were 39 (84.78%) males and 7 (15.22%) females, and their mean age was 53.20 ± 4.75 years. In the OBR group, there were 38 (82.61%) males and 8 (17.39%) females, and their mean age was 54.15 ± 6.36 years. There was no statistically remarkable difference between both groups in terms of age, gender, European Hernia Society (EHS) classification of inguinal hernia and co-morbidities ($P > .05$), and the groups could be compared with each other (Table 1). The EHS staging of inguinal hernia is based on the EHS treatment guidelines staging criteria: grade I: hernia ring <2 cm, grade II: hernia ring 2-3 cm, and grade III: hernia ring >3 cm.[12]

Table 1. General Data Table

	TAPP group (n = 46)	OBR group (n = 46)	χ^2 or t	P value
Age	53.20 ± 4.75	54.15 ± 6.36	0.811	.419
Weight	77.89 ± 10.52	76.43 ± 7.36	0.770	.445
Gender			0.079	.778
men	39 (84.78%)	38 (82.61%)		
female	7 (15.22%)	8 (17.39%)		
EHS classification of inguinal hernia			0.186	.911
grade I	11 (23.91%)	10 (21.74%)		
grade II	27 (58.70%)	29 (63.04%)		
grade III	8 (17.39%)	7 (15.22%)		
Coronary heart disease			0.187	.666
have	16 (34.78%)	18 (39.13%)		
none	30 (65.22%)	28 (60.87%)		
Hypertension			0.045	.832
have	19 (41.30%)	18 (39.13%)		
none	27 (58.70%)	28 (60.87%)		
Diabetes			0.062	.804
have	11 (23.91%)	10 (21.74%)		
none	35 (76.09%)	36 (78.26%)		

Treatment strategies

TAPP group: Patients were placed in a supine position with head down and feet up at approximately 15°, followed by general anesthesia with tracheal intubation. A 1.5-cm curved incision was made around the umbilicus and a pneumoperitoneum needle was punctured to create a pneumoperitoneal environment, maintaining abdominal pressure at 13 mmHg. The operation was guided by laparoscopic observation through the lower edge of the umbilicus, looking for the outer edge of the flat umbilical rectus abdominis muscle and the middle of the line between the contralateral umbilicus and the anterior superior iliac spine. Two 5 mm incisions were made, and a Trocar was punctured and placed in each, and the peritoneum was dissected to separate the anterior hiatus and dissect the hernia sac. A suitable size hernia patch was selected and introduced into the abdominal cavity by a 10 mm puncture device so that the pubococcygeal muscle foramen was completely covered and laid flat in the anterior peritoneal space. The corresponding ligaments, muscle bundles, and tendons were fixed with the patch and then observed for bleeding, and the peritoneum was finally closed with an attractable suture.[13]

OBR group: The patient was placed under epidural anesthesia in the prone position, oblique incision was made parallel to the inguinal ligament (6.0-8.0 cm) from 1.5-2.0 cm above the midpoint of the groin to the phalangeal tuberosity, and the extra-abdominal oblique tendon membrane was separated after gradual incision in layers. The hernia sac was located and excised, the transverse abdominal fascia was closed, and the patch was operated intact by laying it flat in the anterior peritoneal space and then fixing sutures to the united tendons, pubic tuberosity, and inguinal ligament. Intermittent sutures were used to close the extra-abdominal oblique tendon membrane and the incision.[14]

Outcome measures

The clinical data related to surgery (time, bleeding), postoperative (length of stay, costs), postoperative (near and far) complications, visual analog score (VAS) score within 6 months after surgery, and postoperative SF-36 health survey scale were compared between the two groups.

VAS score:[15] The specific scoring criteria were plotted as a horizontal line scale, with 0 being no pain to 10 being unbearable severe pain. Postoperative SF-36 health survey scale:[16] Eight precise health dimensions were selected from

different quality of life measurement scales, including physical function, social function, physical reason's role function limitation, psychological reason's role function limitation, mental health, vitality, pain, and overall health evaluation. The mean scores of the eight dimensions were counted and calculated as the measurement data for this experiment.

Postoperative follow-up

Patients are advised to perform normal daily activities for one week after surgery and to exercise appropriately after one month after surgery. Regular follow-up visits were performed at 3 days, 14 days, 2 months, and 6 months after surgery to understand and record patients' recovery from life and work, any recurrence of hernia, and chronic pain conditions. Immediate complications, including subcutaneous ecchymosis in the operated area, and redness and swelling of the incision, were counted in the patients after the operation until 14 days after the operation. In the 2nd postoperative month, patients were counted for long-term complications, including foreign body sensation and stiffness.

Statistical analysis

Comparisons between groups for counting data were made using the chi-square test, expressed as (rate). Data with measurement data conforming to normal distribution were expressed as (mean ± standard deviation) using *t* test, paired *t* test. Statistical analysis was performed using SPSS 22.0 Chinese version statistical software. $P < .05$ was defined as a statistically remarkable difference.

RESULTS

Comparison of operation time and intraoperative bleeding between both groups

The mean operative time was 64.89 ± 6.09 min in the TAPP group and 85.37 ± 7.50 min in the OBR group. The mean operative time in the TAPP group was dramatically lower than that in the OBR group ($P < .05$). The intraoperative bleeding was 42.51 ± 7.54 mL in the TAPP group and 60.00 ± 8.02 mL in the OBR group. The intraoperative bleeding in the TAPP group was dramatically lower than that in the OBR group ($P < .05$) (Figure 1).

Comparison of postoperative hospital stay and hospital costs between both groups

The postoperative hospital stay was 4.28 ± 1.03 d in the TAPP group and 6.50 ± 1.89 d in the OBR group, and the postoperative hospital stay was shorter in the TAPP group than in the OBR group ($P < .05$). The hospitalization cost was 15259.56 ± 2989.26 yuan in the TAPP group and 9773.22 ± 1720.80 yuan in the OBR group, implying that the hospitalization cost is much higher in the TAPP group than in the OBR group ($P < .05$) (Figure 2).

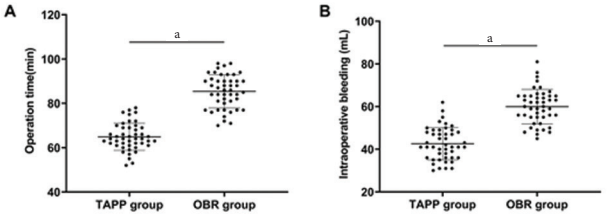
Comparison of recent postoperative complications

The manifestations of recent postoperative complications between both groups were compared. There were two cases of subcutaneous petechiae in the operative area, one case of incisional erythema, and two cases of infection in the TAPP group, with an overall incidence of 5 (10.87%). In the OBR group, there was one case of subcutaneous petechiae in the operative area, two cases of incisional erythema, one case of incisional ooze, and two cases of infection, with an overall incidence of 6 (13.04%). There was no statistically remarkable difference between both groups ($P > .05$) (Table 2).

Comparison of long-term postoperative complications

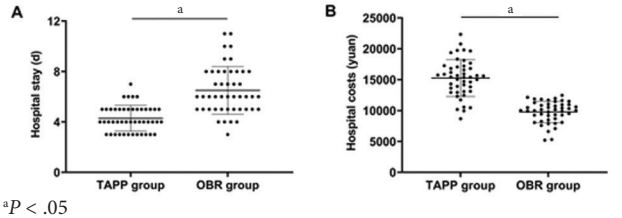
The manifestation of distant postoperative complications between both groups was compared. There were three cases of foreign body sensation, two cases of stiffness, one case of pulling sensation, and one case of recurrence in the TAPP group, with an overall incidence of 7 (15.22%). In the OBR group, there were 2 (4.35%) cases of foreign body sensation, 3 (6.52%) cases of stiffness, 1 (2.17%) case of abnormal nerve sensation, 1 (2.17%) case of pulling sensation, and 2 (4.35%) cases of recurrence, with

Figure 1. Comparison of Operation Time (A) and Intraoperative Bleeding (B) Between Both Groups



[a]$P < .05$

Figure 2. Comparison of Postoperative Hospital Stay (A) and Hospital Costs (B) Between Both Groups



[a]$P < .05$

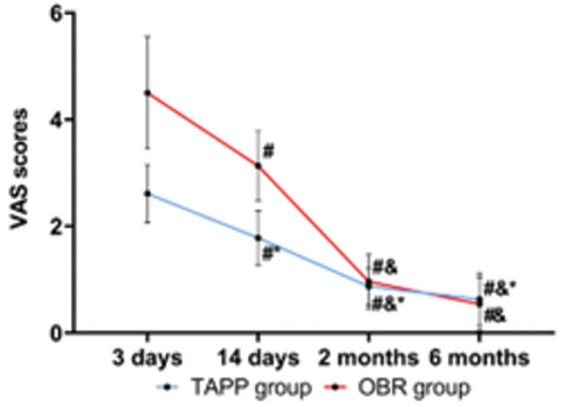
Table 2. Comparison of Recent Postoperative Complications

Group	Cases	Subcutaneous petechiae in the operative area	Redness and swelling of the incision	Incisional exudate	Infection	Recent postoperative complications (cases)
TAPP group	46	2 (4.35%)	1 (2.17%)	0 (0.00%)	2 (4.35%)	10.87%
OBR group	46	1 (2.17%)	2 (4.35%)	1 (2.17%)	2 (4.35%)	13.04%
χ^2						1.589
P value						.662

Table 3. Comparison of Long-Term Postoperative Complications Between Both Groups

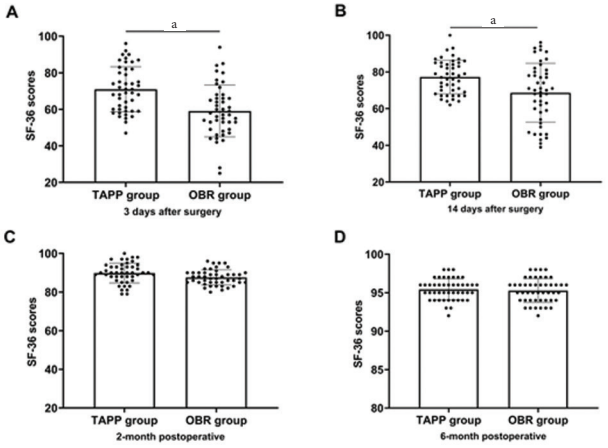
Group	Cases	Foreign body sensation	Stiffness	Nerve sensory abnormalities	Tugging sensation	Recurrence	Long-term postoperative complications (cases)
TAPP group	46	3 (6.52%)	2 (4.35%)	0 (0.00%)	1 (2.17%)	1 (2.17%)	15.22%
OBR group	46	2 (4.35%)	3 (6.52%)	1 (2.17%)	1 (2.17%)	2 (4.35%)	19.57%
χ^2							1.507
P value							.825

Figure 3. VAS Score Within 6 Months After Surgery



#Means $P < .05$ Compared with 3 Days After Surgery
&Means $P < .05$ Compared with 14 Days After Surgery
*Means $P < .05$ Compared with OBR Group

Figure 4. Comparison of Quality of Life Between Both Groups After Surgery. (A) Comparison of SF-36 Scores 3 Days After Surgery. (B) Comparison of SF-36 Scores 14 Days After Surgery. (C) Comparison of SF-36 Scores 2-Month Postoperative. (D) Comparison of SF-36 Scores 6-Month Postoperative.



a$P < .05$

an overall incidence of 19.57%. There was no statistically remarkable difference between groups ($P > .05$) (Table 3).

VAS score within 6 months after surgery

The VAS scores of both groups at 6 months after surgery were assessed. The mean VAS scores of the TAPP group on the 3rd and 14th day after surgery were dramatically lower than those of the OBR group ($P < .05$). There was no obvious difference in VAS scores between both groups at the postoperative follow-up of 2 and 6 months ($P > .05$) (Figure 3).

Comparison of quality of life between both groups after surgery

The mean SF-36 scores of the TAPP group were dramatically higher than those of the OBR group on the 3rd and 14th day after surgery ($P < .05$), and there was no obvious difference in SF-36 scores between both groups at 2-month and 6-month postoperative follow-up ($P > .05$). It is suggested that both TAPP and OBR can improve the quality of life of inguinal hernia patients through surgery (Figure 4).

DISCUSSION

Inguinal hernia morbidity accounts for a relatively high proportion of extra-abdominal hernia diseases. Inguinal hernias are formed after a prominent change in the transversalis fascia and the musculo-pubic fissure and are the result of a combination of factors that produce a defective or weak area of muscle and tendon protection in the abdominal wall. An inguinal hernia occurs when the transversus abdominis fascia can no longer withstand intra-abdominal pressure due to compression.[17]

The incidence of inguinal hernia accounts for about 90% of the overall hernia incidence in China, with umbilical, incisional, femoral, and other types of hernia accounting for only about 10% of this incidence.[18] In the early stages of the development of hernia surgery, most inguinal hernias have been managed surgically, especially in the presence of ingrowth and strangulation of the hernia contents.[19s] With the availability of modern anesthesia and aseptic techniques, hernia surgical procedures and outcomes are becoming more sophisticated by the day. The discovery and application of the OBR procedure further improved the problem of tension sutures in traditional repair surgery and effectively controlled the incidence of postoperative complications and recurrence.[20] Along with the advancement of medical technology, the concept of "minimally invasive surgery" has been popularized. Clinics have been searching for more delicate surgical methods to achieve the goal of reducing postoperative pain, decreasing postoperative complications, and enabling patients to resume their daily activities more quickly. Thus, this study aimed to investigate the differences in various aspects of the efficacy and outcome of laparoscopic TAPP and OBR in the treatment of UIH and to discuss them in detail.

Surgery for UIH is performed in two main steps: management of the hernia sac and reconstruction of the abdominal wall.[21] The use of laparoscopy for surgical treatment is minimally invasive, but it is difficult to avoid damaging the peritoneum while performing a delicate peeling of the hernia sac in a relatively small space. The current study manifested that the mean operative time and intraoperative bleeding were dramatically lower in the TAPP group than in the OBR group. This indicates that the refinement of the operator's laparoscopic technique did not affect the operator's operation compared to conventional open surgery and intraoperative bleeding was controlled due to the small invasive surface. The postoperative hospital stay was dramatically shorter in the TAPP group than in the OBR group in the study, suggesting that the TAPP group had a marked minimally invasive advantage and a shorter recovery time. Surgical operation is highly restricted in laparoscopic hernia repair, requiring skilled mastery and hands-on experience of the physician compared to open surgery, and more detailed requirements for patients to meet their

standards. The anesthesia risk of taking general anesthesia is an aspect of the entire surgical procedure that cannot be ignored. The intraoperative use of general anesthesia techniques and consumables such as laparoscopes and other instruments can increase the cost of treatment, increasing the financial pressure on patients and limiting their cooperation throughout the treatment. Consistent with the results of this study, the TAPP group had dramatically higher hospitalization costs than the OBR group. It has been reported that when collecting a large amount of clinical data on laparoscopic and early open surgical techniques and counting their postoperative complications, laparoscopic hernia repair had a higher probability of rare but serious complications (urological, cardiovascular, and intestinal obstruction) and other aspects of the disease.[22] However, this study suggested no obvious difference in both immediate and long-term postoperative complications between both groups. This indicates that in patients with UIH, modern sophisticated techniques and practicing physicians have been able to control the complication rate to a large extent within satisfactory limits.

This study also statistically analyzed the pain and quality of life of postoperative patients and concluded that the mean VAS scores were dramatically lower in the TAPP group and the mean SF-36 scores were dramatically higher in the TAPP group than in the OBR group on 3rd and 14th day after surgery. There were no obvious differences in VAS scores and SF-36 scores at 2-month and 6-month postoperative follow-up. From the level of surgical operation method, OBR is a method of strengthening the posterior wall of the inguinal canal by synthetic mesh being placed between the extra-abdominal oblique muscle layer and the internal oblique muscle layer on the tissue repair to close the defect so that the tissue can be sutured without tension. However, tissue separation under local anesthesia is required, and the trauma is large resulting in a large postoperative painfulness and a long return to normal life.[23] It has been reported that the structures in the inguinal region are not dissected during TAPP, and the small surgical incision results in a shorter postoperative recovery time, a lower infection rate than traditional open surgery, a significant reduction in persistent postoperative pain, and a corresponding reduction in the use of postoperative analgesia and narcotics.[24] Another study revealed that in patients with UIH, the laparoscopic group was able to resume daily function more rapidly than the open group after surgery, allowing patients to return to normal daily work quickly and reducing indirect financial losses due to periods of incapacity.[25] This is consistent with the results obtained in this study.

CONCLUSION

The TAPP treatment in people suffering from UIH helps to avoid the disadvantage of large incision areas associated with surgery and has outstanding advantages in terms of postoperative pain and recovery ability. If there exists a hospital with immature technology and equipment, the selection limitations are high. While patients choose their treatment plan, physicians should respect patients' right to know, inform them of the advantages and disadvantages of different treatments and the occurrence of late complications, and cooperate with them to make a careful choice of the best treatment plan according to their actual condition.

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AUTHOR DISCLOSURE STATEMENT

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