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Transobturator Four Arms Mesh versus Anterior Colporrhaphy in Management of Stress Urinary Incontinence with Cystocele

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ABSTRACT

Background: Cysticocele-associated stress urinary incontinence (SUI) is a prevalent condition among women that can have significant negative impacts on their overall well-being. In order to treat this condition, numerous surgical procedures have been implemented, such as anterior colporrhaphy (AC) and the transobturator four-arm mesh technique.
Objective: This study aimed to compare AC and four arms mesh for the surgical treatment of anterior vaginal wall prolapse (AVWP) associated with SUI.
Methods: This cross-sectional study was conducted on 50 women who had cystocele-associated SUI in the Obstetrics & Gynecology Department of Benha University Hospitals. All patients were allocated into 2 equal groups: group 1 (n=25) who were treated with transobturator four arms mesh and group 2 (n=25) treated with AC.
Results: The findings of the research indicated that age, sex, and comorbidities as well as preoperative SUI grades did not differ significantly between the two groups. However, significant differences were observed in cystocele stage, total ICIQ score, general health perception, role limitation, physical limitation, operative time, and hospital stay. No significant differences were found in postoperative symptoms, postoperative SUI grades, and early complications.
Conclusions: Both surgical procedures are effective methods to manage AVWP in patients with SUI and cystocele. The selection between the transobturator four arms mesh technique and AC should be based on cystocele stage, general health perception, and operative time, among other considerations.
Keywords: Stress urinary incontinence, Cystocele, Transobturator four-arm mesh, Anterior colporrhaphy; Surgical outcomes.

INTRODUCTION

Pelvic organ prolapse (POP) is a commonly observed pathological condition among women. Among adult females, the incidence of female stress urinary incontinence (SUI) varies between 12.8% and 46.4%, thereby constituting a significant health concern [1]. POP in women is cystocele, which is also known as anterior vaginal wall prolapse (AVWP). This condition is distinguished by the bladder herniating through the anterior vaginal wall. The implantation of mid-urethral slings by placing polypropylene trans-vaginal or trans-obturator tapes is a common method for treating SUI. Since POP and SUI frequently coexist, the simultaneous treatment of these two conditions has been a source of contention. Typically, a mid-urethral sling is implanted after cystocele repair when both procedures are performed during the same session [2].

Anterior colporrhaphy (AC) is the most frequently employed technique for the treatment of AVWP. Conventional approaches to anterior wall prolapse repair have been found to have a significant recurrence rate when native tissue is utilized [3].

Due to the high rate of recurrence and the failure of native tissue in the management of SUI and POP, numerous procedures, such as polypropylene mesh, have been utilised on a large scale, resulting in high success rates [4]. A four-pointed mesh has been designed to secure the pelvic side wall through the use of four anatomical routes and four arms. For the treatment of SUI. A double transobturator four-arm polypropylene mesh was implemented in addition to anterior compartment repair. Complications such as visceral or vascular injury, pelvic pain, and mesh extrusion have been documented in instances involving the insertion of mesh or needles [5]. This study aimed to compare AC and four-arm mesh in the surgical treatment of AVWP accompanied by SUI.

Methodology

Patients: This prospective study included 50 female patients who were selected from the outpatient clinic at Benha University Hospitals based on specific inclusion criteria.

Inclusion criteria: Female patients experiencing symptomatic SUI with cystocele.
Exclusion criteria: Patients with past history of transvaginal mesh surgeries, with underlying neurological disorders, with detrusor overactivity, and those diagnosed with malignancies of the female genital system or urinary bladder.

All patients underwent complete history taking including personal, medical and gynecological data, presentation of SUI symptoms, precipitating factors, and categorization of incontinence severity using Stamey's grading of SUI. Physical examination (general, abdominal, and neurological assessment) and local examination including stress test, was done in the lithotomy position. This test involved assessing urinary leakage while the patient cough. The test was repeated with the patient standing and legs separated, and urine leakage was clinically noted in all patients.

The POP quantification system (POP-Q System) was used to assess and characterize the degree of

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prolapse in the patients. The POP-Q System is widely employed in clinical settings for the assessment of POP.

Technique:

Pre-examination: Before the procedure, it is necessary to ensure that the patient's bladder and, whenever possible, rectum were empty. A full bladder could result in an underestimation of the POP-Q score and, as a result, staging errors. The patient should be positioned to highlight the prolapse's maximum extent, which the patient can confirm. Possible positions while giving birth are supine, standing, or in a 45-degree slanted birthing chair. If necessary, the anterior and posterior vaginal walls can be retracted using a Sim's speculum during the examination. It is essential to document all methods and positions used during the examination to ensure reproducibility.

Measurement Parameters: Six distinct locations (Aa, Ba, C, D, Ap, Bp) and three anatomical markers [GH, PB, Total vaginal length (TVL)] comprise the measurement parameters (Figure 1): Point Aa is situated at the midline of the vaginal anterior wall. When prolapse is absent, this site is situated precisely inside the vaginal opening, 3 centimeters above the hymen. Measurements may vary from -3 cm (representing the absence of anterior vaginal prolapse) to +3 cm (denoting complete prolapse) from the hymen. The most superior region of the anterior vaginal wall is referred to as point Ba. This location is referred to as Aa (-3 cm) in women who do not have anterior prolapse. However, in women who have complete prolapse, this site aligns with point C. Determine whether the cervix is descending or not by indicating at point C the lowest edge of the cervix or vaginal cuff (e.g. hysterectomy scar). Comparing point D to point C allows for an evaluation of the extension to the cervix, as point D represents the highest point of the posterior vaginal wall. Point Ap is located 3 cm proximal to the hymen in the midline of the posterior vaginal wall, its distances relative to the hymen range from -3 cm to +3 cm. At point Bp, the posterior vaginal wall is at its highest point.

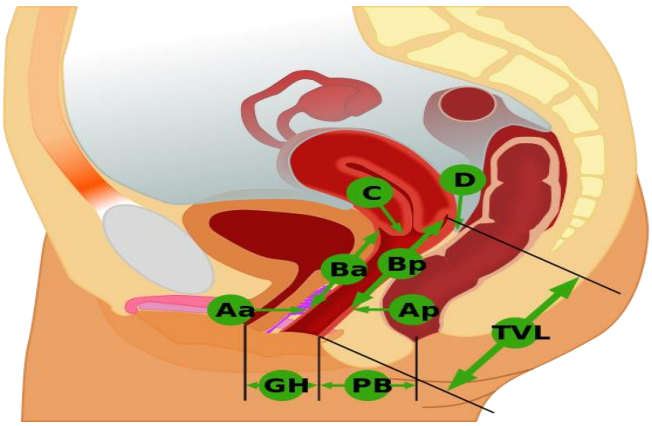

Figure (1): POP-Q System Locations.

GH is the 'Genital hiatus,' which determines the laxity of this region by measuring the distance between the urethral opening and the posterior vaginal opening/hymen. The PB provides information regarding the tonicity of the superficial pelvic floor. It was measured from the posterior aspect of the hymen to the mid-anal opening and was referred to as the "perineal body." By measuring TVL from the most distal point to the hymen, prolapse depth can be evaluated both before and after surgical repair.

Recording measurements: During a maximum Valsalva or cough, six separate locations were measured in relation to the hymen, which is defined as 0 cm. When the prolapse was reduced, TVL measurements were taken at rest. A point receives a measurement of 0 centimeters when it was in alignment with the hymen. A negative measurement was recorded if the object remains above the hymen; conversely, a positive measurement was recorded if the object extended beyond the hymen. Every measurement was recorded in centimetres utilising a ruler or tape measure.

Staging of Prolapse: After all measurements have been obtained, the stage of the prolapse can be determined in relation to the hymen:

Stage 0: Absence of prolapse (points Aa, Ba, C, D, Ap, and Bp are all < / = -3 cm). **Stage 1:** Placing Aa, Ba, C, D, Ap, and Bp below -1cm from the hymen indicates that the most proximal portion of prolapse exceeds 1 cm above the hymen's level. **Stage 2:** Placing points Aa, Ba, C, D, Ap, and Bp at -1 cm and +1 cm, respectively, defines the most proximal portion of prolapse as the region bounded by the hymen and extending toward it by 1 cm. **Stage 3:** Beyond the hymen, the most distal segment of the prolapse extends from beyond 1 cm to below 2 cm, with no measurement surpassing TVL (points Aa, Ba, C, D, Ap, and Bp may be >/= +2 cm and /=-3 cm, respectively). **Stage 4:** Vaginal eversion or eversion within 2 cm of TVL (points Aa, Ba, C, D, Ap, and Bp can be >/= to TVL -2 cm).

Evaluation of stress incontinence: A cough stress test and the validated Arabic version of The International Consultation on Incontinence Questionnaire-Short Form (ICIQ-UI SF) were utilized to assess stress incontinence. Stamey's grading of SUI was utilized to evaluate its severity.

Cough stress test (CST): Patients underwent CST with a full bladder, and the testing procedure was explained to them. Participants were given the directive to cough a maximum of five times across five unique scenarios. Each of the five CSTs was executed consecutively and in the exact sequence. Without prolapse reduction, the patient stood in a semilithotomy position during the initial and subsequent CSTs. Prolapse reduction was achieved during the third and fourth CSTs by employing a posterior speculum and a suitably sized ring pessary, all while maintaining a semi-lithotomy position. Using the volume of voided and residual urine, the total bladder volume was computed during the fifth CST, while the pessary was in place. Urinary loss concomitant with coughing was

indicative of a positive CST in at least one of the five criteria.

King Health Questionnaire (KHQ) Forms: The King Health Questionnaire (KHQ) forms were used for evaluation.

Investigations: Several laboratory and radiological examinations, including urine analysis and culture, liver function tests, coagulation profile, CBC, renal function tests, and blood sugar levels were performed. The purpose of the abdominal-pelvic ultrasound was to detect urologic diseases and estimate bladder capacity.

Procedure: Patients were randomly categorized into two groups:

Group A (Transobturator Four Arm-Mesh Technique): Patients were placed in the dorsal lithotomy position under spinal anaesthesia. The urethra was catheterized. Following the administration of saline and adrenaline, a midline longitudinal incision was performed, extending from the bladder neck to either the cervix or the vaginal cuff. Lateral dissections were conducted in the paravesical space between the bladder and the vaginal wall. On each side of the genitofemoral crease, two incisions were made. A needle was passed through the incised skin and guided to the vaginal incision using the "out-in" technique. The upper and lower arms of the mesh were attached to the needle and then extracted through the incised skin. The prolapsed region was covered by adjusting the four mesh arms without tension. After removing excess mucosa, absorbable sutures were used to close the vaginal and groyne incisions. After 24 hours, the catheter was removed, and a vaginal pack was placed for 24 hours.

Group B (Anterior Colporrhaphy Repair): An incision was made through the full thickness and length of the anterior vaginal wall. The bladder and the bladder pillars were separated from the vaginal wall, to reduce the cystocele. Closure of anterior vaginal wall by interrupted sutures to preserve the length of the repaired connective tissues. A vaginal pack was used when an anterior repair was combined with a posterior repair.

Follow-up: Patients were evaluated postoperatively at 2 weeks for complications. At 3 and 6 months postoperatively to assess KHQ, ICIQ-SF, POP-Q system. Cough test and SUI severity were assessed. Also, visual analogue scale for satisfaction, measurement of postvoid residual, and repeat urodynamic studies at 6 months postoperatively.

Ethical Approval: An informed written consents were obtained from the patients or relatives of the patients. The study was done after approval from The Ethical Committee Obstetrics and Gynecology Department, Faculty of Medicine, Benha University Hospital (approval code: Ms 17/5/2022). The study was adhered to the principles outlined in the Declaration of Helsinki for Medical Research Involving Human Subjects.

Statistical analysis

IBM SPSS statistics was utilized to revise, code, and tabulate the gathered data in preparation for statistical analysis. The normality of the data distribution was evaluated using the Shapiro-Wilk test. Parametric continuous data included mean and standard deviation. For non-parametric continuous data, median, range, frequency and percentage. Descriptive statistics included mean and standard deviation. Analytical statistics comprised the following: Student T-Test was utilized to compare the means of study groups, Mann Whitney Test (U test) to assess differences in non-parametric variables, Chi-Square test to investigate relationships between qualitative variables, Wilcoxon signed rank sum test to evaluate changes over time, Repeated measures ANOVA to compare means across repeated observations and ANCOVA to examine the main and interaction effects of independent variables. All p-values that were reported had two tails, and significance was established as $p \leq 0.05$.

RESULTS

There were no statistically significant differences in age, parity, or place of residence between the two groups under study. There was no significant difference observed between the two groups in terms of comorbidities. No statistically significant differences were observed in terms of symptoms between the two groups (Table 1).

Table (1): Demographic characteristics, comorbidities and preoperative urinary symptoms between studied groups

Variables		Four arms mesh (n=25)	Colporrhaphy (n=25)	t / χ^2	P
Age (years), Mean± SD		57.13 ± 4.93	58.45 ± 4.81	.958	.343
Parity (Mean± SD)		3.19 ± 1.58	3.12 ± 1.69	.151	.881
Residence	Urban	14 (56%)	16 (64%)	.333	.564
	Rural	11 (44%)	9 (36%)		
DM		5 (20%)	4 (16%)	.136	.713
Hypertension		7 (28%)	6 (24%)	.104	.747
Previous hysterectomy		5 (20%)	3 (12%)	.595	.440
Preoperative urinary symptoms					
Frequency		21 (84%)	22 (88%)	.166	.684
Urgent		20 (80%)	21 (84%)	.136	.713
Nocturia		12 (48%)	15 (60%)	.725	.395

Cystocele stage did not differ significantly between the two groups (Table 2).

Table (2): Clinical characteristics between the two studied groups

Variables	Four arms mesh (n=25)	Colporrhaphy (n=25)	χ^2	P
Type			.439	.508
Central cystocele	5 (20%)	7 (28%)		
Lateral cystocele	20 (80%)	18 (72%)		
Cystocele stage			11.6	0. 3
Stage 2	16(64	19 (76%)		
Stage 3	16 (64%)	5 (20%)		
Stage 4	2 (8%)	1 (4%)		

There was no significant difference between the two groups regarding Preoperative SUI grades (Table 3).

Table (3): Preoperative SUI grades distribution between the two studied groups

Variables	*Four arms mesh (n=25)*	*Colporrhaphy (n=25)*	χ^2	P
Grade 0	5 (20%)	6 (24%)	.384	.944
Grade 1	4 (16%)	4 (16%)		
Grade 2	4 (16%)	5 (20%)		
Grade 3	12 (48%)	10 (40%)		

No statistically significant differences were observed in terms of Qmax, post-void residual volume, or MUCP between the two study groups. No statistically significant difference was observed in the total ICIQ scores of the two groups. In relation to the two groups' preoperative general health perception, role limitation, physical limitation, and total KHQ score, no statistically significant difference was observed (Table 4).

Table (4): Preoperative urodynamic assessment, preoperative ICIQ score and preoperative King Health Questionnaire (KHQ) between the two studied groups

Variables	Four arms mesh (n=25)	Colporrhaphy (n=25)	t	P
Q_{max} (mL/s) Mean± SD	15.94 ± 7.33	17.15 ± 9.21	.514	.610
Post-void residual volume (mL) Mean± SD	41.12 ± 94.72	13.46 ± 39.55	347	.224
MUCP (cm H_2O) Mean± SD	63.12 ± 28.96	67.03 ± 25.68	.506	.616
Preoperative ICIQ score			χ^2	P
Moderate	6 (24%)	4 (16%)	.525	.769
Severe	14 (56%)	15 (60%)		
Very severe	5 (20%)	6 (24%)		
Total ICIQ score Mean± SD	15.64 ± 0.257	15.87 ± 0.292	2.96	.500
Preoperative King Health Questionnaire (KHQ)			χ^2	P
General health perception Mean± SD	3.64 ± 0.134	3.72 ± 0.106	2.34	.23
Incontinence impact score (Mean± SD)	2.71 ± 0.119	2.66 ± 0.147	1.32	.193
Role limitation (Mean± SD)	5.48 ± 0.227	5.63 ± 0.213	2.41	.20
Physical limitation (Mean± SD)	5.41 ± 0.236	5.58 ± 0.275	2.35	.23
Total KHQ score (Mean± SD)	69.57 ± 1.24	68.84 ± 1.32	2.02	.48

A significant difference was found between the studied groups regarding operative time and hospital stay. However, there was non-significant difference regarding blood loss (Table 5).

Table (5): Operative and clinical data between the two studied groups

Variables	Four arms mesh (n=25)	Colporrhaphy (n=25)	t	P
Operative time (min), Mean± SD	45.01 ± 12.73	34.64 ± 11.91	**2.97**	**.005**
Blood loss (ml), Mean± SD	97.51 ± 69.72	75.64 ± 32.55	1.42	.162
Hospital stay (days), Mean± SD	3.65 ± 0.551	4.13 ± 0.983	**2.13**	**.038**

No significant difference was found between the studied groups regarding postoperative symptoms and total UDSI (Table 6).

Table (6): Symptoms distribution pre and postoperative between the two studied groups

Variables		Four arms mesh (n=25)	Colporrhaphy (n=25)	χ^2	P
Symptoms					
Frequency	Pre	21 (84%)	22 (88%)	.166	.684
	Post	3 (12%)	6 (24%)	1.22	.271
Urgent	Pre	21 (84%)	21 (84%)	**7.22**	**1**
	Post	2 (8%)	2 (8%)	--	1
Nocturia	Pre	12 (48%)	15 (60%)	.725	.395
	Post	1 (4%)	0	1.02	.315
Total UDSI					
UDSI	Pre	21 (84%)	24 (96%)	2	.157
	Post	2 (8%)	2 (8%)	**--**	1
Occult UDSI	Pre	4 (16%)	1 (4%)	2	.157
	Post	0	0	**--**	1

We found no significant difference between the two groups regarding postoperative SUI grades (Table 7).

Table (7): Postoperative SUI grades distribution between the two studied groups

Variables	*Four arms mesh (n=25)*	*Colporrhaphy (n=25)*	χ^2	*P*
Grade 0	*22 (88%)*	*23 (92%)*	*2.36*	*.502*
Grade 1	*2 (8%)*	*1 (4%)*		
Grade 2	*0*	*1 (4%)*		
Grade 3	*1 (4%)*	*0*		

In regard to the postoperative ICIQ score, no statistically significant difference was observed between the two groups. In terms of postoperative general health perception, incontinence impact score, role limitation, and physical limitation, a significant difference was observed between the two groups (Table 8).

Table (8): Postoperative ICIQ score and Preoperative King Health Questionnaire (KHQ) between the two studied groups

Variables	Four arms mesh (n=25)	Colporrhaphy (n=25)	χ^2	P
Slight	20 (80%)	22 (88%)	.629	.730
Moderate	3 (12%)	2 (8%)		
Severe	2 (8%)	1 (4%)		
Total ICIQ score (Mean± SD)	1.71 ± 0.438	1.69 ± 0.455	.158	.845
Preoperative King Health Questionnaire (KHQ)	**Four arms mesh (n=25)**	**Colporrhaphy (n=25)**	χ^2	**P**
General health perception (Mean± SD)	1.41 ± 0.102	1.08 ± 0.1	**11.6**	**.000**
Incontinence impact score (Mean± SD)	1.31 ± 0.105	1.1 ± 0.101	**7.2**	**.000**
Role limitation (Mean± SD)	2.61 ± 0.113	2.27 ± 0.109	**11**	**.000**
Physical limitation (Mean± SD)	2.54 ± 0.112	2.18 ± 0.107	**11.6**	**.000**
Total KHQ score (Mean± SD)	17.42 ± 2.35	17.1 ± 2.11	.507	.615

Regarding early complication, the complications frequencies were comparable in the two groups but without statistical significance (Figure 2).

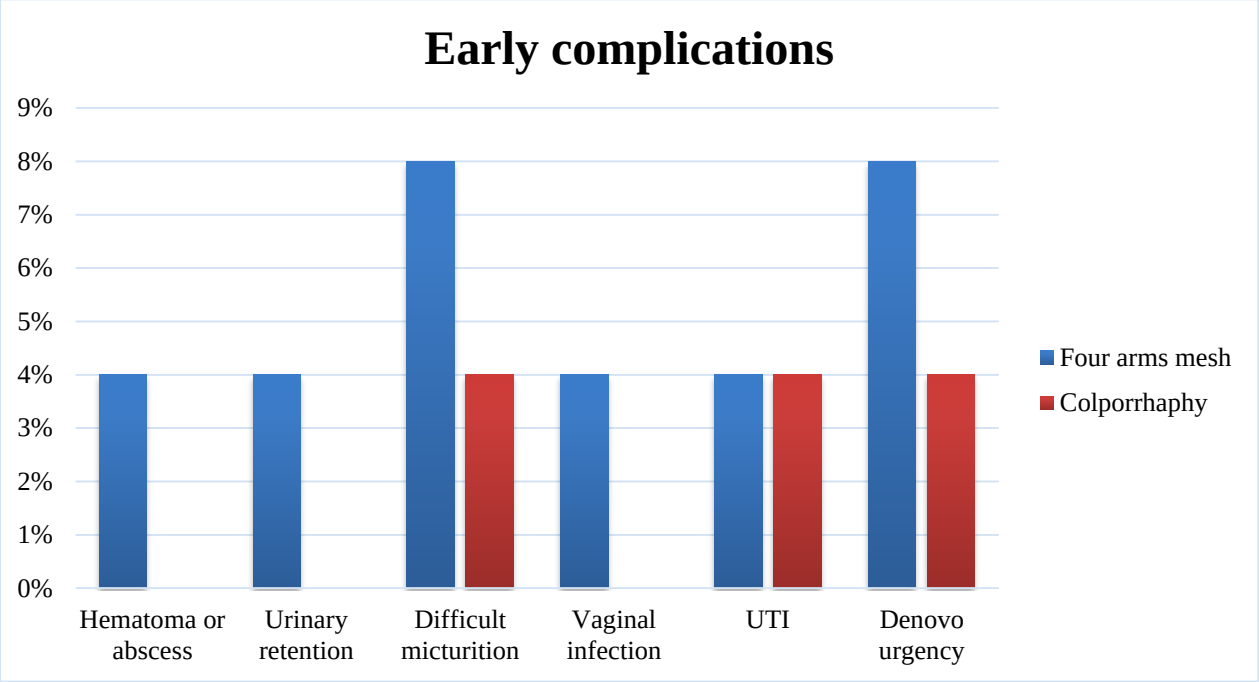

Figure (2): Early Complications between the two studied groups.

Regarding late complication, there was no significant difference between the two groups (Figure 3).

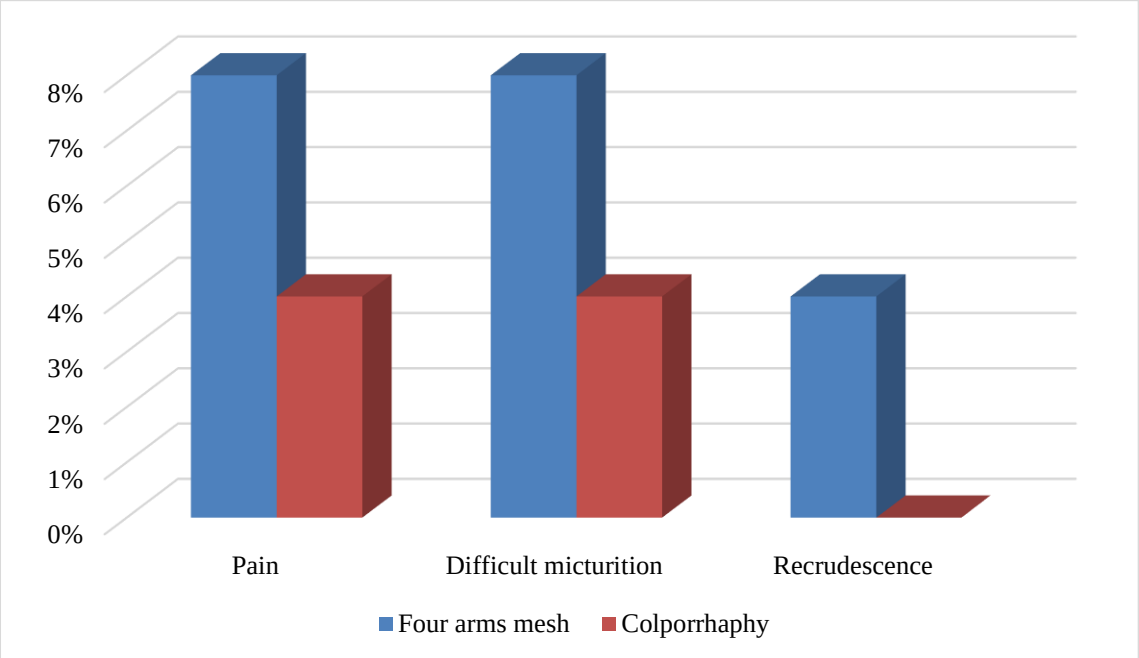

Figure (3): Late complications between the two studied groups

DISCUSSION

In the present study, there was no significant difference between the two groups regarding urinary symptoms and total UDSI in the distribution of preoperative urinary symptoms. Similarly, **Sharifiaghdas *et al.*** [6], observed that the sensation of a lump was the most common preoperative symptom, followed by irritative and obstructive symptoms of the lower urinary tract. Twelve patients were identified as having occult SUI, whereas 38 were diagnosed with overt SUI. In contrast, **Turgal *et al.*** [7], found that symptomatology, did not differ significantly between the AC and mesh surgery groups.

Regarding clinical characteristics, this study revealed a significant difference between the two groups in cystocele stage, but no significant difference in cystocele type. This is in contrast with the results of **Ahmed *et al.*** [8] and **Gupta *et al.*** [9] who reported no significant differences between groups in terms of cystocele stages and types. Variations in sample size and inclusion criteria could account for these disparities. Qmax, post-void residual volume, and MUCP did not differ significantly between the two groups in terms of preoperative urodynamic evaluations, which is consistent with the results of **Ahmed *et al.*** [8].

Regarding the preoperative ICIQ score, the present study found a significant difference between the groups, while **Ahmed *et al.*** [8] reported no significant difference, which could be due to differences in sample size and inclusion criteria. Additionally, our findings contradict those of the study by **Delroy *et al.*** [10] that reported no statistically significant difference in preoperative severity. The findings of the present study revealed statistically significant differences among the groups with regard to preoperative KHQ scores, encompassing general health perception, role limitation, physical limitation, and total KHQ score. **Delroy *et al.*** [10] demonstrated no significant differences in these particular facets. This differences were due to variations in the inclusion criteria and different sample size.

A notable disparity in bleeding rates did not exist between the two groups, despite the mesh procedure exhibiting a significantly longer operative duration but a shorter hospital stay. This aligns with the findings of **Ahmed *et al.*** [8], which documented intraoperative bleeding in both groups and a significantly longer operative time in the mesh group, but found no significant differences in hospital stays. **Gupta *et al.*** [9] also noted that the use of mesh was associated with significantly increased intraoperative hemorrhage and operating time. In contrast, **Delroy *et al.*** [10] reported no significant difference between the groups in terms of hospital stay and bleeding, but the mesh procedure required a significantly longer operative time. Additionally, the study by **Altman *et al.*** [11] reported longer operative time associated with the mesh procedure and significant blood loss, although hospital stay did not differ significantly. **De Tayrac *et al.*** [12] reported that there was absence of a statistically significant differences in operative time, hospital stay, or bleeding between the groups that may be attributed to intraoperative complications and surgeon experience.

Regarding the distribution of pre- and posto-perative symptoms between the two studied groups, we discovered that there was no significant difference in terms of postoperative symptoms and total UDSI between the two groups. In both groups, symptoms improved significantly. This is in agreement with **De Tayrac *et al.*** [12] who observed that postoperative symptoms did not differ significantly between the two groups. Also, in harmony with the current study, **Turgal *et al.*** [7] in terms of postoperative symptoms, reported that no significant difference existed between the two groups. In both groups, symptoms significantly improved.

Postoperatively, there was no significant difference in SUI grades between the two studied groups, which aligns with the findings of **Ahmed *et al.*** [8] who observed no significant difference between groups in terms of postoperative SUI grade. On the contrary, the current investigation is corroborated by **Long *et al.*** (13) who observed a noteworthy amelioration in SUI grade among a cohort of females afflicted with stage 2 cystocele subsequent to transobturator four-arm polypropylene mesh anterior vaginal wall repair. Similarly, **Sherif *et al.*** [5], stated that the SUI grade of fifty female patients with SUI and cystocele improved significantly following transobturator four-arm mesh implantation, according to the study. Furthermore, no statistically significant differences were observed in the postoperative ICIQ scores of the two groups, which is consistent with the results reported by **Ahmed *et al.*** [8]. However, **Sherif *et al.*** [5] and **Long *et al.*** [13] observed a significant improvement in ICIQ score after transobturator four-arm mesh implant.

A significant difference was identified in the postoperative general health perception, incontinence impact score, role limitation, and physical limitation throughout the two groups. In this regard, the mesh procedure demonstrated its superiority. Both groups exhibited significant improvement in the KHQ. In contrast, **Delroy *et al.*** [10] reported absence of significant differences in postoperative general health perception, prolapse impact, role limitation, and physical limitation between the groups, which may explain the lack of significant differences in these parameters preoperatively. However, our study identified significant differences in these parameters. **Sherif *et al.*** [5] and **Long *et al.*** [13] reported improved significantly n KHQ mean values following four-arm mesh transobturator implantation.

Early and late complications were comparable between the two groups without statistical significance. Consistent with this study, **Ahmed *et al.*** [8] showed that

there was no significant difference between the groups in terms of postoperative complications except for a higher incidence of micturition difficulty in the colporrhaphy group during early follow-up. Tape exposure was observed in 5% of patients in both groups, with comparable rates of total complications. **De Tayrac *et al.* [12]** also discovered similar reoperation rates, vaginal length, and complications. No difference in morbidity between the two techniques. In contrast, **Gupta *et al.* [9]** documented more complications with the mesh procedure compared to the conventional procedure. Additionally, **Altman *et al.* [11]** noted that in comparison with AC, the utilization of a standard trocar-guided mesh kit for cystocele repair led to increased rates of surgical complications and postoperative adverse events, while also demonstrating superior short-term treatment success.

CONCLUSION

AC is comparable in efficacy and safety to four-armed mesh application when it comes to the treatment of SUI caused by a cystocele. The utilization of mesh did not have an impact on the subjective outcome. However, the mesh group achieved a superior objective result. Despite similar results, the mesh group underwent a significantly shorter hospitalization period but had a comparatively longer duration of surgery.

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