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Original Research Article

## Prevalence and clinical predictors for early post-operative urinary retention in patients undergoing pelvic reconstructive surgeries: a prospective cohort study

Annie P. Vijjeswarapu<sup>1\*</sup>, Vaibhav Londhe<sup>1</sup>, Mahasampath Gowri<sup>2</sup>,  
Aruna Kekre<sup>1</sup>, Nitin Kekre<sup>3</sup>

<sup>1</sup>Department of Obstetrics and Gynecology, <sup>2</sup>Department of Biostatistics, <sup>3</sup>Department of Urology, Christian Medical College, Vellore, India

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**\*Correspondence:**

Dr. Annie P. Vijjeswarapu,

E-mail: [drannieprasanthi@gmail.com](mailto:drannieprasanthi@gmail.com)

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### ABSTRACT

**Background:** Pelvic organ prolapse (POP) has a significant impact on quality of life. Post-operative voiding dysfunction is seen in 2.5 to 24% of patients following pelvic reconstructive surgery. Risk factors like age of the patient, size of the genital hiatus and stage of prolapse are known to be associated with early post-operative voiding disorders.

**Methods:** This is a prospective cohort study done in Christian Medical College, Vellore over one year. Patients with stage II to IV pelvic organ prolapse who underwent pelvic reconstructive surgery were observed post operatively for covert and overt urinary retention. Inability to void accompanied by pain and discomfort is defined as overt retention. Early post-operative urinary retention (POUR) is retention of urine in the first 72 hours postoperatively. Covert retention is defined as a non-painful bladder with chronic high post void residue. Chi- square test or Fisher's exact test was used to assess the association between the clinical predictors and early post-operative urinary retention in univariate analysis.

**Results:** In this study, 75 patients were recruited. Nine patients had POUR. Among the patients who had post-operative urinary retention, 77.78% had stage III pelvic organ prolapse (n=7). P value was 0.042. The prevalence of early POUR after pelvic reconstructive surgery was 12.85 % (n=9). A 55.55% had covert retention (n=5) and 44.44% patients had overt retention (n=4).

**Conclusions:** The prevalence of early POUR after pelvic reconstructive surgery was 12.85%. Stage of the prolapse was an independent predictor for early postoperative urinary retention.

**Keywords:** Clinical predictors, Pelvic floor repair, Pelvic organ prolapse, Post-op urinary retention, Post void residue

### INTRODUCTION

Pelvic organ prolapse is not a life-threatening condition, but it has a significant impact on the quality of life.<sup>1</sup> The life time risk of women undergoing surgery for prolapse or incontinence is 11%.<sup>2</sup> Urinary retention is a very common complication following pelvic reconstructive surgery. Postoperative urinary retention among patients

who undergo surgery for urinary incontinence and pelvic organ prolapse is in the range of 2.5 to 24%.<sup>2</sup> Post-surgical pain and associated spasm of the levator ani can lead to post-operative urinary retention.<sup>3</sup> The patients who have undergone pelvic reconstructive surgery may take days and sometimes months to resume the normal voiding. Postoperative urinary retention is associated with increased length of hospital stay, cost and anxiety in

the women. Prolonged, unattended post-operative urinary retention (POUR) can subsequently lead to bladder denervation and permanent loss of bladder contractility.<sup>3</sup> In patients with pelvic organ prolapse, risk factors like age of the patient, size of the genital hiatus, stage of the prolapse, tone of levator ani are known to be associated with early post-operative voiding disorders.<sup>2,3</sup> Early POUR is the first 72 hours of post-operative period. Urinary retention is clinically divided into overt and covert retention. According to International Continence Society, overt retention is defined as 'the sudden onset of the inability to void' leaving a significant amount of residual urine in the bladder. It is symptomatic and characterized by the inability to void accompanied by pain and discomfort.<sup>4</sup> Covert retention is defined as a non-painful bladder, where there is a chronic high post void residue. Patients with covert retention may present with urinary frequency, voiding less than 150ml with feeling of incomplete emptying which is detected clinically or by catheterization or by ultrasound.<sup>5</sup> Clinician's perception of the condition and vigilance in the diagnosis of post-operative urinary retention play a vital role in the successful care of patients undergoing surgical repair.

Objective of this study were to study the primary outcome was to determine the prevalence of early post-operative urinary retention in patients who had pelvic reconstructive surgery and the secondary outcome was to study the clinical predictors for early post-operative urinary retention.

## **METHODS**

This study was reviewed and approved by the Institutional review board and ethics committee of Christian Medical College, Vellore. This study was done in Christian Medical College, Vellore, India over one year. The sample size was calculated according to prevalence of post-operative urinary retention for patients undergoing surgery for pelvic organ prolapse taken as 2.5-25 percent.<sup>1</sup> Sample size was calculated according to the formula  $n=4xpq/d^2$ ;  $p$ =prevalence 9 percent,  $q$ =100- $p$ = 91,  $d$ =precision =7 percent,  $n$ = 70%. A sample of 70 is needed to detect prevalence of nine percent for urinary retention with 95% confidence interval and 7 percent precision. Seventy-five women with pelvic organ prolapse who underwent vaginal hysterectomy with pelvic floor repair were recruited.

### **Inclusion criteria**

Patients who were planned for pelvic reconstructive surgery i.e. vaginal hysterectomy with pelvic floor repair and vault prolapse repair.

### **Exclusion criteria**

Patients with pelvic organ prolapse who were planned for hysterectomy with concomitant mid urethral sling

surgeries and those who required long term catheterization due to intra operative complications.

### **Preoperative work up**

All patients planned for pelvic reconstructive surgery had a thorough clinical examination. Staging of pelvic organ prolapse was according to POP-Q quantification system. Tone of levator ani muscle was assessed by modified oxford scale and pre-operative uroflowmetry was done in all patients.

Preoperative post void residue is the volume of fluid remaining in the bladder immediately following the completion of micturition in the pre-operative period. Preoperative PVR was considered abnormal if the volume of urine in the bladder on ultrasound scan is greater than or equal to 100ml after voiding or more than 1/3<sup>rd</sup> of voided volume.

Post-operative post void residue was considered abnormal if the volume of urine in the bladder on ultrasound scan is greater than or equal to 300ml after voiding.<sup>6,7</sup> Flow rate of less than 15ml/sec was considered abnormal.

Urinary retention can be clinically divided into covert retention and overt retention. Overt retention is symptomatic and characterized by the inability to void accompanied by pain and discomfort. Covert retention is asymptomatic. Clinically urinary retention can be diagnosed only by clinical history and examination or by ultrasound examination.<sup>8</sup>

### **Study protocol**

Pelvic reconstructive surgery was done as per surgeon's decision. Details of type and technique of surgery, type of anesthesia, duration of surgery and the amount of blood loss were noted. All patients were catheterized for a maximum of 72 hours or as per the discretion of the operating surgeon (catheterized for 48 hours for large cystoceles or 72 hours after sacrospinous fixation). Patients were encouraged to void after catheter removal and were given a trial void. After the patient voided, the residual volume was recorded with ultrasound scan by principal investigator. If post void residue was more than 150ml and patient was comfortable, she was encouraged to void. However, repeat post void residue was done if the patient had frequency and sense of incomplete voiding. If the patient had persistent post-operative urinary retention even after repeated attempts of voiding or if patient had pain, they were re-catheterized for 72 hours. Patients were encouraged to void after removal of the catheter. Patients who failed to void were re-catheterized for 7 days or taught intermittent self-catheterization. The patient who failed to regain normal voiding pattern despite 7 days of indwelling catheter underwent urodynamic evaluation.

All the information was computerized, and confidentiality maintained. The risk factors associated were analyzed. Chi-square test or Fisher's exact test was used to assess the association between the clinical predictors and early post-operative urinary retention in univariate analysis. Clinical predictors which were significant at less than 0.10 level of significance in univariate analysis were taken into multiple logistic regressions to assess its independent association with early post-operative urinary retention. p-value of less than 0.05 was considered to be statistically significant in multiple logistic regression to indicate the corresponding risk factor as an independent predictor. Association of risk factors with post-operative urinary retention in multiple logistic regression were presented with odds ratio and its 95% confidence interval. The clinical predictors studied were; age of the patient, stage of the prolapse, body mass index, menopausal status, size of genital hiatus, tone of levator ani, preparative PVR, type of surgery, duration of surgery, type of anesthesia and intra-operative blood loss.

## RESULTS

Seventy-five patients were recruited in this study. Five patients were excluded due to intra-operative complications. Nine patients had POUR. Among the patients who had POUR, 77.78% (n=7) had stage III POP which was significant with P value of 0.042. The prevalence of early post-operative urinary retention after pelvic reconstructive surgery was 12.85% (n=9). Out of nine patients, 55.55% of the patients had covert retention (n=5) and 44.44% of the patients had overt retention (n=4). Two patients had persistent POUR and were re-catheterized for 7 days. Of the two, one patient had normal voiding after catheter removal. However, one patient who had vault prolapse repair with sacrospinous fixation could not void even after 7 days of indwelling catheter. This patient had urodynamic evaluation which revealed atonic bladder with underactive detrusor with overflow incontinence. She opted for clean intermittent catheterization. This condition resolved within 3 weeks and she resumed normal voiding. Remaining 7 patients were catheterized for 72 hours after which they voided freely. The clinical predictors for early post-operative urinary retention after pelvic reconstructive surgery studied were age, body mass index, menopausal status, size of genital hiatus, degree of prolapse, tone of levator ani muscle, pre-operative post void residue, type of anaesthesia, type and technique of surgery, operation time and intra-operative blood loss.

Pearson chi square test was used to assess the association between age, menopause and early post-operative urinary retention. Fisher's exact test was used to assess the association between body mass index and early post-operative urinary retention.

Fisher's exact test was used to assess the association between stage of prolapse, tone of levator ani and early

post-operative urinary retention. The tone of levator ani was 3 (which is medium contraction of pelvic floor muscles where there is a slight lift of examiner's finger without applying resistance) was not statistically significant. P value was 0.192 (Table 2). Pearson chi square test was used to assess the association between size of genital hiatus and early post-operative urinary retention.

**Table 1: Demographic detail.**

Demographic details		POUR		P value
		Present	Absent	
Age	≥50 years	6 (66.67%)	40 (65.57%)	0.949
BMI	Overweight (25-29.99)	4 (44.44%)	15 (25%)	0.9
Menopause		8 (88.89%)	44 (72.13%)	0.283

**Table 2: Risk factors for Pour.**

Risk factors for POUR		POUR		P value
		Present	Absent	
Stage of prolapse	3	7 (77.78%)	42 (68.85%)	0.042
Size of genital hiatus	≥5cm	7 (77.78%)	47 (77.05%)	0.961
Tone of la	3	7 (87.5)	29 (52.73)	0.192

Pearson chi square test was used to assess the association between pre-operative PVR, uroflow and early post-operative urinary retention. Fisher's exact test was used to assess the association between anaesthesia, type of surgery and early post-operative urinary retention. Pearson chi square test was used to assess the association between duration of surgery, intraoperative blood loss and early post-operative urinary retention. From this analysis, none of the clinical predictors had any bearing on POUR except the stage of prolapse which was the only significant determinant of POUR.

## DISCUSSION

Postoperative voiding dysfunction among the patients who undergo surgery for urinary incontinence and pelvic organ prolapse is estimated to be 2.5-24%.<sup>2</sup> One of the common complications following pelvic reconstructive surgery is urinary retention. Sensation for voiding is limited by post-surgical pain. Associated spasm of the muscles and bladder denervation can lead to retention of urine. In patients with pelvic organ prolapse, risk factors like age of the patient, size of the genital hiatus, stage of prolapse, and tone of levator ani are known to be associated with early post-operative voiding disorders.<sup>6</sup> Following the pelvic reconstructive surgery, patients may take significant time to resume the normal voiding. Hence these patients require continuous bladder drainage in the immediate post-operative period.<sup>2</sup> Unattended

POUR can cause bladder over-distension and permanent detrusor damage. Distended bladder leads to neurovascular damage resulting in atonia of the bladder followed by urinary retention and overflow.<sup>6</sup> Complications of urinary retention are bladder over-distension and urinary tract infection. Bladder distension injury accounts for 44% of complications.<sup>7</sup> Few human and animal studies showed that acute over-distension can cause structural and functional abnormalities of the bladder due to bladder ischemia.<sup>7</sup> Persistent urinary retention can exacerbate the storage dysfunction of the bladder by decreasing the bladder capacity and producing the sensation of incomplete voiding. This further results in frequency of micturition, urinary urgency and overflow incontinence.<sup>7</sup> Urinary tract infection is a direct complication of postoperative urinary retention because of stasis of urine. This along with heavy bacterial colonization of the perineum and periurethral region, and short urethra contributes to the urinary tract infection.<sup>9</sup> Pain and discomfort in lower abdomen is one of the conventional predictors of urinary retention.<sup>6</sup> Palpation and percussion of bladder in supra pubic region is a clinical method to diagnose urinary retention but it lacks sensitivity.<sup>9</sup> Lamonerie et al suggested ultrasound scan for assessing bladder volume after surgery is one of the non-invasive methods of assessing bladder dysfunction.<sup>10</sup> Predictors for post-operative urinary retention after pelvic reconstructive surgery are stage of prolapse, age, body mass index, menopausal status, size of genital hiatus, tone of levator ani muscle, pre-operative post void residue, type of anaesthesia, type and technique of surgery, operation time, intra-operative blood loss.<sup>11</sup>

#### **Stage of the prolapse**

In large cystoceles, kinking of the urethra results in incomplete emptying of the bladder preoperatively. Pre-operative stage of prolapse plays a major role in postoperative urinary retention. According to multicenter prospective cohort study by Komesu apical suspension for grade III and IV vaginal apex descent are associated with prolonged postoperative catheterization.<sup>12</sup> In this study, among the patients who had post-operative urinary retention, 77.78% (n=7) had stage III pelvic organ prolapse which was significant with P value of 0.042 (Table 2).

#### **Age**

The risk of post-operative urinary retention increases with age. It is 2.4 times more in patients over 50 years of age.<sup>7</sup> According to study done by Keita, age more than or equal to fifty years was an independent predictive factor for post-operative urinary retention.<sup>6</sup> Possible reason could be age related progressive neuronal damage leading to bladder dysfunction.<sup>7</sup> Aging and parity are associated with fibrosis, variation in fiber diameter and centralization of nuclei in levator ani muscle. In this study, 64.29% of women were more than fifty years of age (n=46). However, six patients (66.7%) were more

than or equal to 50 years and they had POUR. P value was >0.99 which was not statistically significant (Table 1).

#### **Body mass index**

It is hypothesized that excess body weight is associated with increased abdominal pressure during physical activity. This in turn increases bladder pressure and urethral hypermobility.<sup>13</sup> However, study done by Revicky showed no statistical significant influence of obesity on the incidence of bladder injury or urinary retention.<sup>14</sup> In this study, among the patients who had POUR, four patients (44.44%) were overweight with a P value of 0.097 which was not significant.

#### **Menopause**

In women with pelvic organ prolapse, it has been demonstrated that protein content and estrogens in uterosacral ligaments, vagina and in the parametrium were reduced.<sup>15</sup> According to a retrospective study done at the Cleveland Clinic Foundation between August 1999 and July 2003, Menopausal status was a potential predictor of prolonged post-operative urinary retention. In this study though 88.89% of patients who had POUR had attained menopause, it was not a significant determinant for POUR with P value of 0.283 (Table 1).

#### **Size of genital hiatus**

Pelvic floor denervation is thought to result in decreased levator tone and widening of genital hiatus.<sup>16</sup> According to retrospective study done in Mississippi, patients with genital hiatus greater than 5cm were 3 times more likely to have emptying disorders than those with less than 5cm.<sup>16</sup> In this study among the patients who had post-operative urinary retention, seven patients (77.78%) had the size of genital hiatus more than 5cm. Association between size of genital hiatus and early POUR was not statistically significant (p value 0.961) (Table 2).

#### **Tone of levator ani**

In the study done by Shafik et al, poor tone of the levator ani muscle is one of the reported risk factors for POUR.<sup>17</sup>

Among the patients who had post-operative urinary retention, seven patients (87.5%) had the tone of levator ani score 3 which was not statistically significant (p value 0.192) (Table 2).

#### **Preoperative flow and PVR**

According to a study done by Miller et al, high post-void residual urine volume predicted delayed return to normal voiding.<sup>18</sup> After the pelvic reconstructive surgery, most patients with high pre-operative post-void residual volume had normalization of the post-void residual volume.<sup>19</sup> Among the patients who had post-operative

urinary retention, seven patients (77.78 %) had high PVR (more than or equal to 100ml) preoperatively which was not statistically significant (p value >0.9) (Table 3). Among the patients who had POUR, two patients (40%) had abnormal uroflow pre-operatively which was not associated with POUR. It was not statistically significant, (p value 0.115) (Table 3).

**Table 3: Investigations.**

		POUR		P value
		Present	Absent	
Pre-op PVR	≥100ml	7 (77.78%)	06 (9.84%)	>0.99
Abnormal uroflowmetry	Abnormal	2 (40%)	06 (13.04%)	0.115

### Anesthesia

General anaesthetic agents interfere with the autonomic nervous system and cause bladder atony. After intrathecal injection of local anesthetics, the sensation of urgency to void disappears within 30-60 seconds.<sup>7</sup>

According to a prospective study done by Phipps S et al, prolonged anaesthesia time was identified as an independent risk factor for post-operative urinary retention.<sup>20</sup> In this study 88.89% (n=8) patients who had POUR, had spinal anesthesia with a P value >0.99 which was not statistically significant (Table 4).

**Table 4: Other risk factors for POUR.**

		POUR		P value
		Present	Absent	
Anaesthesia	Spinal	8 (88.89%)	49 (80.33%)	>0.99
Surgery	VH-PFR	5 (55.56%)	44 (72.13%)	0.273
Duration	≥2hr	4 (44.44%)	42(70%)	0.129
blood loss	≥500ml	2 (32.79%)	20 (32.79%)	0.524

### Type of surgery

Sensation for voiding is limited by post-surgical pain and associated spasm of the muscles leading to retention of urine. In patients who have undergone vaginal hysterectomy with pelvic floor repair, spasm edema and tenderness of the pubococcygeus muscle may pose problems in voiding.<sup>8,20</sup>

However, Sekhavat et al and Thapa et al in their studies did not find urinary retention in pelvic reconstructive surgeries.<sup>21,22</sup> In this study, among the patients who had POUR, five patients (55.56%) had VH-PFR for stage II and III which was not statistically significant (p value 0.273) (Table 4).

### Duration of surgery and intraoperative blood loss

In a retrospective study by Petros, duration of surgery was found to be significantly associated with post-operative urinary retention.<sup>23</sup> An increased blood loss intra operatively as risk factor for urinary retention can be due to prolonged operating time and extensive damage to innervations of detrusor muscle.<sup>24</sup> In this study, among the patients who had post-operative urinary retention, five patients (55.56%) had duration of surgery less than two hours which was not statistically significant with P value of 0.129. The reason for increased blood loss intra operatively as risk factor for urinary retention can be due to prolonged operating time and extensive damage to innervations of detrusor muscle.<sup>24</sup> In this study among the patients who had POUR, 22.22% (n=2) had blood loss more than 500ml which was not statistically significant and the P value was 0.524.

### CONCLUSION

The prevalence of early post-operative urinary retention after pelvic reconstructive surgery was 12.85%. Covert retention was seen in 55.55% (n =5) of the patients while 44.44% (n=4) had overt retention. Stage of the pelvic organ prolapse was an independent predictor for early post-operative urinary retention (P value 0.042).

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