

Clinical efficacy of pelvic autologous tissue reconstruction in treating pelvic organ prolapse in 36 patients

Ling-Xiao Huang, MD, Ren-Liang Li, MD, Li-Xiao Sha, MD, Xiao-Hua Lin, MD*

Abstract

This study aims to search for a new, economic, convenient, and low recurrence rate operation for the surgical management of pelvic organ prolapse (POP). The clinical value of the operation for treating POP was determined through retrospective case series. The new operation was called, pelvic autologous tissue reconstruction.

Women with symptomatic uterine prolapse, who required surgery, were recruited. A total of 97 women [stage III to IV, according to POP quantification (POP-Q) staging] were collected from January 2010 to December 2016. Among these women, 61 women underwent a traditional operation (TO, vaginal hysterectomy and vaginal anterior and posterior wall repair), while the remaining women underwent pelvic autologous tissue reconstruction.

First, there was no statistically significant difference in intraoperative blood loss, indwelling urethral catheter time, in-hospital time, and the time of passage of gas through the anus between the pelvic autologous reconstruction (PAR) and TO groups ($P > .05$). The average operation time in the PAR group was significantly longer than that in the TO group ($P < .05$). Second, ultrasonic parameters before and after the operation between the 2 groups were compared. The postoperative rotation angle of the urethra (UR), posterior vesicourethral angle (PVA), and bladder neck descent (BND) significantly decreased in the PAR group ($P < .05$). There was no statistically significant difference in UR between before and 12 months after surgery in the TO group ($P > .05$). Furthermore, BND increased in the TO group at 12 months after the operation, compared with that at 3 months after the operation ($P < .05$). There was no significant difference in PVA and UR before the surgery and at 3 and 12 months after the surgery between the 2 groups ($P > .05$). In addition, BND was significantly smaller in the PAR group than in the TO group at 3 and 12 months after the surgery ($P < .05$). Third, there was no statistically significant difference in PFIQ-7 and PISG-12 in both groups after surgery.

The stability of the pelvic floor structure was better in the PAR group than in the TO group. Furthermore, PAR is better for preventing the occurrence of pelvic floor prolapse and stress urinary incontinence after surgery.

Abbreviations: BMI = body mass index, BND = bladder neck descent, OSUI = occult stress urinary incontinence, PAR = pelvic autologous reconstruction, PFD = Pelvic floor dysfunction, PFIQ-7 = Pelvic Floor Impact Questionnaire short form, PISQ-12 = Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire, POP = pelvic organ prolapse, POP-Q = POP quantification, PVA = posterior vesicourethral angle, SUI = stress urinary incontinence, TO = traditional operation, UR = urethra, $x \pm SD$ = mean \pm standard deviation.

Keywords: pelvic autotissue rebuilding, pelvic organ prolapse, the main sacral ligament complex, vaginal hysterectomy and vaginal anterior and posterior wall repair

1. Introduction

Pelvic organ prolapse (POP) is a common disease in postmenopausal women, which is characterized by prolapse of the vulva, and some of these patients are accompanied by abnormal defecation, paruria,

inflammation, and vulvar hemorrhage.^[1] POP seriously affects the quality of life and physical and mental health of middle-aged and elderly women. Severe POP usually requires surgical treatment. Furthermore, the operation methods vary, and the curative effects are different. In the present study, pelvic floor reconstruction was performed with a bulged and relaxed pubic cervical fascia, pubis urethral ligament, Denonvilliers fascia, and arcus tendineus fasciae pelvis. Through the introduction of pelvic floor autologous tissue reconstruction and follow-up after the operation, the value of this method in clinical practice was discussed.

2. Information and methods

This study was conducted in accordance with the declaration of Helsinki. This study was conducted with approval from the Ethics Committee of People's Hospital of Wenzhou. Written informed consent was obtained from the participants.

2.1. Subjects of study

From January 2010 to December 2016, a total of 97 patients were diagnosed with grades III and IV uterine prolapsed,

Editor: Yan Li.

All authors declare that they have no conflict of interests.

The author(s) of this work have nothing to disclose.

Department of Gynecology, People's Hospital of Wenzhou, Wenzhou, Zhejiang, China.

* Correspondence: Xiao-Hua Lin, Department of Gynecology, People's Hospital of Wenzhou, No. 57 of Canghou Lane, Lucheng District, Wenzhou 325000, China (e-mail: linxh201435@163.com).

Copyright © 2018 the Author(s). Published by Wolters Kluwer Health, Inc. This is an open access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

Medicine (2018) 97:42(e12765)

Received: 5 July 2018 / Accepted: 18 September 2018

<http://dx.doi.org/10.1097/MD.00000000000012765>

according to the POP quantification (POP-Q) proposed by Bump.^[2] These patients were divided into 2 groups, according to the different surgical methods: in pelvic autologous reconstruction (PAR) group, 36 patients underwent transvaginal hysterectomy and pelvic floor tissue reconstruction using pubic cervical fascia, pubic urethral ligament, Denonvillier fascia, and arcus tendineus fasciae pelvis (abbreviated as: “pelvic floor autologous tissue reconstruction”); in traditional operation (TO) group, 61 patients underwent traditional transvaginal hysterectomy and anterior and posterior vaginal wall repair. These 2 surgical procedures were prepared in the same way before the operation, and the operations were carried out by the same chief physician in our hospital. Furthermore, the specific surgical procedures were also concomitantly inspected, assessed, and determined by a deputy chief physician and the chief physician who performed the operation. Before and after the operation, the pelvic floor situation of all patients was evaluated by pelvic floor and perineum ultrasound. Then, a Pelvic Floor Impact Questionnaire short form (PFIQ-7) and Pelvic Organ Prolapse/Urinary Incontinence Sexual Questionnaire (PISQ-12) were filled in.

2.2. Surgical procedures

Transvaginal hysterectomy and anterior and posterior vaginal wall repair are common and traditional procedures, and the main basis is “Female Pelvic Organ Prolapse Surgical Therapeutics.”^[3]

2.2.1. Key points of pelvic floor autologous tissue reconstruction.

- (1) Patients were treated with transvaginal hysterectomy, and the bilateral main sacral residual ligaments were separated for approximately 2 cm. Two overlapping U-shaped sutures were performed to reinforce the main sacral ligament and connective tissues surrounding the cervical ring and strengthen the first level of support force.
- (2) Water was injected into the vesicovaginal space, and a longitudinal incision was made at the anterior vaginal wall in the midline to approximately 1 cm below the genital groove. Then, a blunt and sharp separation of the bilateral vaginal walls was performed, and the space was freed to the level of the white line segment on the descending branch of the pubis.
- (3) The bilateral vaginal mucosa was separated from the pubic cervical fascia to the white line segment on the descending branch of the pubis, and the fascia layers were freed.
- (4) The top of the pubic cervical fascial flap, which was previously freed, was transversely cut by approximately 1 cm (middle segment of the urethra) in the left and right direction. Then, the top of the left pubic cervical fascial flap was sutured to a site approximately 1 cm to the starting of the right pubis descending branch with a 1# silk thread, in order to restore the normal anatomical position of the middle segment of the urethra, while the lower end of the suture was 1 cm front the ischial spine. The fascia layer was paved, and 2 stitches were intermittently sutured in the middle. The same method was used to process the contralateral side. The left and right layers of the pubic cervical fascia were sutured in an overlapping fashion, and fixed on the anchored structure to strengthen the anterior vaginal wall.
- (5) The redundant vagina mucosa was cut. The principle of “looser is better than tighter” was observed to preserve vaginal ruga as far as possible, and induce the tissue to obtain full tension. Then, continuous longitudinal over-and-over whip suture of the anterior vaginal wall mucosa was performed in the middle using a 3–0 Vicryl suture.
- (6) Transversal suture of the vaginal stump was performed using a 3–0 Vicryl suture, and the top of the vaginal stump was sutured to the main sacral ligament complex to prevent vaginal top prolapse and maintain the vaginal length.
- (7) The bridge over-and-over whip suture of the posterior vaginal wall was performed using a 3–0 Vicryl suture to complete the pelvic floor reconstruction.

2.3. Evaluation method

In the present study, transperineal ultrasound was performed to evaluate the pelvic floor geometry features, instead of POP-Q for evaluating the effect of postoperative recovery, in order to evaluate female lower urinary tract dysfunction and POP. Pelvic floor ultrasound was performed by the same deputy chief physician of the Department of Ultrasound before the operation and at 3 and 12 months after the operation. The inspection methods are as follows: Before the inspection, patients emptied the stool and moderately filled the bladder (It was appropriate to display the bladder neck and triangle area of the bladder, which was <50 mL). Two-dimensional ultrasound of the pelvic floor and perineum was performed to obtain images from the following views: median sagittal section, parasagittal section, and coronal section. Three-dimensional ultrasound was performed on the transverse section. The following parameters were measured in resting state using the maximal Valsalva maneuver:

Posterior vesicourethral angle (PVA): This included the angle between the proximal urethra and posterior wall of the bladder.

Urethral tilt angle: This included the angle between the proximal urethra and vertical axis of the human body. The value was negative if the urethral axis deviated to the ventral side, and the value was positive when it deviated to the dorsal side. Along the lower margin of the pubic symphysis, a horizontal line was drawn on the ventral dorsal side, and the vertical distance from the bladder neck to this horizontal line was measured. The value was positive if the bladder neck was at the head side of this horizontal line, and the value was negative if it was at the foot side of this horizontal line.

Calculation of the UR: This refers to the difference in urethral tilt angle between the Valsalva state and resting state.

Postoperative rotation angle of the urethra (UR): This refers to the difference in PVA between the Valsalva state and resting state.

Bladder neck descent (BND): This refers to the vertical displacement of the bladder neck between the Valsalva state and resting state.^[4] In addition, before the operation and at 12 months after the operation, all patients filled in the PFIQ-7 and PISQ-12, and the scores were calculated as the subjective evaluation index for the curative effect.^[5,6]

2.4. Statistical analysis

All data were statistically analyzed using SPSS 19. Measurement data were expressed as mean \pm standard deviation ($\bar{x} \pm SD$), and compared using independent-sample *t* test. $P < .05$ was considered statistically significant.

3. Results

3.1. Comparison of general situations

The difference in age, body mass index (BMI), duration of menopause, parity, and duration of disease between the TO group and PAR group were not statistically significant ($P > .05$). Hence, these 2 groups were comparable (Table 1).

Table 1**Comparison of general situations between the 2 groups ($\bar{x} \pm s$).**

Groups	Cases	Age, years old	BMI, kg/m ²	Menopause, y	Parity, times	The duration of disease, y
The TO group	61	66.9±6.7	24.55±1.16	16.75±6.69	3.09±1.02	5.07±2.36
The PAR group	36	65.1±5.7	24.36±1.05	17.08±6.49	3.44±1.05	4.47±2.01
<i>T</i>	—	1.316	0.818	-0.237	-1.587	1.263
<i>P</i>	—	.191	.415	.813	.116	.210

BMI = body mass index, PAR = pelvic autologous reconstruction, TO = traditional operation.

3.2. Comparison of perioperative situations

The difference in operation duration between these 2 groups was statistically significant ($P < .05$), because the autologous reconstruction was completed on the basis of the TO. Therefore, the operation duration was longer in the PAR group than in the TO group. The differences in postoperative length of hospital stay, intraoperative bleeding volume, indwelling catheter time, and postoperative anal exhaust time between these 2 groups were not statistically significant ($P > .05$, Table 2).

In the TO group, urinary retention occurred in 6 patients, and the incidence was 9.84%. In the autogenous reconstruction group, urinary retention occurred in 1 patient, and the incidence was 2.78%. However, the symptoms were relieved, and urination recovered to the normal state again after the catheterization.

3.3. Comparison of results of pelvic floor and perineum ultrasound before and after the operation

At 3 and 12 months after the operation, the BND was significantly smaller in the PAR group than in the TO group, and the difference was statistically significant ($P < .05$). The differences in changes in UR and PVA, and BND between the 2 groups were not statistically significant ($P > .05$). The UR at 12 months after the operation was not statistically different from that before the operation ($P > .05$). Furthermore, the UR, PVA, and BND in these 2 groups were smaller at the other time points than those before the operation, and the differences were statistically significant ($P < .05$). The BND in the traditional surgery group was higher at 12 months after the operation than at 3 months after the operation, and the difference was statistically significant ($P < .05$). The UR, PVA, and BND in the 2 groups at 12 months after the operation were not statistically different from those at 3 months after the operation ($P > .05$). The specific results are presented in Table 3.

3.4. Improvement of quality of life after the operation in the 2 groups

In the TO group, 5 patients were widows, and 7 patients had no sexual life after the operation. In the PAR group, 2 patients were widows, and 4 patients had no sexual life after the operation. All

remaining patients completed the PFIQ-7 and PISG-12 questionnaires. The differences in PFIQ-7 and PISG-12 scores before the operation and at 12 months after the operation between the 2 groups were not statistically significant ($P > .05$). The PFIQ-7 and PISG-12 scores in these 2 groups were lower at 12 months after the operation than those before the operation in the same group ($P < .05$, Table 4).

3.5. Postoperative recurrence in the 2 groups

In the TO group, reexamination at 1 year after the operation revealed mild stress urinary incontinence (SUI) in 5 patients. In the PAR group, no postoperative SUI was found. For patients who have been continuously followed up, TO group reexamination at 36 months after the operation revealed a recurrence of prolapse of the anterior and posterior vaginal wall in 4 patients in the TO group. These patients were rehospitalized and underwent anterior and posterior vaginal autologous tissue reconstruction. Follow-up at 3 months after the second operation revealed that the vagina could contain 2 fingers, the length of the vagina was approximately 7 to 9 cm, and tissue elasticity was good, which was similar to normal tissue. In the PAR group, the follow-up lasted for up to 6 years, and no recurrence was found. Due to the small number of cases in the present study, a comparison could not be performed to determine whether the difference was statistically significant.

4. Discussion

POP is a common but secret disorder. It seriously affects the quality of life of middle-aged and elderly women in China. Wang^[7] revealed in an investigation conducted in the Beijing region that for married women, the incidence of uterine prolapse was 25.8%, the incidence of simple anterior vaginal wall bulge was approximately 41.6%, and the incidence of simple posterior vaginal wall bulge was approximately 32.1%. Due to its high incidence and difficulty in treatment, POP has attracted the attention of the obstetrics and gynecology community at home and abroad. POP is graded using the POP-Q proposed by Bump. Patients with POP grades III and IV often require surgical treatment. At present, there are many types of surgery for POP,^[8]

Table 2**Comparison of perioperative situations between the 2 groups ($\bar{x} \pm s$).**

Groups	Cases	Duration of operation, time	Postoperation hospitalization duration, d	Bleeding during the operation, mL	Indwelling catheter, d	Passage of gas by anus, h
The TO group	61	120.21±9.60	7.05±0.96	70.33±25.19	3.34±0.96	26.16±4.88
The PAR group	36	149.03±7.91	6.75±0.55	75.28±26.88	3.17±0.70	27.61±5.42
<i>t</i>	—	-15.214	1.713	-0.912	0.965	-1.355
<i>P</i>	—	<.001	.090	.364	.337	.179

PAR = pelvic autologous reconstruction, TO = traditional operation.

Table 3

Comparison of results of the pelvic floor and perineum ultrasound in the 2 groups before and after the operation ($\bar{x} \pm s$).

Groups	Rotation angle of the urethra, °			Posterior vesicourethral angle, °			Bladder neck descent, mm		
	Before the operation	3 mo after the operation	12 mo after the operation	Before the operation	3 mo after the operation	12 mo after the operation	Before the operation	3 mo after the operation	12 mo after the operation
The TO group	26.19 ± 10.30	19.35 ± 9.42*	23.14 ± 10.28 ^{†,§}	38.84 ± 15.77	24.51 ± 9.27*	27.81 ± 12.95 ^{*,§}	30.02 ± 7.54	18.74 ± 5.88*	22.56 ± 7.70 ^{*,‡}
The PAR group	24.76 ± 10.46	18.05 ± 9.34*	19.86 ± 11.88 ^{*,§}	41.95 ± 14.89	23.86 ± 11.05*	25.90 ± 10.36 ^{*,§}	32.10 ± 5.74	15.76 ± 4.23*	16.19 ± 5.31 ^{*,§}
<i>t</i>	0.517	0.520	1.140	-0.755	0.249	0.589	-1.111	2.072	3.407
<i>P</i>	.607	.605	.259	.453	.804	.558	.271	.042	.001

PAR = pelvic autologous reconstruction, TO = traditional operation.

* Compared with before the operation, *P* < .05.

† Compared with before the operation, *P* > .05.

‡ Compared with 3 mo after the operation, *P* < .05.

§ Compared with 3 mo after the operation, *P* > .05.

such as Mansmann operation, transvaginal hysterectomy, anterior and posterior vaginal wall repair, vaginal closure, and pelvic floor reconstruction. Different surgical methods have different therapeutic effects. Traditional surgical methods have high postoperative recurrence rates,^[9] which can lead to lower quality of life and unsatisfactory sexual life. A study proposed that transvaginal hysterectomy and anterior and posterior vaginal wall repair combined with vaginal closure could be used to reduce postoperative recurrence, but this combined method is not accepted by patients, because patients cannot have sexual life after surgery. In order to make up the defects of these “traditional” operations, a variety of high-tech nets were used for pelvic floor reconstruction, leading to good postoperative effects and a low recurrence rate. However, these nets have not been widely accepted and recognized by patients due to problems such as postoperative net erosion, pain, exposure, rejection, bleeding, infection, and high prices.^[10,11]

PE PaPa Petros proposed a new theory to describe female pelvic floor function, dysfunction, and treatment based on scientific research and clinical practice in recent 20 years. It was proposed that^[12] the pelvic floor is an inherent correlation system. Muscles, connective tissue, and nerve components in pelvic floor form an interrelated balance system, in which connective tissue is the most prone to damage. Pelvic floor dysfunction (PFD) is mainly induced by the loss of connective tissue in the suspensory ligament of the pelvic floor due to different reasons. The principle of treatment for this disease is “reconstruction of morphology (structure) to achieve functional recovery.” Hence, the investigator proposed “pelvic floor autologous tissue reconstruction” on the basis of the repair of the anterior and posterior vaginal walls. The bulged and loose anterior vaginal wall fascias were retained and utilized for double-deck overlapping suture, in order to strengthen the anterior pelvic cavity. The vaginal stump was sutured to the main sacral ligament complex and a posterior

vaginal wall bridge repair was performed to strengthen the middle and posterior pelvic cavity. It was found in the present study that the surgical procedure had a small local trauma, and the differences in intraoperative bleeding, postoperative catheterization time, and length of hospital stay were not statistically significant, when compared with those in the TO group. For the postoperative recovery of the anatomical structure of the pelvic floor, 3-dimensional ultrasound of the pelvic floor and perineum was used for evaluation in the present study. Pelvic floor function assessment using 3-dimensional ultrasound of the pelvic floor and perineum has been recognized, and its advantages include its noninvasiveness and repeatability, and that it can obtain the quantized indexes.^[13] National and international studies have revealed that^[14,15] parameters, such as BND, PVA, and bladder neck rotation angle, could directly reflect the function of the bladder and urethra support structure. In the present study, the indexes of the pelvic floor ultrasound in the PAR group after the operation were all lower than those before the operation. In the TO group, although the UR and BND were smaller at 3 months after the operation, compared with those before the operation, the difference in UR at 12 months after the operation and before the operation was not statistically significant, and the BND was higher at 12 months after the operation than at 3 months after the operation. Therefore, it was concluded that pelvic floor autologous tissue reconstruction is better than TOs in restoring pelvic floor anatomical stability, and the effect was more durable and reliable. Patients with severe prolapsed are often concomitantly complicated with urinary incontinence and POP,^[16] and parturition injury, constipation, and chronic cough were the common risk factors for both.^[17,18] The symptom of urinary incontinence in many patients can be improved after POP corrective surgery.^[19] However, some patients have no urinary incontinence before operation, but develop typical symptoms of urinary incontinence after POP is improved. This symptom is

Table 4

Comparison of PFIQ-7 and PISG-12 scores in the 2 groups before and after the operation ($\bar{x} \pm S$).

Groups	Time	PFIQ-7 (points)	PISG-12 (points)
The TO group	Before the operation	81.3 ± 14.6	26.7 ± 3.1
	12 mo after the operation	21.4 ± 3.0*	40.3 ± 4.3*
The PAR group	Before the operation	76.7 ± 15.6 [†]	29.3 ± 2.6 [†]
	12 mo after the operation	26.4 ± 3.6 ^{*,†}	38.5 ± 3.0 ^{*,†}

PAR = pelvic autologous reconstruction, PFIQ-7 = Pelvic Floor Impact Questionnaire short form, TO = traditional operation.

* Compared with before the operation, *P* < .05.

† Compared with the TO group, *P* > .05.

called occult stress urinary incontinence (OSUI).^[20–22] The increase in BND is considered to be closely correlated to female SUI.^[23] If a patient has cystocele and severe uterine prolapse, the patient may have no subjective leakage of urine before the operation. For such patients, pelvic floor ultrasound can reveal that the location of the bladder neck is lower than that of the lower margin of the pubic symphysis, which protrudes from the vagina with the anterior vaginal wall. However, the bladder neck remains located above the bladder wall, and cause the folding of the urethra, covering up the SUI symptoms. If the anatomic structure recovers after the operation, SUI may occur.^[24] It remains controversial whether POP complicated with OSUI requires pelvic floor reconstruction and anti-incontinence surgery to prevent postoperative SUI. A scholar considered that patients may be overtreated when they receive anti-incontinence surgery and treatment for POP, and that the urinary incontinence symptom in many patients can be significantly improved after POP. The reason may be that pelvic floor reconstruction strengthens the urination control ability in the middle segment of the urethra.^[25] The results of the present study revealed that at 3 and 12 months after the operation, the BND was significantly smaller in the PAR group than in the TO group. This suggests that autologous pelvic floor reconstruction is better than TOs in improving BND and has a certain preventive effect on new SUI after the operation. Therefore, for patients with prolapse grades above III without SUI, or with mild SUI revealed by preoperative evaluation, “pelvic floor autologous tissue reconstruction” is recommended. The surgical procedure utilizes anterior pelvic autologous tissues for reconstruction to overlap and strengthen the fascias of the middle segment of the urethra, repairing the vaginal hammocks under the urethra to a certain extent, and better supporting the prolapse tissues of the anterior pelvic cavity. Compared with traditional surgery, it has a better preventive effect on postoperative pelvic floor prolapse and new SUI. Compared with the implantation of high-tech nets, this operation procedure is more economical and is easily accepted by patients. Furthermore, it also avoids postoperative complications caused by the nets, and the operation is simple and easy. Therefore, it can be carried out in primary hospitals. The scores for improving prolapse symptoms and sexual life in the PAR group were better after the operation than those before the operation, but the differences were not statistically significant when compared with those in the TO group. After the autologous tissue reconstruction, the vagina had enough length and width, which allowed it to maintain a normal vaginal anatomic axial position, and allowed the patients to have a satisfactory sexual life.

However, the investigator found in the operation that pelvic floor autologous tissue reconstruction has the following disadvantages: First, patients with POP grades <III are not suitable for autologous tissue reconstruction of the anterior and posterior vaginal wall due to the insufficiency of vaginal tissue looseness. Second, in the present study, 1 patient developed gaps, and had a small amount of effusion due to folds occurring in the overlapping of 2 layers of fascia, thereby developing pain after the operation. These symptoms improved after anti-infection treatment and spontaneous drainage. Therefore, there is a need for doctors who are proficient in pelvic floor surgery skills, in order to seriously and carefully operate, and avoid such complications.

In summary, with the aging of the population and improvement of the people’s living standard, people are becoming more and more demanding in terms of maintaining their quality of life,

and the visiting rate of POP patients is increasing year by year. Pelvic floor autologous tissue reconstruction is a safe and highly efficient minimally invasive surgery. Surgeons need to be familiar with the anatomic structure of the pelvic floor, and have a whole theoretical concept of the pelvic floor. In addition, they should have good vaginal surgery skills, and strictly master the operation indications and contraindications.

Author contributions

Conceptualization: Ling-Xiao Huang, Xiao-Hua Lin.

Data curation: Ling-Xiao Huang, Ren-Liang Li.

Formal analysis: Ling-Xiao Huang, Ren-Liang Li, Xiao-Hua Lin.

Investigation: Ling-Xiao Huang, Ren-Liang Li, Li-Xiao Sha.

Methodology: Ling-Xiao Huang.

Project administration: Xiao-Hua Lin.

Resources: Li-Xiao Sha.

Software: Li-Xiao Sha.

Supervision: Xiao-Hua Lin.

Writing – original draft: Ling-Xiao Huang.

Writing – review & editing: Ren-Liang Li, Li-Xiao Sha, Xiao-Hua Lin.

References

- [1] Haylen BT, Maher CF, Barber MD, et al. An International Urogynecological Association (IUGA)/International Continence Society (ICS) Joint Report on the terminology for female pelvic organ prolapse (POP). *Neurourol Urodyn* 2016;35:137–68.
- [2] Haylen BT, Maher CF, Barber MD, et al. An International Urogynecological Association (IUGA)/International Continence Society (ICS) joint report on the terminology for female pelvic organ prolapse (POP). *Int Urogynecol J* 2016;27:655–84.
- [3] Han JS. *Surgical Treatment of Pelvic Organ Prolapse*. 2016;Peking University Medical Press, Beijing:21–37, 7.
- [4] Chen HY, Xu HY. Parameter characteristics and significance of pelvic organ prolapse with stress incontinence evaluated by transperineal sonography. *Progr Obstet Gynecol* 2015;24:209–11.
- [5] Gagnon LH, Boucher J, Robert M. Impact of pelvic floor muscle training in the postpartum period. *Int Urogynecol J* 2016;27:255–60.
- [6] Shaaban MM, Abdelwahab HA, Ahmed MR, et al. Assessment of female sexual function among women with pelvic organ prolapse or urinary incontinence via an Arabic validated short-form sexual questionnaire. *Int J Gynaecol Obstet* 2014;124:24–6.
- [7] Wang JL. Assessment of reconstructive pelvic surgery with the times. *Chin J Clin Obstet Gynecol* 2012;13:81–2.
- [8] Wang XH, Huang YH, Ding JL. The progress of operation procedures for uterine prolapse. *Med Recapit* 2013;21:3917–9.
- [9] Jelovsek JE. Predicting urinary incontinence after surgery for pelvic organ prolapse. *Curr Opin Obstet Gynecol* 2016;28:399–406.
- [10] Purcell RL, Cody JP, O'Donnell M, et al. Pelvic floor reconstruction utilizing a residual hamstring rotational flap following traumatically induced subtotal hemipelvectomy in a combat blast casualty: a case report. *Mil Med* 2016;181:e1172–1176.
- [11] Natalia S, Menahem N, Haim K, et al. The “Pelvic Harness”: a skeletonized mesh implant for safe pelvic floor reconstruction. *Int Braz J Urol* 2016;42:507–13.
- [12] Luo LM. The current concerns of anti pelvic organ prolapse surgery. *Chin J Clin Obstet Gynecol* 2012;13:83–4.
- [13] Rao XP. A primary study of the stability of pelvic floor reconstruction surgery assisted by laparoscopy and stability of traditional transvaginal operation. *Jilin Med J* 2017;38:1500–2.
- [14] Sendag F, Vidiñli H, Kazandi M, et al. Role of perineal sonography in the evaluation of patients with stress urinary incontinence. *Aust N Z J Obstet Gynaecol* 2003;43:54–7.
- [15] Ma Y, Wang XY, Zhang L. The progress of diagnosis of overactive bladder in female: the interpretation of the guides of overactive bladder from the American Urological Association in 2012. *Chin J Obstet Gynecol Pediatr* 2012;8:561–7.
- [16] Anderson KM, Davis K, Flynn BJ. Urinary incontinence and pelvic organ prolapse. *Med Clin North Am* 2015;99:405–16.

- [17] Giarenis I, Robinson D. Prevention and management of pelvic organ prolapse. *F1000Prime Rep* 2014;6:77.
- [18] Liu B, Wang L, Huang SS, et al. Prevalence and risk factors of urinary incontinence among Chinese women in Shanghai. *Int J Clin Exp Med* 2014;7:686–96.
- [19] Chang TC, Hsiao SM, Chen CH, et al. Clinical outcomes and urodynamic effects of tailored transvaginal mesh surgery for pelvic organ prolapse. *Biomed Res Int* 2015;2015:191258.
- [20] Lensen EJ, Withagen MI, Kluivers KB, et al. Urinary incontinence after surgery for pelvic organ prolapse. *Neurourol Urodyn* 2013;32:455–9.
- [21] Khan ZA, Thomas L, Emery SJ. Outcomes and complications of transvaginal mesh repair using the Prolift (kit for pelvic organ prolapse at 4 years median follow-up in a tertiary referral centre. *Arch Gynecol Obstet* 2014;290:1151–7.
- [22] Jundt K, Wagner S, von Bodungen V, et al. Occult incontinence in women with pelvic organ prolapse: does it matter? *Eur J Med Res* 2010;15:112–6.
- [23] Yue S, Wu QQ, Wang XR, et al. Evaluation of pelvic floor function after spontaneous labor by transperineum four-dimensional ultrasound. *Chin J Med Ultrasound* 2014;11:28–33.
- [24] Al-Mandeeel H, Ross S, Robert M, et al. Incidence of stress urinary incontinence following vaginal repair of pelvic organ prolapse in objectively continent women. *Neurourol Urodyn* 2011; 30:390–4.
- [25] Song Y, Wang XJ, Chen YS, et al. Management of urinary incontinence before and after total pelvic reconstruction for advanced pelvic organ prolapse with and without incontinence. *Chin Med J (Engl)* 2018;131: 553–8.