Original Article

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Role of Anterior Colporrhaphy in Post Void Residual Urine Volume and Stress Urinary Incontinence: A Prospective Interventional Study

Obstetrics and Gynaecology Section

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ABSTRACT

Introduction: Pelvic floor disorders are quite debilitating for middle aged and elderly women. Post Void Residual (PVR) urine volume is a key marker for the efficacy of emptying of bladder. Both, preoperative and postoperative assessment of PVR volume helps to know about the voiding dysfunction and help to detect Stress Urinary Incontinence (SUI). There is a paucity of data available regarding postoperative outcome assessment of surgical intervention in terms of PVR urine volume.

Aim: To identify the risk factors for elevated PVR and to evaluate the rate of resolution of elevated PVR in patients undergoing vaginal hysterectomy with anterior colporrhaphy for Pelvic Organ Prolapse (POP).

Materials and Methods: A prospective interventional study was conducted at Atal Bihari Vajpayee Institute of Medical Sciences and Dr. Ram Manohar Lohia Hospital, Delhi from June 2019 to June 2021. A total of 50 patients with POP meeting the inclusion criteria were enrolled. Preoperative grade of prolapse, SUI and PVR urine volume was assessed. All patients enrolled in study, underwent vaginal hysterectomy with anterior colporrhaphy. Postoperative PVR urine volume and de novo SUI and occult stress urinary incontinence (OSUI) was assessed. Data was analysed using Statistical Package for the Social Sciences (SPSS) version 21.0. The p-value <0.05 was considered significant. Qualitative variables were analysed using Fischers-exact test.

Results: Preoperative PVR (≥50 mL) was seen in 28 (56%) women. Advancing age (p-value 0.043) higher Body Mass Index (BMI) (p-value=0.033) higher POP (p-value=0.003) and higher degree of cystocele (p-value<0.001) staging were significantly associated with elevated preoperative PVR. In this study, only 22% of patients (11/50) had preoperative SUI and 12% (6/50) had preoperative OSUI. In this study amongst the six patients with preoperative OSUI, 100% had significant preoperative PVR. None of the patients with preoperative SUI and preoperative OSUI had postoperative persistent SUI or de novo SUI after undergoing anterior colporrhaphy with vaginal hysterectomy (p-value <0.001).

Conclusion: The PVR urine volume is increased with degree of prolapse. Raised PVR is also associated with OSUI, which is usually seen in patients with advanced prolapse and cystocele. Vaginal hysterectomy with anterior colporrhaphy significantly reduced postoperative PVR and SUI.

Keywords: Pelvic floor disorders, Urinary retention, Vaginal hysterectomy, Voiding dysfunction

INTRODUCTION

Pelvic organ prolapse is the protrusion of uterus and its accompanying vaginal section into or via the vagina [1]. Volume of urine remaining in the bladder immediately after micturition is defined as PVR urine which is a key marker for the efficacy of emptying of bladder [2]. The proposed mechanism is the distortion or kinking effect of the prolapse on the urethra to cause bladder outlet obstruction. Neglected or improperly treated voiding dysfunction, can cause various complications including urine infections, and even upper urinary tract damage [3]. Therefore, PVR urine volume measurement is essential in women with the symptoms of pelvic floor dysfunction [3]. According to Agency for Healthcare Policy and Research (AHCPR) ≥50 mL of PVR urine volume is considered abnormal [4]. SUI is a condition of involuntary loss of urine on effort, physical exertion, sneezing, or coughing. Most common cause is urethral hypermobility, that occurs when urethral support is weakened and bladder and urethra prolapse through weakend anterior vaginal wall [5].

At times -operative obstructive kinking of the urethra may hide the symptoms of incontinence in the presence of large and chronic anterior vaginal wall prolapse, which is revealed when prolapse is reduced. It is called OSUI. OSUI is more common in women with severe genitourinary prolapse [6]. There are two options for dealing with these patients. First is by adding an incontinence surgery along with vaginal hysterectomy and anterior colporrhaphy. With this known side-effects and risks of anti-incontinence operation (including bladder perforation, haematoma, voiding dysfunction/urinary retention, vaginal erosion) must be taken into account. Second is by doing a two-step procedure that is vaginal hysterectomy and anterior colporrhaphy in first setting and anti-incontinence procedure might not be required if patient has no postoperative SUI there by preventing above mentioned side-effects in majority of patients. Disadvantage is increased morbidity because of two procedures. It is essential to identify patients likely to develop de novo SUI in postoperative period, thereby preventing postoperative morbidity, requirement of repeat surgery and reducing chances of bladder and urethral injury. It can be done by continence testing performed with the prolapse reduced [6]. Being a subjective assessment, a more objective parameter is to assess PVR volume preoperatively in all prolapse patients. High PVR volume is associated with OSUI and therefore PVR measurement can act as a surrogate marker for OSUI in these patients [5].

In several studies it has been shown that incontinence surgery should be done for patients of prolapse with SUI or OSUI to prevent postoperative incontinence [7,8]. On the other hand several studies have shown that anterior colporrhaphy can successfully treat SUI without need of extra anti-incontinence procedure, thereby preventing extra morbidity and chances of injury to urethra and two

step approach is better to treat SUI in patients of POP [9-11]. Also, there are several studies in which the prolapse repair was combined with a prophylactic incontinence surgery for OSUI and despite the incontinence surgery, the rate of postoperative SUI (on average several years later) was higher [9,12,13].

Present study aimed to see the effectiveness of anterior colporrhaphy in reducing incontinence in patients with POP and SUI or OSUI as there is no clarity regarding surgical approach in such patients. Also, there are no large studies assessing the efficacy of anterior colporrhaphy for correction of SUI and not much work is being done on OSUI associated with prolapse in Indian context. The aim of this study was to identify risk factors for elevated PVR and to evaluate the rate of resolution of elevated PVR in patients undergoing vaginal hysterectomy with anterior colporrhaphy for POP, to find prevalence of SUI and OSUI in patients of prolapse and SUI correction with surgery for POP without anti-incontinence procedure.

MATERIALS AND METHODS

A prospective interventional study was done at Atal Bihari Vajpayee Institute of Medical Sciences and Ram Manohar Lohia Hospital, Delhi, India in the Department of Obstetrics and Gynaecology from June 2019 to June 2021. Institutional Ethical Committee (IEC) approval was obtained with letter number IEC/ABVIMS/RMLH/739/19.

Sample size calculation: The study of Saravanan N et al., [3] observed that out of 100 patients, 10 women had raised preoperative PVR which resolved after surgery. Taking this value as reference, the minimum required sample size with 5% level of significance was 48 patients. To reduce margin of error, total sample size taken was 50.

Formula used is:

$$N \geq ((p(1-p))/(ME/z\alpha)^2$$

Where Zα is value of Z at two-sided alpha error of 5%, ME is margin of error and p is proportion of raised PVR before operation patients who had normal PVR after operation. Calculations: -n>=((0.1*(1-0.1))/(0.085/1.96)^2=47.85=48 (approx.)

Inclusion criteria: A total of 50 women with age >30 years and completed family undergoing vaginal hysterectomy with anterior colporrhaphy for POP with cystocele and willing to participate in the study were included in this study.

Exclusion criteria: Women with no cystocele, history of previous pelvic surgeries, associated bladder injuries, structural bladder abnormalities and urge incontinence were excluded from the study.

Study Procedure

Pelvic examination was done to assess the degree of prolapse quantified by POP quantification (POPQ) staging, grades of cystocele [14]. SUI assessment was done along with prolapse examination with full bladder-

- With full prolapse
- With prolapse reduced with a tampon (occult SUI/true SUI) [14]

The SUI was reassessed with empty bladder to rule out overflow incontinence. Ultrasound measurements of PVR was done in all cases preoperatively. PVR volume was assessed by suprapubic ultrasound using 5 MHZ within 5 minutes of voiding and estimated by equation: height*width*depth*0.52 mL [15]. PVR volume of ≥50 mL was considered abnormal.

Vaginal hysterectomy [16]: A circular incision was made over the cervix below the bladder sulcus, and the vaginal mucosa dissected off the cervix all around. Anterior and posterior pouches were opened. Bladder was pushed upwards, vaginal hysterectomy was performed by cuttting and transfixing Mackenrodt's and uterosacral ligaments ligating uterine vessels and cornual structures on both sides in this sequence. The peritoneal cavity was closed with a purse string suture, using chromic catgut 0.

Anterior colporrhaphy [17]: A portion of the relaxed anterior vaginal wall was excised to mobilise the bladder. Bladder was supported by tightening the pubo-cervical fascia.

Postoperatively, PVR urine volume and SUI were reassessed at on day five and three months and six months.

Variables assessed in each case: Age, BMI, parity, degree of prolapse, grades of cystocele, urinary incontinence, ultrasound measurements of PVR.

STATISTICAL ANALYSIS

The data entry was done in the Microsoft excel spreadsheet and the final analysis was done with the use of Statistical Package for Social Sciences (SPSS) software, IBM manufacturer, Chicago, USA, version 21.0. The association of the variables which were qualitative in nature were analysed using Fischers-exact test. The p-value <0.05 was taken as significant.

RESULTS

A 56% of women were more than 50 years of age with mean age of 51.88±10.1 years, 52% of patients were obese i.e., BMI >25 kg/m^2. 60% of patients were had parity >3 [Table/Fig-1] [18].

Socio-demographic characteristics	n	Percentage
Age (years)		
31-40	7	14
41-50	15	30
51-60	18	36
61-70	8	16
>70	2	4
Body mass index (kg/m^2) [18]		
18.5-22.99 (Normal BMI)	12	24
23-24.99 (Overweight)	12	24
>25 (Obese)	26	52
Parity		
<3	5	10
3	15	30
>3	30	60

[Table/Fig-1]: Socio-demographic characteristics of study subjects (n=50) [18].

About 24 (48%) patients had stage 4 prolapse and 27 (54%) of patients had grade 2 cystocele, 28 (56%) patients had significant preoperative PVR (≥50 mL). About 10 (20%) of patients had preoperative SUI. Preoperative OSUI elicited on reducing the prolapsed part was present in only 6 (12%) of patients [Table/Fig-2] [4,14].

Parameters	N (%)
POPQ staging [14]	
2	7 (14)
3	19 (38)
4	24 (48)
Degree of cystocele [14]	
1°	10 (20)
2°	27 (54)
3°	13 (26)
Preoperative PVR (mL) [4]	
≥50	28 (56)
<50	22 (44)
SUI	
SUI	10 (20)
Occult SUI	6 (12)
Absent	34 (68)

[Table/Fig-2]: Distribution of other parameters (POPQ staging, degree of cystocele, preoperative PVR, SUI) in study subjects (n=50) [4,14].

Association of age, BMI and parity with preoperative PVR is shown in [Table/Fig-3,4]. Advancing age, higher BMI were risk factors associated with elevated preoperative PVR, p-value=0.043 and 0.033, respectively [Table/Fig-3]. Parity was not found significantly associated with preoperative PVR (p-value=0.253) [Table/Fig-4].

Socio-demographic characteristics	<50 mL (n=22)	≥50 mL (n=28)	Total (n=50)
Age (in years)			
31-40	4 (18.18%)	3 (10.71%)	7 (14%)
41-50	7 (31.82%)	8 (28.57%)	15 (30%)
51-60	7 (31.81%)	11 (39.2%)	18 (36%)
61-70	4 (18.18%)	4 (14.29%)	8 (16%)
>70	0	2 (7.14%)	2 (4%)
Mean±SD	52.05±12.08	51.75±8.47	51.88±10.1
p-value	0.043*		
Body mass index (kg/m²) [18]			
18.5-22.99 {Normal BMI}	5 (22.73%)	7 (25%)	12 (24%)
23-24.99 {Overweight}	5 (22.73%)	7 (25%)	12 (24%)
25-29.99 {Obese}	12 (54.55%)	14 (50%)	26 (52%)
Mean±SD	24.75±1.81	24.79±2.08	24.77±1.95
p-value	0.033*		

[Table/Fig-3]: Association of age and BMI with preoperative PVR (≥50 mL).
Fischers-exact test; *A p-value <0.05 is considered to be statistically significant

Parity	<50 mL (n=22)	≥50 mL (n=28)	Total (n=50)	p-value
<3	3 (13.64%)	2 (7.14%)	5 (10%)	0.253*
3	4 (18.18%)	11 (39.29%)	15 (30%)	
>3	15 (68.18%)	15 (53.57%)	30 (60%)	
Total	22 (100%)	28 (100%)	50 (100%)	

[Table/Fig-4]: Association of parity with preoperative PVR (≥50 mL).
Fischers-exact test; *A p-value <0.05 is considered to be statistically significant

The POPQ staging was significantly associated with preoperative PVR, 70.83% of elevated preoperative PVR cases seen were with POPQ stage 4. Degree of cystocele was significantly associated with preoperative PVR with 92.31% patients with elevated preoperative PVR with grade 3 systole [Table/Fig-5].

	Preoperative PVR (mL)	
POPQ staging [14]	<50 mL (n=22)	≥50 mL (n=28)
2 (n=7)	7 (100%)	0
3 (n=19)	8 (42.11%)	11 (57.89%)
4 (n=24)	7 (29.17%)	17 (70.83%)
p-value	0.003*	
Degree of cystocele [14]	**<50 mL (n=22)**	**≥50 mL (n=28)**
1° (n=10)	10 (100%)	0
2° (n=27)	11 (40.74%)	16 (59.26%)
3° (n=13)	1 (7.69%)	12 (92.31%)
p-value	<0.001**	

[Table/Fig-5]: Association of preoperative PVR (mL) with POPQ staging and degree of cystocele.
Fischers-exact test; *A p-value <0.05 is considered to be statistically significant

In this study amongst the 11 patients with preoperative SUI, 7 patients i.e., 63.64% had significant preoperative PVR and 36.36% had normal PVR. This association was not found significant.

In this study amongst the six patients with preoperative OSUI, 100% had significant preoperative PVR. This association was found significant (p-value 0.028) i.e., increased PVR is associated with OSUI. This can be concluded in a way that measuring preoperative PVR can help us detect patients with preoperative OSUI those were likely to develop de novo SUI postoperatively [Table/Fig-6a,b].

	Preoperative PVR	
Preoperative SUI	<50 mL	≥50 mL
SUI absent (n=39)	18 (46.15%)	21 (53.85%)
SUI present (n=11)	4 (36.36%)	7 (63.64%)
Total	22 (44%)	28 (56%)
p-value	0.734*	

[Table/Fig-6a]: Association of preoperative SUI with preoperative PVR.
Fischers-exact test; *A p-value <0.05 is considered to be statistically significant

	Preoperative PVR	
Preoperative OSUI	<50 mL	≥50 mL
OSUI present	0	6 (100%)
OSUI absent	22 (50%)	22 (50%)
p-value	0.028*	

[Table/Fig-6b]: Association of preoperative OSUI with preoperative PVR.
Fischers-exact test; *A p-value <0.05 is considered to be statistically significant

Preoperative SUI was not significantly associated with degree of prolapse. Although OSUI more commonly seen in patients with higher degrees of prolapse this relationship is not found significant due to small sample size [Table/Fig-7].

	Preoperative SUI		
POPQ staging	Absent (n=39)	Present (n=11)	Total
2 (n=7)	5 (71.43%)	2 (28.57%)	7 (100%)
3 (n=19)	15 (78.95%)	4 (21.05%)	19 (100%)
4 (n=24)	19 (79.17%)	5 (20.83%)	24 (100%)
p-value	0.902*		
	Preoperative OSUI		
POPQ staging	**Absent (n=44)**	**Present (n=6)**	**Total**
2 (n=7)	7 (100.00%)	0	7 (100.00%)
3 (n=19)	18 (94.74%)	1 (5.26%)	19 (100.00%)
4 (n=24)	19 (79.17%)	5 (20.83%)	24 (100.00%)
p-value	0.273*		

[Table/Fig-7]: Association of preoperative SUI and OSUI with POPQ staging.
Fischers-exact test; *A p-value <0.05 is considered to be statistically significant

In this study it was found that anterior colporrhaphy significantly reduced elevated PVR. Vaginal hysterectomy with anterior colporrhaphy significantly reduced postoperative persistent SUI or de novo OSUI [Table/Fig-8].

PVR (mL)	Preoperative (n=50)	Postoperative (n=50)			p-value
		Day 5	3 months	6 months	
<50	22 (44%)	50 (100%)	50 (100%)	50 (100%)	<0.001*
≥50	28 (56%)	0	0	0	
SUI	**Preoperative (n=50)**	**Postoperative (n=50)**			**p-value**
		Day 5	3 months	6 months	
SUI	10 (20%)	0	0	0	<0.001*
Occult SUI	6 (12%)	0	0	0	

[Table/Fig-8]: Comparison of PVR (mL) SUI and OSUI between preoperative and postoperative.
Fischers-exact test; *A p-value <0.05 is considered to be statistically significant

DISCUSSION

In the present study, increase in age was associated with an increase in PVR volume indicating increase in the incidences of urinary disturbances with age which was in sync with Ulrich A et al., who performed a study at the University of Connecticut, Hartford Hospital that showed the elevated PVR cohort was older [19]. Also, higher PVR was seen in patients with higher BMI. Similar results were by Coates KW et al., [20].

The number of patients with significant preoperative PVR were more in the group with higher parity i.e., 7.14%, 39.29% and 53.57% in groups with parity <3, 3 and >3, respectively. But this association was not found significant. Therefore, higher parity was not associated with higher preoperative PVR in present study. Similar findings were confirmed by a study Ulrich A et al., while assessing risk factors for preoperative PVR [19]. Against this, in the Pelvic Organ Support Study (POSS) a multicentric study by Swift S et al., increasing parity was associated with prolapse risk. Risk of POP increased 1.2 times with each delivery [21]. In the present study, POPQ staging was significantly associated with preoperative PVR with p-value of 0.003. Results were comparative in a study by Saravanan N et al., in which 100 patients with POP were studied with voiding dysfunction defined as PVR >100 mL. Study found the higher prevalence of voiding dysfunction with stage 3 and 4 prolapse [3]. Degree of cystocele was significantly associated with preoperative PVR (p<0.001) i.e. larger cystocele had higher preoperative PVR. Similar results were seen by Aravinda KV et al., they also found that higher degree of cystocele was associated with elevated preoperative PVR [22].

Preoperative SUI was not associated with stage of prolapse. A study done by Richardson DA et al., also stated that greater degrees of anterior vaginal wall prolapse (Stage III and IV) had no association with symptoms of genuine stress incontinence [23]. Their study found that greater degree of prolapse was significantly associated with OSUI in their patients [23]. Also, in a study done by Reddy NS et al., OSUI was found to be more prevalent in women with grade 4 prolapse when compared to grade 2 and grade 3 prolapse [6]. Although in present study as well, OSUI more commonly seen in patients with higher degrees of prolapse (p-value=0.028). In the present study amongst the patients with preoperative PVR ≥50 mL (22/50 patients) none had persistent elevated preoperative PVR postoperatively. Therefore, in this study anterior colporrhaphy significantly reduced elevated PVR. Ulrich A et al., also showed that all women undergoing surgery for POP had postoperative resolution of elevated PVR by surgical correction of prolapse with cystocele repair [19]. Similar findings were confirmed by a study done by Saravanan N et al., [3], preoperative elevated PVR resolved postoperatively in 100%, which was highly significant. Several studies [9,12,13] in which the prolapse repair was combined with a prophylactic anti-incontinence surgery for OSUI and despite the incontinence surgery, the rate of postoperative SUI (on average several years later) was higher.

Bump RC et al., [12] reported 14% of women developing SUI after needle colposuspension and Groutz A et al., [9] in 23% after anti-incontinence procedure. In present study none of the patient with preoperative SUI and preoperative OSUI had postoperative persistent SUI or de novo SUI after undergoing anterior colporrhaphy alone with vaginal hysterectomy without any anti-incontinence procedure showing that prolapse repair (Vaginal Hysterectomy and Anterior colporrhaphy) might work as an anti-incontinence surgery. Bergman A and Elia G [24] also showed immediate success rate of 90% and 5-year success rate of 37% using the anterior colporrhaphy in stress incontinence. Similar results were given by Beck RP et al., [25] who reported that only 10% of continent women undergoing vaginal prolapse surgery without suspending urethropexy had postoperative stress incontinence. No such study was found in Indian context.

Limitation(s)

Limitations of this study were the small sample size and paucity of time to follow-up all patients till five years postoperative period. Furthermore, large studies should be conducted to assess the ability of anterior colporrhaphy for the treatment of SUI and OSUI linked with prolapse in Indian setting.

CONCLUSION(S)

Increasing age, BMI and degree of prolapse are risk factors for higher preoperative PVR urine volume. Preoperative OSUI is associated with advanced degree of prolapse and raised PVR urine volume. Preoperative assessment of PVR volume can act as a simplistic measure of preoperative OSUI. Anterior colporrhaphy can not only reduce PVR volume significantly in most of the cases but also alleviate SUI in most patients. Those cases with PVR volume ≥50 mL and SUI can be managed by vaginal hysterectomy and anterior colporrhaphy.

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