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ORIGINAL

IMPACT OF LAPAROSCOPIC LATERAL ABDOMINAL WALL SUSPENSION ON FUNCTIONAL RECOVERY IN ATHLETICALLY ACTIVE WOMEN WITH UTERINE PROLAPSE UNDER 60

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ABSTRACT

Objective: To evaluate the efficacy and advantages of laparoscopic lateral abdominal wall suspension in the treatment of uterine prolapse in women under 60 years old, with a focus on postoperative outcomes and recovery. Methods: Sixty patients diagnosed with uterine prolapse were enrolled and divided into two groups based on the surgical approach. The study group underwent laparoscopic lateral abdominal wall suspension, while the control group received laparoscopic anterior wall suspension. Perioperative data were recorded, and all patients were followed up for a minimum of six months. Postoperative clinical outcomes and prognoses were analyzed and compared between the groups. **Results**: There were no significant differences between the two groups in preoperative characteristics, S-POP-Q scores, PFDI-20 scores, operative time, or hospital stay ($P > 0.05$). However, the study group demonstrated significantly reduced intraoperative blood loss and shorter urinary catheter retention times compared to the control group ($P < 0.05$). Both groups showed significant improvements in S-POP-Q and PFDI-20 scores postoperatively ($P < 0.05$ within groups), with no significant differences between groups ($P > 0.05$). Additionally, the incidence of postoperative complications was significantly lower in the study group than in the control group ($P < 0.05$). **Conclusion**: Laparoscopic lateral abdominal wall suspension is as effective as

anterior wall suspension in treating uterine prolapse, with added benefits including improved uterine support, enhanced anatomic position recovery, reduced intraoperative blood loss, and fewer postoperative complications. These findings support its broader clinical application for younger patients with uterine prolapse.

KEYWORDS: Uterine Prolapse; Laparoscopic Abdominal Wall Suspension; S-POP-Q grading.

1. INTRODUCTION

Uterine prolapse, a condition characterized by the descent of the uterus into or beyond the vaginal canal, is a prevalent gynecological issue that significantly impacts the quality of life for affected women. Although the condition is more common among postmenopausal women, a growing number of younger patients under 60 years old are presenting with uterine prolapse due to factors such as childbirth trauma, connective tissue disorders, and chronic increased intra-abdominal pressure. Early intervention and appropriate surgical treatment are essential to restore pelvic organ function, alleviate symptoms, and improve overall well-being.

Laparoscopic surgical approaches have gained traction as minimally invasive techniques that offer quicker recovery, less postoperative pain, and reduced complications compared to traditional open surgeries. Among these, laparoscopic anterior wall suspension has been widely adopted and shown to yield favorable outcomes. However, recent advancements in surgical techniques, such as laparoscopic lateral abdominal wall suspension, aim to provide enhanced uterine support, improved anatomic restoration, and fewer complications. This study explores the efficacy and safety of laparoscopic lateral abdominal wall suspension compared to anterior wall suspension in women under 60, providing valuable insights into the evolving landscape of surgical treatment for uterine prolapse.(Liang et al., 2021). There are various pathogenic factors of POP (Subgroup & Gynecology, 2020), among which age and birth time are positively correlated with the occurrence of the disease (Li et al., 2019).

Vaginal delivery is an independent risk factor for severe POP, accounting for about 40% of patients over 40 years of age (Word, Pathi, & Schaffer, 2009). With the population trend and the implementation of the three-child policy, this proportion will further increase and expand to younger groups. In 2017, the American College of Obstetricians and Gynecologists (ACOG) issued guidelines (Paul, 2017) recommending that surgical treatment options be prioritized for patients with moderate to severe POP.But until now,there has been no consensus on the best procedure for POP (Subgroup & Gynecology, 2020). In recent years, the vaginal implantation of mesh for pelvic floor

reconstruction has gradually become the main surgical approach for pelvic floor surgery (Szymczak, Grzybowska, & Wydra, 2019). Its advantages include the simultaneous correction of defects in all three compartments, strengthening of the pelvic floor connective tissue, reduction in the rate of anatomical recurrence, and minimized trauma, making it favored by pelvic floor doctors. However, due to a variety of postoperative complications, such as mesh exposure, erosion, infection, pain and sexual discomfort, as well as expensive mesh costs have made the operation controversial, the United States FDA has twice issued warnings and issued a ban on mesh. Our guidelines (Subgroup & Gynecology, 2020) clearly indicate that this surgery is indicated for patients with recurrent POP surgery and patients over 60 with severe initial POP treatment. For younger and sexually active patients, this surgical approach should be carefully chosen. Therefore, finding the optimal surgical method for middle-aged patients under 60 with moderate to severe prolapse has also become a hot topic in the field of pelvic floor research.

Laparoscopic sacral uterine vaginal fixation is considered the gold standard for treating apical defects (Chen et al., 2012), suitable for young and sexually active women. However, due to the complexity of the operation, the risks of intraoperative bleeding, nerve damage, bladder and ureteral injury, and the high requirements for surgical anesthesia, it is difficult to promote its application. Thus, finding a safe, effective, and easy-to-perform surgical method is of great importance. Studies have found that laparoscopic abdominal wall suspension can avoid the dense areas of pelvic floor blood vessels and nerves, avoid the risk of bleeding and damage during sacral utero-vaginal fixation, and achieve a good uterine elevation effect. Abdominal wall suspension has been used clinically for many years, but as a new surgical approach, lateral abdominal wall suspension has not yet been widely used. To illustrate the efficacy and superiority of this surgery, this article will compare it clinically with laparoscopic anterior abdominal wall suspension, with the report as follows.

2. Materials and Methods

Anterior abdominal wall suspension is a relatively mature surgical method, while lateral abdominal wall suspension has not been widely used, but there are precedents. As two different surgical methods are compared, there are no unknown things involved in this study, so the approval of the hospital ethics committee is not required. Each patient has signed an informed consent before the operation, and has been informed in detail about possible risks and complications during and after the operation.

2.1 General Information

Sixty patients with uterine prolapse under 60 years old admitted to Kunshan First People's Hospital from January 2020 to August 2023 were

divided into two groups according to the surgical method. Thirty patients in the lateral abdominal wall suspension group were the study group, aged 53.31±2.12 years, the number of deliveries was 1.85±0.22 years, and the course of disease was 3.47±0.97 years. 30 patients in the anterior abdominal wall suspension group were the control group, aged 54.05±2.04 years, the number of deliveries was 1.63±0.16 years, and the course of disease was 2.73 ±0.64 years. Both groups of patients had different degrees of vaginal wall swelling. Inclusion criteria :(1) Meet the criteria for uterine prolapse diseases proposed by the World Health Organization; (2) Patients with prolapse symptoms that significantly affect the quality of life, who refuse conservative rehabilitation treatment or fail to respond to conservative treatment; (3) Good compliance, good follow-up; (4) No history of pelvic floor surgery, hysterectomy history, etc., no serious medical diseases; (5) Patients and their families sign informed consent forms.

2.2 Methods

Both groups were treated with preoperative preparation such as intestinal cleaning. It is necessary to determine whether the patient is complicated with other diseases before surgery. For example, if the patient is complicated with anterior and posterior vaginal wall swelling, anterior and posterior vaginal wall repair should be performed; if the patient has uterine and adnexal lesions, hysterectomy and adnexectomy should be performed as appropriate.

Study Group: After successful anesthesia, the patient was placed in the lithotomy position, the abdomen, vagina and vulva were disinfected, and sterile towels and operating sheets were laid. The trocar was inserted into the abdominal cavity through the umbilical hole, pneumoperitoneum was established, a speculum was placed, and the other three trocars were placed separately under the supervision of the speculum. The uterine cup in the vagina lifts the uterus, laparoscopically separates the peritoneum of the lower curvature of the bladder, and pushes the bladder down to the anterior fornix of the vagina and part of the upper vaginal segment. Fold the mesh and cover the upper end of the front wall of the vagina in the center. 0-0 tendon suture fixed the patch and fixed the patch to the anterior wall of the vagina. The patch was inserted into the outer peritoneum 4cm above and 3cm behind the left anterior superior iliac spine, and a tunnel was opened along the direction of the circular ligaments on both sides to pierce the proximal end of the circular ligaments into the vesical reflex peritoneum. Pull one end of the patch down along the peritoneum until the puncture clamp is fixed, and do the same on the other side. Adjust the length of the patch so that the length of the vagina is about 7cm. Suture the retrovesical peritoneum continuously, and completely wrap the patch (FIG. 1) so that no part of the patch is exposed. Cut off excess mesh from the

piercing. Similarly, for hysterectomy patients, the patch was cut into a "middle" shape after hysterectomy, and the middle part covered the vaginal stump, so that the front tongue of the patch was fixed on the front wall of the vagina, and the stump was sutured with 0-0 tendon to fix the back tongue of the patch with the vaginal stump and the sacral ligament. The remaining methods are the same as above (Figure 2).

Control Group: In the same way as the study group, the patients were anesthetized, positioned, sterilized and covered with surgical site, trocars puncture and uterine cup lifting were performed, part of cervix was exposed, the patch was trimmed in an "inverted T" shape and placed in the cervix, the non-absorbable line was inserted into the trocar through the median suprapubic foramina, and a tunnel of about 3cm was inserted subcutaneously on both sides through the rectus abtris muscle and fascia. The separation forceps formed a tunnel through blunt extraperitoneal puncture through the puncture hole, punctured the forceps tip directly above the proximal end of the round ligament, pulled one end of the mesh, pulled down along the peritoneum until the clamp was fixed, treated the opposite side in the same way, and the absorption line stitched the bladder recurve peritoneum to complete peritonealization (FIG. 3). The mesh was completely wrapped so that no part of the mesh was exposed. Adjust the length of the sling, keep the stump lying flat without tension, and fix the bilateral sling above the rectus abdominis with silk suture at the puncture mouth. The serous surface of the anterior wall of uterus was cauterized by electrotome, and the peritoneal surface corresponding to the anterior abdominal wall was cauterized with an area of about 3×3cm. If the patient does not retain the uterus, the mesh can be folded in a "middle" shape after laparoscopic total hysterectomy, and the median part of the mesh can cover the vaginal stump, and No. 7 silk thread should be sutured and fixed on the stump, and the other methods are the same as above (Figure 4).

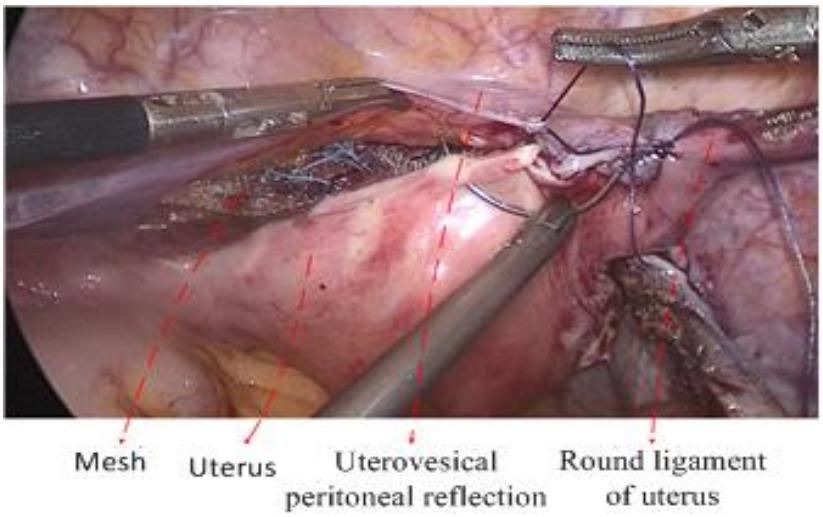

Figure 1: Suture the peritoneum of the bladder continuously

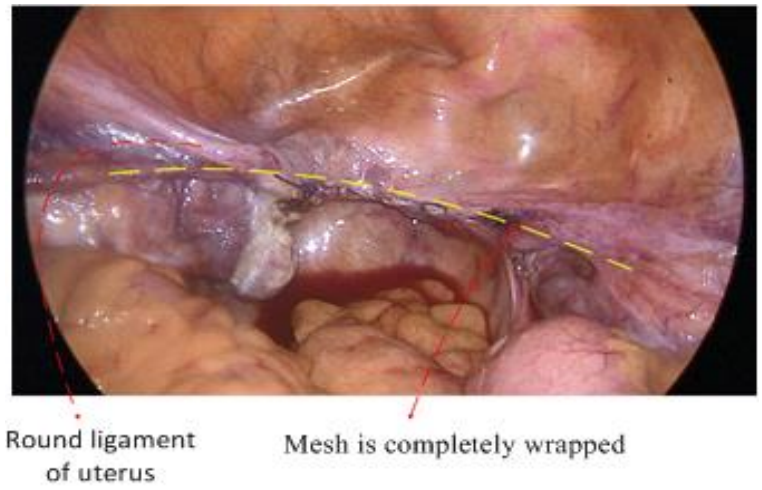

Figure 2: Position of the mesh after it is wrapped

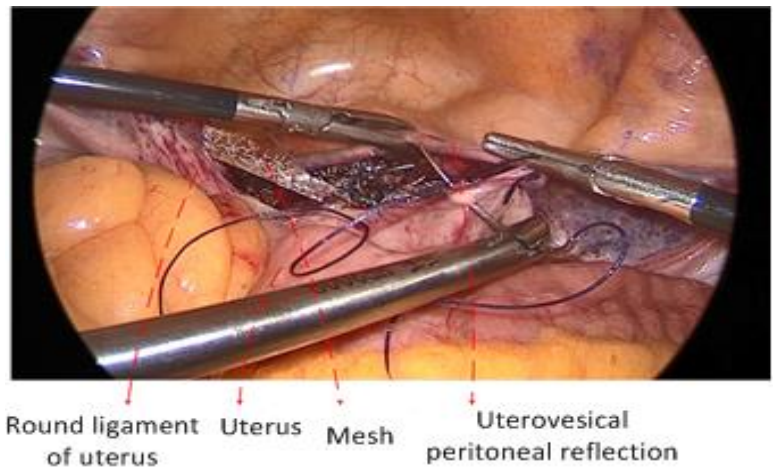

Figure 3: Suture the peritoneum of the bladder continuously

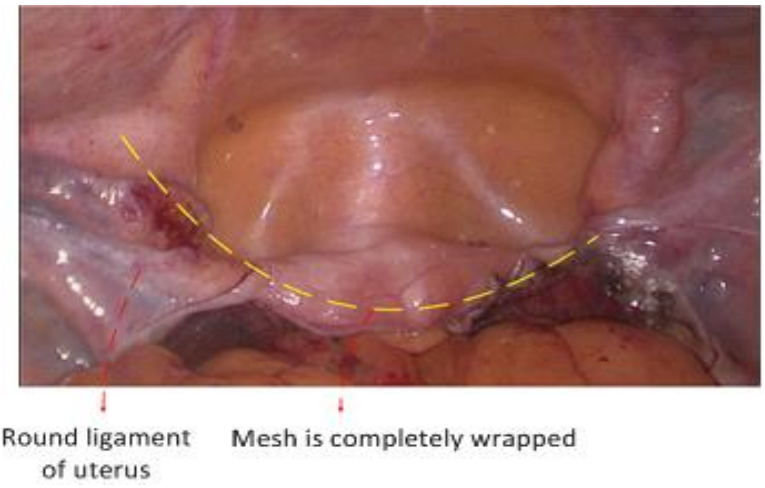

Figure 4: Position of the mesh after it is wrapped

After hemostasis was completed in both groups, iodophor gauze strip was filled in the vagina and removed 24 h after operation. An indwelling catheter

was placed and antibiotics were given to prevent infection. Both groups were followed up within 6 months after surgery.

2.3 Observation Indicators

(1)Preoperative age, number of deliveries, duration of disease and simplified POP-Q (Manonai et al., 2011)scale (S-POP-Q) were recorded. (2) The amount of intraoperative blood loss, operation time, catheter indwelling time and hospital stay of the two groups were recorded; (3) Mesh exposure, abdominal strain, abnormal vaginal discharge and recurrence of prolapse were followed up within 6 months after surgery; (4) The preoperative and postoperative symptoms of the two groups were recorded, and the quality of life of the patients before and after treatment was compared by using the Pelvic Floor Dysfunction Disease Questionnaire (PFI-20) (Barber, Walters, & Bump, 2005). The PFDI-20 questionnaire has a total score of 300, and the higher the score, the worse the patient's quality of life.

2.4 Statistical Methods

In this study, SPSS22.0 statistical software was used to process relevant data. Measurement data were represented by mean $\bar{x}$± standard deviations ($\bar{x}$±s), and T-test was adopted. The count data was expressed as a percentage (%), and the Fisher exact probability method was used for comparison between groups. P< 0. 05 was considered statistically significant.

3. Results

3.1 Comparison of Preoperative General Clinical Data of Patients

There was no significant difference in age, frequency of delivery and course of disease between the two groups (P>0.05), which could exclude the error caused by different general conditions, as shown in Table1.

Table 1: Comparison of general clinical data between the two groups（$\bar{x} \pm s$）

GROUPS	N	AGE (YEAR)	DELIVERY FREQUENCY (TIME)	COURSE OF DISEASE (YEAR)
STUDY GROUP	30	53.31±2.12	1.85±0.22	3.47±0.97
CONTROL GROUP	30	53.05±2.04	1.63±0.16	2.73±0.64
T		-0.087	-0.789	-0.639
P		0.932	0.438	0.530

3.2 Comparison of the Positions of Each Indicating Point of POP-Q Between the two Groups

There was no significant difference in the position of S-POP-Q indicators between the two groups before operation (P > 0.05), as shown in Table2.

Table 2: Comparison of the position of each indication point of two groups of S-POP-Q ($\bar{x}$±s)

GROUPS	N	BA POINT	BP POINT	C POINT	D POINT
STUDY GROUP	30	0.92±0.29	-0.58±0.42	0.19±0.65	-2.27±0.54
CONTROL GROUP	30	1.55±0.35	-0.76±0.41	-0.29±0.68	-2.6±0.59
T		1.377	-0.321	-0.511	-0.286
P		0.179	0.751	0.613	0.777

3.3 Comparison of relevant operations between the two groups

There was no statistically significant difference between the two groups in terms of operation and hospital stay (P>0.05), while the intraoperative blood loss and urinary catheter retention time in the study group were significantly lower than those in the control group (P<0.05). As shown in Table 3.

Table 3: Comparison of relevant clinical indexes during operation between the two groups

GROUPS	N	SURGICAL TIME (MIN)	INTRAOPERATIVE BLEEDING VOLUME (ML)	URINARY CATHETERIZATION TIME (D)	HOSPITALIZATION TIME (D)
STUDY GROUP	30	175.62±9.42	43.85±3.85	2.54±0.14	4.92±0.31
CONTROL GROUP	30	163.11±11.39	96.11±20.37	3.28±0.27	6.67±0.88
T		-0.982	2.481	2.189	1.839
P		0.334	0.022	0.038	0.079

3.4 Comparison of Pelvic Organ Prolapse Index (POP-Q) before and after Operation

Preoperative and postoperative POP-Q scores were compared between the two groups, and there was no statistical significance (preoperative: P > 0.05, postoperative: P > 0.05). In intra-group comparison, POP-Q grading was significantly improved in both groups after surgery compared with before surgery, and the differences were statistically significant (P < 0.05). The results showed that the two methods had good curative effect on the patients, and the anatomical cure rate of the two groups was 100% in the six months after the operation, and there was no recurrence of prolapse (prolapse recurrence is considered to be greater than or equal to II degree), as shown in Table 4.

Table 4: Comparison of pelvic organ prolapse (POP-Q) before and after operation

1	N	0 DEGREE	1 DEGEE	2 DEGREE	3 DEGREE	4 DEGREE
STUDY GROUP	30					
PRE-OPERATION		0	11(36.7)	7(23.3)	10(33.3)	2(6.67)
6 MONTHS AFTER SURGERY		30(100)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
CONTROL GROUP	30					
PRE-OPERATION		0	11(36.7)	9(30)	6(20)	4(13.3)
6 MONTHS AFTER SURGERY		28（93.3）	2(6.7)	0(0.00)	0(0.00)	0(0.00)

3.5 Comparison of Postoperative Complications

The postoperative complications of the two groups were analyzed respectively. In the study group, there was 1 case of dysuria and 1 case of abdominal pulling sensation after the operation, which was obvious after prolonged sitting and relieved after symptomatic treatment. In the control group, abdominal incision infection occurred in 1 case, dysuria in 1 case, abdominal pulling sensation in 3 cases, vaginal stump cracking in 1 case and abnormal vaginal discharge in 2 cases, all of which were significantly improved after symptomatic treatment.

The other patients had no complaints of discomfort during the immediate and long-term postoperative follow-up. Compared with the two groups, the probability of postoperative complications in the study group was significantly lower than that in the control group, and the difference was statistically significant ($^{a}P<0.05$), as shown in Table 5.

Table 5: Statistics of postoperative complications in two groups

GROUPS	N	DYSURIA	APS	INFECT	AVD	VSD	ME	TOTAL
STUDY GROUP	30	1(3.33)	1(3.33)	0	0	0	0	2(6.66) ^{A}
CONTROL GROUP	30	1(3.33)	3(10)	1(3.33)	2(6.66)	1(3.33)	0	8(26.67)

Note: *Superscript "a" is using Fisher's exact probability method, ^{a}P =0.034<0. 05. "APS", "AVD", "VSD" and "ME" stand for abdominal pulling sensation, abnormal vaginal discharge, vaginal stump dehiscence and mesh exposure, respectively.*

3.6 Comparison of Quality-of-Life Scores between and within Groups

There was no statistical significance in preoperative PFDI-20 assessment between the two groups (P>0.05). Half a year after surgery, the intra-group comparison of PFDI-20 scores between the two groups was significantly lower than that before surgery, with statistical significance (*P<0.05), but there was no statistical difference between the two groups (P>0.05), as shown in Table 6.

Table 6: Comparison of quality-of-life scores between and within groups

GROUPS	NUMBER OF CASES	PFDI-20	
		PRE-OPERATION	6 MONTHS AFTER SURGERY
STUDY GROUP	30	137.18±6.12	16.67±3.13*
CONTROL GROUP	30	142.54±6.38	20.61±1.79*
T		2.05	2.09
P		0.55	0.27

*Note: Compared with the same group before surgery, the two groups *P<0.05.*

4. Discussion

Uterine prolapse is a common benign condition in middle-aged and elderly women, often accompanied by bulging of the anterior and posterior vaginal walls. It typically occurs in women aged 40-60. Currently, clinical treatment requires an individualized plan based on patients' main complaints, symptoms, and needs. Non-surgical treatment should be the first-line approach for all prolapse patients (Subgroup & Gynecology, 2020), but surgical treatment is more effective for moderate to severe cases. There have been over 40 surgical methods used in clinical practice for uterine prolapse (Tolstrup, Lose, & Klarskov, 2017), with hysterectomy being the earliest classical operation proposed and widely utilized. However, hysterectomy results in infertility as well as postoperative complications such as urinary incontinence, vaginal wall swelling, and decreased ovarian function (Sizzi et al., 2018; Zhu et al., 2022). Therefore, it is not a permanent solution. With a better understanding of pelvic floor structure, the focus of treatment has shifted from symptom improvement to restoring anatomical structure, strengthening pelvic floor support function, and enhancing quality of life (Rakel, 2011). Uterine prolapse involves mid-pelvic defects that require successful control of top support during surgery. The most commonly used procedures currently include transvaginal mesh implantation for pelvic floor reconstruction and laparoscopic sacral hysteron vagopexy. However, both procedures have limitations: pelvic floor reconstruction may not be suitable for young sexually active patients due to its impact on sexual function; meanwhile using mesh can be costly and impose financial burden on

patients. Sacropexy cannot be widely adopted in primary hospitals due to its technical difficulty, long operation time requirements for anesthesiologists and surgeons. Therefore, it is important to seek a safe, effective, simple operation and easy to promote the use of grass-roots hospitals. Laparoscopic uterine abdominal wall suspension is to fix the stump of the uterus or vagina on the abdominal wall with a mesh to restore the uterus and the bulging vaginal wall to the anatomical position. This method avoids the vascular and nerve dense area of the pelvic floor in the anatomical position, and reduces the probability of bleeding and nerve organ damage. There are two kinds of suspension methods in abdominal wall suspension, one is to suspend the anterior uterine wall and part of the cervix from the rectus sheath after fixation with the mesh, the other is to suspend the anterior cervical wall from both sides of the abdominal wall after fixation with the mesh, so as to achieve the purpose of restoring the anatomic position of the uterine or vaginal tip. With simple operation and good therapeutic effect, anterior abdominal wall suspension of rectus abdominis has been applied in clinical practice for many years. Dong et al. (Dong, Luo, & Wang, 2017) concluded through the analysis of 21 patients with uterine prolapse after treatment that transrectus abdominis suspension can not only achieve satisfactory operation field, effectively avoid blood vessels and nerves, but also shorten the operation time, less trauma, and reduce the occurrence of complications. Zeng et al. (Zeng et al., 2020)also drew similar conclusions through analysis and comparison of 53 patients with uterine prolapse. However, laparoscopic lateral abdominal wall suspension, as a new surgical method to treat uterine prolapse, has not been widely used in China. In order to determine whether this new operation is suitable for vigorous promotion, this experiment analyzed the effect and feasibility of lateral abdominal wall suspension in patients under 60 years old by comparing with anterior abdominal wall suspension, and further explored the advantages of lateral abdominal wall suspension. Through the analysis, we found that in the case of no statistical difference in preoperative data between the two groups, the two kinds of surgery can achieve the same satisfactory results in the treatment of uterine prolapse and improve the quality of life of patients, and the postoperative cure rate of the two groups is the same, with no statistical significance ($P>0.05$). However, the incidence of postoperative complications in the study group was significantly lower than that in the control group, and the difference was statistically significant ($P<0.05$), which may be related to the different suspension positions and operation methods of the two groups. In the control group, the uterus was pulled to the anterior abdominal wall and fixed, while the bladder was positioned in front of the uterus. There was a risk of damage to the bladder while fixing the uterus, but the study group avoided this risk by avoiding the bladder area. In addition, the uterus is pulled forward, which increases the risk of long-term posterior vaginal wall and enterocele (Śliwa, Kryza-Ottou, Zimmer-Stelmach, & Zimmer, 2020). At the same time, during the operation, we also found that the fixed-point position of lateral abdominal wall

suspension was lower than that of uterine fixation, and the fixed position of anterior abdominal wall suspension was higher. Compared with the two methods, lateral abdominal wall fixation could enable the uterus to obtain better support and longer lifting route, and the vagina could also obtain better upward traction. In addition, under the traction of the tension-free strap, the uterus is evenly pulled to both sides of the abdominal wall, and the cervical position is not shifted, and the uterine body is kept forward and outward, restoring the natural anatomical position of the uterus. In an article published in 2023, Guo et al.(Guo, Wang, Yin, & Li, 2023) also pointed out that lateral abdominal wall suspension method can keep the uterus and vaginal axis in the front position, which is more in line with the natural physiological law, and the surgical results are more stable. In addition to the differences in complications, the experimental results indicated that there was no difference between the two groups in terms of hospital stay and operation time ($P>0.05$), but the intraoperative blood loss and urinary catheter retention time in the study group were lower than those in the control group, with statistical significance ($P <0.05$), which may be related to the occurrence of two cases of severe pelvic adhesion in the control group during the operation. There was more bleeding in the process of separation and adhesion, and the catheter was retained for a longer time after operation. Because the sample size of this study is small, error interference cannot be excluded.

5. Conclusions

Laparoscopic lateral abdominal wall suspension demonstrates equivalent efficacy to anterior wall suspension in treating uterine prolapse in patients under 60 years of age. Both surgical techniques significantly improve S-POP-Q and PFDI-20 scores, indicating effective symptomatic relief and anatomical correction. However, lateral abdominal wall suspension offers distinct advantages, including reduced intraoperative blood loss, shorter urinary catheter retention time, and a lower incidence of postoperative complications. These findings suggest that lateral abdominal wall suspension not only achieves comparable clinical outcomes but also enhances patient safety and recovery. Given its minimally invasive nature and potential for better uterine support and anatomical restoration, laparoscopic lateral abdominal wall suspension emerges as a promising surgical option for younger patients with uterine prolapse. This technique's reduced complication rates and improved perioperative parameters highlight its feasibility for broader clinical adoption. Further long-term studies are warranted to confirm these results and explore its applicability across diverse patient populations.

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