

## A Prospective Study of Minimally Invasive Paravaginal Repair of Cystocele and Associated Pelvic Floor Defects: Our Experience

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### Abstract

**Aims and objectives** To assess the outcome of minimally invasive paravaginal repair of symptomatic cystocele and to correlate postoperative outcome with preoperative presentation. The primary outcome was the anatomical outcome measured by postoperative physical examination and the functional outcome was assessed by subjective symptoms and questionnaires. The secondary outcomes were perioperative and postoperative complications.

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**Materials and methods** In this longitudinal prospective observational study, 44 women underwent laparoscopic or robotic paravaginal cystocele repair from January 2016 to July 2016 and they were followed up to 1 year after surgery in a tertiary advanced laparoscopic center. All patients had a symptomatic lateral cystocele  $\geq$  grade 2 according to Baden–Walker classification. Other coexisting defects like apical cystocele or combined defects were corrected concomitantly. The anatomical outcome was measured by physical examination and functional outcome was assessed by questionnaires—Pelvic Organ Prolapse Distress Inventory 6 and Urinary Distress Inventory 6 preoperatively and during postoperative follow-up.

**Results** All 44 patients were followed up to 12 months after surgery. The anatomical cure rate for cystocele was 97.7%. There were no major complications. All subjective symptoms and quality of life scores improved significantly during postoperative follow-up. The anatomical recurrence rate in our study was 2.3%.

**Conclusion** Minimally invasive paravaginal repair of cystocele is an effective advanced laparoscopic procedure. It can be concomitantly performed with other surgical procedures to correct coexisting defects. The anatomical and functional results were outstanding with minimum perioperative morbidity and encouraging long-term outcome.

**Keywords** Laparoscopy · Robotic · Paravaginal repair · Cystocele · Prolapse

## Introduction

The advent of minimally invasive (MIS) surgical techniques has revolutionized urogynecology. Traditional anterior colporrhaphy was based on the concept of weakened anterior endopelvic fascia. White in the nineteenth century first described the detachment of the endopelvic fascia from the arcus tendineus fascia pelvis (ATFP) in a lateral cystocele and proposed the paravaginal repair. It was not widely accepted until Richardson's publication on abdominal approach. Laparoscopic paravaginal repair became popular subsequently [1].

The three Delancey levels of pelvic support are accepted universally. Anterior compartment defects are difficult to treat with recurrence following anterior colporrhaphy up to 70% [2]. Lateral cystoceles are level 2 defects with fascial detachment from ATFP, and apical cystoceles are level 1 defects with fascial detachment from the apex of anterior vaginal wall [2]. Central cystocele results from midline defect in the pubocervical fascia.

Lateral cystocele comprises 85–90% of anterior compartment defects and are ideally corrected by paravaginal

repair. Level 1 evidence suggests that abdominal paravaginal repair is superior to vaginal repair [3].

## Materials and methods

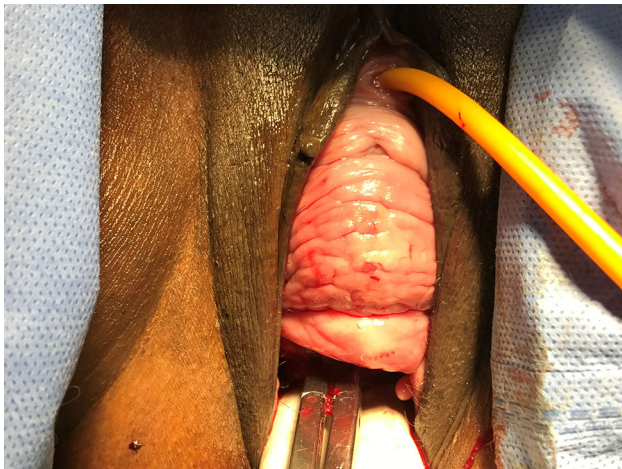
This is a longitudinal observational prospective study of 44 women with symptomatic cystocele  $\geq$  grade 2. All patients were followed for 12 months after surgery, and no patient was lost to follow-up. They underwent a MIS paravaginal cystocele repair. Associated level 1 and level 3 pelvic floor defects were repaired concomitantly with uterosacral colpopexy, moskowitz repair, perineorrhaphy and sacrocolpopexy. The study was approved by our institutional review board. Informed consent was obtained.

The relevant history was noted, and all patients were preoperatively assessed with quality of life (QoL) questionnaires, Pelvic Organ Prolapse Distress Inventory 6 (POPDI-6) and Urinary Distress Inventory short form (UDI-6) [4]. Clinical examination was done during Valsalva and Baden–Walker halfway classification was used in grading prolapse.

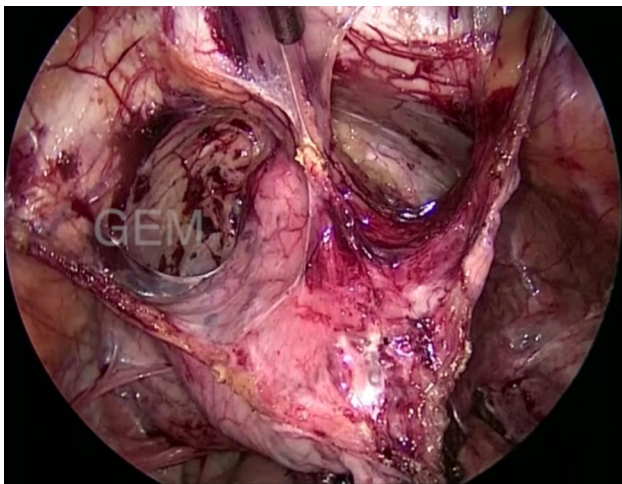
Women with pure stress urinary incontinence (SUI), pelvic malignancy, pelvic irradiation, neurological disorders, contraindication to MIS surgery were excluded from the study. Urinary tract infection (UTI) was treated. All patients with urinary symptoms underwent preoperative urodynamic study to exclude detrusor instability. Thromboprophylaxis and bowel preparation were given preoperatively.

All patients received general anesthesia and an induction dose of antibiotic prophylaxis. Patient is positioned in the modified dorsal lithotomy. Examination under anesthesia is done and patient catheterized. The surgery was performed by two authors. Pneumoperitoneum created with Veress technique followed by a four-port transperitoneal approach in all patients. The primary optical 10-mm cannula is placed 3–4 cm supraumbilically. Two 5-mm cannulas are inserted on the right side, upper one at the level of umbilicus and lower one above the anterior superior iliac spine. A third 5-mm cannula is inserted on the left at the level of umbilicus. Similar port configuration was followed in robotic surgery with 12-mm cannula and 8-mm ancillary ports.

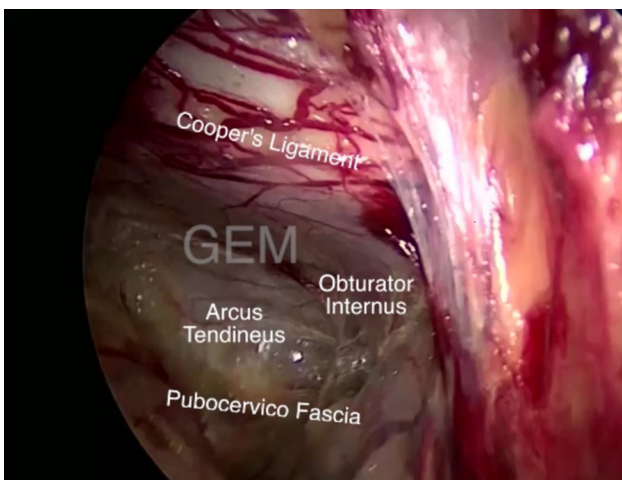
An arched incision is given 2 cm above the bladder dome between the medial umbilical ligaments (Fig. 1). Bladder is reflected from the pubic symphysis by blunt dissection. The retropubic space of retzius is entered (Fig. 2). The dissection is continued laterally exposing the Cooper's ligament, obturator internus with its fascia until the ATFP (Fig. 3). Paravaginal space is identified by medial dissection of the bladder. The dissection is maintained anterior to the obturator neurovascular bundle to avoid inadvertent injury. The vaginal assistant elevates the



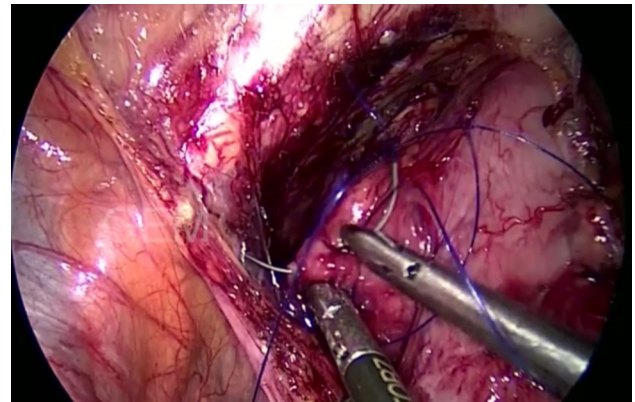
**Fig. 1** Lateral cystocele on examination



**Fig. 2** Incision given 2 cm above dome of the bladder



**Fig. 3** Space of retzius and dissection continued laterally exposing the Cooper's ligament, obturator internus with its fascia until the ATRP

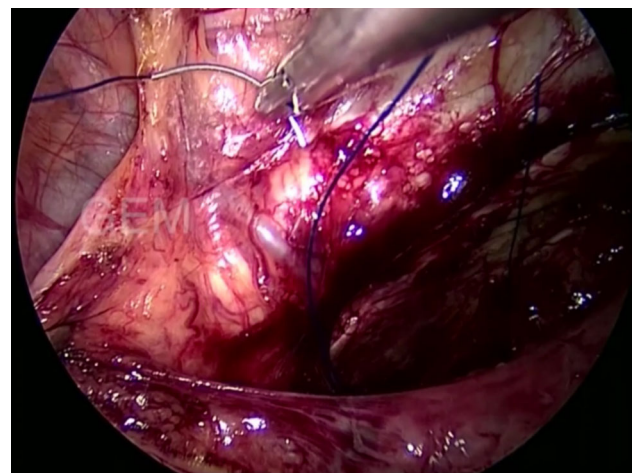


**Fig. 4** First suture taken in lateral vaginal wall and pubocervical fascia

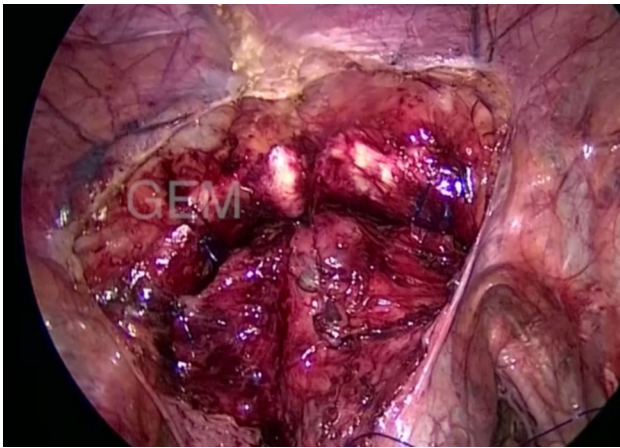
lateral sulcus up to the ATRP to identify the site of the paravaginal defect.

The defect is repaired with 2–4 sutures of No. 2-0 polypropylene. The initial bite of suture is taken in the subepithelial lateral vaginal wall along with pubocervical fascia (Fig. 4) and anchored with one bite in the Cooper's ligament (Fig. 5) and tied without tension. The sutures are alternated on the left and right to maintain vaginal symmetry (Fig. 6). It is ensured that the suture does not enter the vagina. Our aim for anatomical cure was  $\leq$  grade 1 correction of cystocele. In our initial patients, we anchored the vaginal wall to the ATRP. As the outcome in these patients was not satisfactory, we later modified our technique. These patients were not included in this study.

The choice of Cooper's ligament for support is logical than the weakened ATRP as it is a stronger structure. The reflected peritoneum is closed with No. 2-0 polygalactin. Postoperative cystoscopy was not done routinely. All patients were started on liquid diet in 6 h and ambulated within 8 h after surgery. Postoperatively, catheterization



**Fig. 5** Suture taken in Cooper's ligament



**Fig. 6** Three sutures are taken on either side

was done for 72 h. They were assessed for voiding difficulty after catheter removal and discharged.

The postoperative reviews were at 1 week, 3 months and 12 months. Anatomical failure was a cystocele  $\geq$  grade 2. Functional cure was assessed by symptomatic improvement and questionnaires. Clinical data were analyzed with SPSS.

## Results

In our study, 38 women were operated laparoscopically and six patients by robotic surgery. The median age of women was 54.5 years (range 45–69); median weight was 65.5 kg (range 37–87), and most common parity was 2 (range 2–5). Four patients were premenopausal (9%). Thirty-four patients had a history of previous surgery (Table 1). Thirty-nine patients (90%) had urinary symptoms (Table 2). Twenty-four patients had undergone a previous hysterectomy (Table 3). Among them, four patients had cystocele without vault prolapse and underwent an isolated cystocele repair. In the remaining 20, two patients with vault prolapse  $\geq$  grade 2 underwent concomitant uterosacral colpopexy and 18 patients with vault prolapse  $\geq$  grade 3 required a concomitant sacrocolpopexy (Table 4).

**Table 1** Previous surgery (n = 44)

Surgery	N	%
No major surgery	10	22.7
Vaginal hysterectomy for prolapse	8	18.2
Abdominal hysterectomy	16	36.4
Hernia repair with or without mesh	10	22.7
TVT O	1	2.2
Minor surgery	26	59

**Table 2** Subjective prolapse symptoms, n (%), preoperatively and during follow-up

Symptom	Preoperative n = 44 (%)	After 1 week n = 44 (%)	After 3 months n = 44 (%)	After 12 months n = 44 (%)
Mass per vaginum	44 (100)	0	1 <sup>a</sup> (2.3)	1 <sup>a</sup> (2.3)
Difficulty in walking	14 (31.8)	0	0	0
Discomfort	6 (13.6)	0	0	0
Backache	10 (22.7)	0	0	0
Urinary frequency	18 (40.9)	0	0	0
Urinary urgency	12 (27.2)	0	0	0
Incomplete voiding	28 (63.6)	0	0	0
Poor urinary stream	6 (13.6)	0	1 <sup>a</sup> (2.3)	0
Dribbling of urine	6 (13.6)	0	0	0
Nocturia	4 (9)	0	1 <sup>b</sup> (2.3)	0
Urge incontinence	12 (27.3)	0	0	0
SUI	10 (22.7)	0	1 <sup>b</sup> (2.3)	1 (2.3)
Constipation	16 (36.4)	4 (9)	1 (2.3)	1 (2.3)

<sup>a, b</sup>symptoms correspond to the same patient

Four patients had an asymptomatic grade 2 rectocele and were managed conservatively. Twelve patients had an enterocele  $\geq$  grade 2 and underwent concomitant MIS moskowitz repair. There were no major intraoperative complications encountered that include hemorrhage, bladder, ureter and bowel injury, neurovascular injury, conversion to laparotomy. The mean blood loss was 50 ml. Immediate postoperative urinary retention was observed in one patient. Her bladder function recovered after 48 h of catheterization. The anatomical cure rate for cystocele was 100% at 1 week and 3 months postoperatively (Table 3). There was significant improvement in both QoL scale scores (Table 5).

Overall symptomatic relief was seen in 40 patients (90.9%), 41 patients (93.2%), 41 patients (93.2%) during 1 week, 3 months and 12 months follow-up. Urinary symptoms were relieved in 44 patients (100%), 42 patients (98%) and 43 patients (99%), respectively during 1 week, 3 months and 12 months follow-up.

One patient presented with mass per vaginum and poor urinary stream at 3 months with a grade 2 cystocele. Urinary stream was normal after treating UTI. She had a previous hernia repair, TVT O, and she underwent concomitant laparoscopic mesh repair for recurrent ventral hernia. She had asymptomatic grade 3 cystocele 12 months

**Table 3** Baden–Walker grading of prolapse preoperatively and during follow-up

Prolapse	GRADE 0	GRADE 1	GRADE 2	GRADE 3	GRADE 4	Total(n)
<i>Before surgery (n = 44), n (%)</i>						
Cystocele	0	0	12 (27.3)	22 (50)	10 (22.7)	44
Uterine descent	4 (20)	2 (10)	6 (30)	8 (40)	0	20
Vault prolapse	2 (8.3)	2 (8.3)	2 (8.3)	10 (41.7)	8 (33.4)	24
Rectocele	24 (54.5)	16 (36.4)	4 (9)	0	0	44
Enterocele	18 (40.9)	14 (31.8)	4 (9)	2 (4.5)	6 (13.6)	44
<i>After 1 week(n = 44), n (%)</i>						
Cystocele	36 (81.8)	8 (18.2)	0	0	0	44
Vault prolapse	44 (100)	0	0	0	0	44
Rectocele	36 (81.8)	8 (18.2)	0	0	0	44
Enterocele	42 (95.5)	2 (4.5)	0	0	0	44
<i>After 3 months(n = 44), n (%)</i>						
Cystocele	36 (81.8)	8 (18.2)	0	0	0	44
Vault prolapse	44 (100)	0	0	0	0	44
Rectocele	36 (81.8)	8 (18.2)	0	0	0	44
Enterocele	42 (95.5)	2 (4.5)	0	0	0	44
<i>After 12 months(n = 44), n (%)</i>						
Cystocele	35 (79.5)	8 (18.2)	1 (2.3)	0	0	44
Vault prolapse	44 (100)	0	0	0	0	44
Rectocele	36 (81.8)	8 (18.2)	0	0	0	44
Enterocele	42 (95.5)	2 (4.5)	0	0	0	44

**Table 4** Associated procedures (n = 44)

Associated Surgery	n	%
Adhesiolysis	8	18.2
Total laparoscopic hysterectomy	20	45.5
Sacrocolpopexy	18	40.9
Uterosacral colpopexy	22	50
Moskowitz repair	12	27.3
Unilateral salpingo oophorectomy	6	13.6
Bilateral salpingo oophorectomy	22	50
Perineorrhaphy	6	13.6
Cholecystectomy	2	4.5
Hernia repair with mesh	2	4.5
Total	118	

after surgery and was given the option of vaginal mesh repair. However, patient declined surgery as she had no urinary complaints.

One patient presented with nocturia and mild SUI 3 months after surgery. Her preoperative symptoms were incomplete voiding and urgency with grade 3 cystocele, grade 2 vault prolapse. Her cystocele was corrected to grade 0. Nocturia resolved after treating UTI but mild SUI persisted 12 months after surgery with a grade 0 cystocele which was treated conservatively.

## Discussion

Our study accentuates the advantages and feasibility of MIS paravaginal cystocele repair. In our experience, the anatomical cure rate for cystocele repair was 97.7% with recurrence in one patient. There was significant improvement in subjective symptoms and both QoL scale scores. We describe a simple technique with minimal perioperative morbidity, less recurrence and excellent postoperative anatomical, functional results. We advocate the MIS paravaginal cystocele repair in the treatment of symptomatic lateral and combined cystocele.

Historically, the treatment of choice for cystocele was the Kelly's anterior midline plication. However, it does not correct the lateral detachment from the ATFP [5]. In combined cystocele, anterior colporrhaphy with paravaginal repair may worsen the existing lateral defect due to the counteracting tension [1]. Paravaginal repair has been described vaginally, abdominally and laparoscopically. Various techniques have been described with and without mesh. The advantages of sharper delineation of anatomy, better dissection of anterior and posterior pelvic spaces, minimal blood loss with MIS surgery outweigh the morbidity of laparotomy and extreme complications in vaginal paravaginal repair [6, 7].

**Table 5** QoL scale scores before and after surgery

Assessment	Initial review ( <i>n</i> = 44)		Second review ( <i>n</i> = 44)		Third review ( <i>n</i> = 44)	
	Before surgery	1 week after	Before surgery	3 months after	Before surgery	12 months after
POPDI-6	39.3	1.5	39.6	1.3	30	1.5
UDI-6	26	1.4	24.2	3.2	21	5

MIS surgery enables deeper obliteration of cul-de-sac, greater pull strength after anchoring due to precise dissection and suture placement. Recurrence is less and complications like ureter and bowel injury are minimal due to better visualization. MIS surgery facilitates using permanent suture material like polypropylene, and granulation tissue is minimal. The defect can be simultaneously felt vaginally and identified intraoperatively. The restoration of sharper lateral sulci and adequate vaginal length can be done without visible suture material or vaginal incisions [8].

In our study, we performed MIS hysterectomy in 16 patients with uterine descent. This along with other procedures was quicker and less complicated. The ports placed for the cystocele repair can be used for hysterectomy, and better correction can be done due to improved access. This aided in dissecting the bladder from anterior vaginal wall and effective correction of high transverse cystocele along with proper reconstruction of pericervical ring and very minimal blood loss. Rosen et al. favored the incorporation of hysterectomy in all cases of prolapse for similar reasons, and they also reported resurgery for cervical elongation or apical prolapse after providing level 1 support in women not undergoing simultaneous hysterectomy [8]. In all 20 patients who underwent simultaneous hysterectomy in our study, concomitant uterosacral colpopexy was performed for correction of apical cystocele.

Young et al. reported their results after vaginal paravaginal repair without mesh with an objective 98% cure rate for paravaginal defect and 78% for midline defect [3]. Though the results seem impressive, complications encountered during their study were significant. The recurrence reported in their study is significantly less but technical difficulty, requirement of specialized equipment and need for vascular surgeon cannot be taken lightly. Reproducing their results may be difficult. Performing a simultaneous paravaginal and midline plication in their study is questionable. Mesh repair was briefly popular, but high incidence of mesh-related complications led to the renaissance of former anterior colporrhaphy. Kdous et al. described the results of transvaginal transobturator mesh repair of cystocele with anatomical success rate of 93% [7]. Complications specific to mesh-like mesh erosion, retraction, infection, dyspareunia and chronic pelvic pain cannot

be disregarded. Currently, there is insufficient evidence in using a permanent mesh [9].

Abdominal prolapse repair was described to be superior to vaginal repair [3]. The strict criteria of achieving grade 0 repair could be limiting as overcorrection may worsen symptoms. Increased pudendal neurological deficits were also reported after a vaginal repair. The success rate of abdominal paravaginal repair of cystocele in various studies has been reported between 75 and 97% [3]. We have given an intraoperative correction of  $\leq$  grade 1 with effective results.

Willison et al. described a success rate of 98.6% for restoration of paravaginal sulci. They reported that correcting lateral cystocele relieved the symptoms in majority of their patients with combined defects. These findings are similar to our results. 64% patients in their study with residual central defects did not require follow-up procedure [1]. Recurrence of central cystocele was less following paravaginal repair. The subsequent publication by Bedford et al. on long-term outcome reported that 58% of their patients had anatomical failure and 30% eventually required cystocele repair. The median time for recurrent anterior compartment prolapse was 13 months [5]. The limitation in their study was overemphasis on anatomical repair than the functional outcome. Higher recurrence quoted could be due to their stern anatomical criteria.

There are no robust studies demonstrating the efficacy of the MIS paravaginal cystocele repair. Hosni et al. compared vaginal, abdominal and laparoscopic approaches and reported similar results with abdominal and vaginal repair. In their experience, the laparoscopic group had no advantage with prolonged operative time and extended hospital stay. These results cannot be extrapolated as they discontinued the laparoscopic procedure after operating five patients. The average duration of isolated paravaginal cystocele repair in our study was 25–45 min. The operative time decreased in subsequent patients with sound anatomical knowledge and MIS surgical skill. In our patients, the postoperative recovery was quicker following MIS surgery.

Willison et al. reported operative time from 50 to 255 min and hospital stay of 2–17 days. We report similar operative time of 90–220 min with average hospital stay of 2–3 days. In our experience, duration of surgery was

primarily defined by concomitant surgery, which was similar to that of Bedford et al. [5]. Our technique of anchoring the vagina and pubocervical fascia to Cooper's ligament is simple and effective. Willison et al. reported anatomical cure rate of 76% with a comparable technique [1]. Bedford et al. described approximating the vagina with both ATRP and Cooper's ligament [5]. Our results with using the Cooper's ligament alone as an anchoring support are encouraging. The same technique vaginally is not practicable as dissecting up to ATRP itself is challenging. The occurrence of postoperative SUI after cystocele repair has been underreported. The exact frequency cannot be interpreted due to the lack of uniformity in surgical repairs published. The postoperative onset of mild SUI in one of our patients was possibly due to overcorrection.

The strength of our study was the meticulous preoperative symptomatic assessment and proper clinical examination. This aids in planning the surgery and assessment of outcome in a standardized manner. The choice of MIS paravaginal cystocele repair mainly depends on surgical skills. It has numerous advantages in comparison with laparotomy and vaginal surgery [8].

The limitations in our study are the sample size, which is relatively small with short follow-up and the adaptation of Baden–Walker classification as opposed to the Pelvic organ prolapse quantification system (POP Q). Baden–Walker classification is frequently used in clinical practice, whereas POP Q is used in research and followed by less than 50% of gynecologists due to practical constraints [10]. We followed Baden–Walker classification because of its simplicity. Hence, comparing our results with other studies following POP Q should be interpreted with caution.

We are confident that our results are still valid and will be an important contribution to the sparse current literature. Larger randomized studies with longer follow-up are required to contribute further evidence. Our patients are presently on follow-up with recruitment of new patients, and we plan to analyze our long-term outcome.

## Conclusion

This study concludes that MIS paravaginal cystocele repair in lateral and combined cystocele is an effective procedure. It gives excellent access, vision and precision with less recurrence. It provides symptomatic relief, improves

quality of life and a visually perfect repair site while maintaining vagina of normal length, caliber and axis. However, longer follow-up will determine whether defect-oriented anatomical approach will stand the test of time.

## Compliance with Ethical Standards

**Conflict of interest** All authors declare that they have no conflict of interest.

**Ethical Statement** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed Consent** Informed consent was obtained from all individual participants included in the study.

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