

# Retention of Urine after Elective Total Hip and Knee Replacement Surgeries - A Literature review

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## Abstract

Urinary retention postoperatively is alarming complication that happened after elective hip and knee replacement surgeries. This literature review examined the incidence, risk factors, and management of postoperative urinary retention (POUR) in elective total hip and knee replacement surgery over the last five years. POUR is a common complication of these surgeries, which can cause discomfort and managed with catheterisation and catheterisation can lead to urinary tract infection and can affect the efficacy of prosthesis in future, prolonging hospital stay and increasing the cost. Through comprehensive research of relevant databases, eight studies published between 2017 and 2021 were identified and included in this review. The results showed that urinary retention after surgery ranged from 3% to 43%, with higher rates reported in males, patients with pre-existing urinary conditions, and those who received spinal anaesthesia-risk factors associated with POUR included age, BMI, surgery duration, and intraoperative fluid administration. POUR is a significant complication of elective total hip and knee replacement surgery, with a wide range of reported incidence rates. The identified risk factors and management strategies can help clinicians optimize patient care and minimize the risk of POUR. Further research is needed to standardize the diagnosis and management of POUR in this patient population.

**Categories:** Anaesthesiology, Internal Medicine, Orthopaedics

**Keywords:** preventive measures, risk factors, elective total knee replacement, elective total hip replacement, post-operative urinary retention

## Introduction and background

It is not uncommon for patients undergoing elective hip and knee replacement to experience a complication known as postoperative urinary retention (POUR) [1]. Urinary retention is a condition where person is unable to empty their full bladder, resulting in accumulation of urine in bladder. Loss or dysfunction of the detrusor muscle can be caused by delayed diagnosis and timely management of POUR. The risk of postoperative urinary retention 20 folds more in lower limb joint arthroplasty

surgeries, and the incidence varies between as low as 5% - 84% maximum compared to the general surgery population[2]. Various factors, such as an obstruction in the urinary tract, weakened bladder muscles, nerve damage, or certain medications, can cause this. Urinary retention can occur in both men and women and can present as acute or chronic. Symptoms of urinary retention can include difficulty starting urination, weak urine stream, frequent urination with small amounts of urine produced, a feeling of incomplete emptying of the bladder, and abdominal pain or discomfort[3]. Postoperative bladder ultrasonography is a non-invasive method of diagnosis of POUR, and its use has increased over the previous ten years thanks to the efforts of medical professionals. This is the true realm of anaesthesia, where ultrasound equipment is now widely accessible in most facilities[4]. Postoperative urinary retention, also known as POUR, can be a frustrating and uncomfortable experience for patients recovering from total hip or knee replacement surgeries. This condition can arise due to various factors, including the administration of anaesthesia, pain medication, and even surgery-related factors[5]. Although POUR is a potential post-surgery complication, total hip and knee replacement surgeries remain famous for patients seeking relief from joint-related conditions such as arthritis. These procedures can help alleviate pain and improve mobility, enabling individuals to regain their independence and return to their daily activities. As medical professionals continue to explore ways to minimise POUR and other complications associated with surgery, patients can take comfort in knowing they have options to help them recover and regain their quality of life.

The procedure entails extracting the impaired joint and substituting it with an artificial one. Although generally secure and prosperous, the surgery may give rise to a condition known as POUR that may cause uneasiness and an augmented possibility of infection [6] by an invasion of hematogenous bacteria resulting in periprosthetic joint infection. POUR is treated by inserting a urinary catheter to facilitate bladder drainage while detrusor muscle function recovers. Infection, bladder damage, urethral trauma and stricture formation are concerns linked with catheterisation. It may also lengthen the recovery period, extend the hospital stay and increase the cost. In order to avoid such complications, it is crucial to

recognise and address POUR as soon as possible [4]. POUR is a common complication following total hip and knee replacement surgery that can lead to several complications [7,8]. Despite the increased frequency of POUR in lower limbs orthopaedic procedures and existence of a successful strategy to prevent this complication, there is currently no clear guidance available to effectively determine the patients should be offered routine intraoperative catheterisation while undergoing lower limb arthroplasty surgery. However, healthcare professionals should know the risk factors and strategies for preventing and managing POUR to ensure optimal patient outcomes.

## Review

### Materials & method:

In this literature review we included eight studies from 2017 to 2021 out of them six studies are prospective and two of them retrospective studies where urinary retention following elective total hip and knee replacement surgeries, identify potential risk factors, and evaluates preventive measures.

### Search Strategy:

A comprehensive literature search was conducted using electronic databases, including MEDLINE, PubMed, Cochrane Library, and Scopus. The search will be performed using the following keywords: "postoperative urinary retention," "elective total hip replacement," "elective total knee replacement," "risk factors," and "preventive measures". The search will be limited to studies published in English from the last five years 2017 to 2021.

### Eligibility Criteria:

The inclusion and exclusion criteria for this review are as follows in **Table 1**.

| The inclusion criteria   | The exclusion criteria  |
|--|---|
| Studies report the incidence and risk factors for POUR in patients undergoing elective total hip and knee replacement surgery. | Studies reporting on POUR in patients undergoing emergency surgery. |
| Studies published in English between January 2017 and December 2021.   | Studies published in languages other than English.                  |
| Encompassing randomized controlled trials, cohort studies, and case-control studies.   | Animal studies and in vitro studies.                                |

### Study Selection:

Based on the inclusion and exclusion criteria, two independent reviewers assessed the full-text articles of the selected studies for eligibility for inclusion in the review.

### Extraction of Data:

Data was collected from those selected studies fulfilling the inclusion criteria using a standard data collection form. The data extraction form included the following information:

Study design, sample size, age and sex of participants incidence of POUR risk factors for POUR.

### Data Synthesis:

The extracted data were synthesised using a narrative synthesis approach. The results are presented in tabular and graphical forms.

### Ethics:

No ethical approval is required as this is a literature review of published studies.

### Results:

Data total of 2853 patients were collected from eight studies as mentioned below in Table 2, fulfilling the inclusion criteria from January 2017 to December 2021. POUR was present in all studies ranging from 3% to 43 %. This variation is due to different definitions and risk factors in published papers. Studies included in this literature review found that POUR is expected in the majority of patients undergoing total knee or hip replacement, 656 (22.9%) out of 2853 patients developed POUR. At the same time, 2197 (77.1%) remained POUR-free. This showed that age, male gender, bladder volume, previous history of urinary retention, post-voiding urine volume even greater than 50cc, Benign prostatic hyperplasia, use of intermittent catheterisation, lower BMI and longer operative duration were the main risk factors for POUR. In a study by Lawrie et. which total of 174 patients were included in the study majority of patients (43.7%) suffered from Postoperative urinary retention. A study in 2019 by Markopoulos et al., which was prospective and included 218 patients having an age of 69.3 %, found minimum patients of POUR (4.1%), which resulted due to Benign prostatic hyperplasia and age.

Table 2 :Summarize the details of eight published studies

| Sr. No | Study                                     | Design                          | No. of Patients               | Mean Age (Years) | Bladder volume | No. of POUR patient | Risk factors for POUR  | Complications & Infections  |
|--------|---|---------------------------------|-------------------------------|------------------|----------------|---------------------|--|---|
| 1.     | Lavrie et al., 2017 [14].                 | Prospective                     | 174<br>Male/Female=68/106     | 66               | 400cc          | 76(43.7%)           | The volume of intravenous fluids, History of urinary retention                       | 42(35.2%)-single straight catheterization 20(26.3%)-second straight catheterization 14(18.4%)-indwelling catheter |
| 2.     | Love et al., 2017 [15].                   | Retrospective Cohort study      | 638<br>Male/Female=229/418    | 69.3             | 600cc          | 82(12.9%)           | Bladder volume >200 ml in the recovery room  | No description  |
| 3.     | Scholten et al., 2018 [16].               | Prospective Observational Study | 306                           | No description   | 400cc          | 142(46.3%)          | Post-voiding urine volume > 150 ml   | 65(21%) Intermittent catheterization  |
| 4.     | Shah et al., 2019 [5]                     | Prospective                     | 398<br>Male/Female=171/187    | 61.7             | 350cc          | 145(40.5%)          | Age>60, Intraoperative fluids>1350cc   | Catheter use  |
| 5.     | Alasdar JA, Surtini, Cha et al., 2019[17] | Prospective                     | 303<br>Male=130<br>Female=173 | 60.4             | 450cc          | 26(8.6%)            | Age>70years, High International Prostate Score, use of catheterization               | Catheter use  |
| 6.     | Maniopoulos et al., 2019[18]              | Prospective                     | 218<br>M/F=105/113            | 69.3             | No description | 9(4.1%)             | Age, benign prostatic hyperplasia  | No infection found  |
| 7.     | Shah et al., 2021[19]                     | Retrospective                   | 585                           | 64.5             | 500cc          | 198(44%)            | Post void residual volume >50ml  | Catheterization   |
| 8.     | Daniel N. et al.,2021[20]                 | Prospective                     | 271                           | 48.5             | 340cc          | 55(20%)             | Lower Body mass index (BMI), longer operative duration, larger intraoperative fluids | 40(72%)- straight catheterization 9(11)-urine incontinence 6(11%)-Foleys catheter                                 |

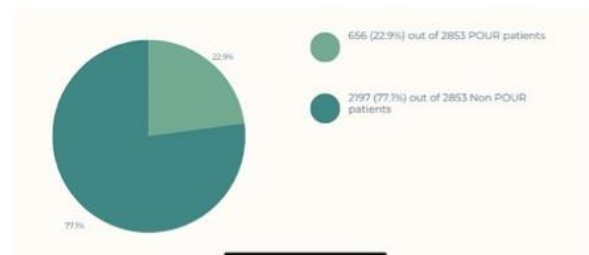


FIGURE 1: Graph explaining total numbers of POUR (Postoperative urinary retention) patients.

### Discussion:

Urinary retention after surgery is the most commonly occurring complication following non-emergency total hip Arthroplasty and knee replacement surgery[9]. Quantitative analysis of postoperative urinary retention risk factors and incidence mentioned in **table 3**.

| Sr No | Risk Factors                                | Incidence |
|-------|---|-----------|
| 1.    | Age>70years                                 | 4-43%     |
| 2.    | Male gender                                 | 6-34%     |
| 3.    | Obesity                                     | 4-32%     |
| 4.    | Pre-operative lower urinary tract infection | 17-38%    |
| 5.    | Longer duration of surgery                  | 7-35%     |
| 6.    | Intermittent catheterization                | 5-35%     |
| 7.    | Use of high intraoperative fluids           | 3-20%     |

**Table 3 :** Illustrating quantitating analysis of POUR (postoperative urinary retention) risk factors

The systematic review published in 2020 found that the incidence of POUR ranged between 4.1% to 46.3% among the 15 studies published from 2010 to 2019, several risk factors for POUR, including male gender, older age, a history of lower urinary tract symptoms, preoperative urinary retention, preoperative catheterisation, longer operative time, and the use of spinal anaesthesia[10] and diagnosis made by ultrasound. The incidence varies widely between studies, likely due to differences in patient characteristics, surgical techniques and management strategies [11,12]. These factors should be considered when assessing patients for the risk of POUR and planning management strategies. The diagnosis of POUR is based on bladder volume using the non-invasive method of bladder scanning in the post-anaesthesia care unit or ward. Any volume of more than 400ml is associated with POUR. In most studies, the value for POUR diagnosis is 400-600ml. Mostly indwelling, inter-operative catheterisation is done in mostly elderly males. The choice is made based on symptoms and bladder volume preoperatively. Catheterisation can also be done within 24-48 hours of surgery. Early removal of the catheter may lead to POUR development [13]. 2017 study published in the Journal of orthopaedic surgery found that the history of urinary retention and use of high intra- operative fluids was associated with a higher incidence of POUR in patients undergoing total hip replacement [14]. The study also found that patients with a history of lower urinary tract symptoms or diabetes were at increased risk of POUR. A 2017 study by Kort et al. published in the European Journal of Science found that using a bladder scanner to measure post-void residual urine volume reduced the occurrence of POUR in patients undergoing total knee replacement. In this study, 638 patients were enrolled; 82(12.9%) developed POUR[15]. The reason for developing post operative urinary retention was bladder volume greater than 200ml in the recovery room. Similarly, in a 2018 Scholten et al. study, a Prospective observational survey in which 306 patients were included, a third study found that male gender and a post-voiding urine volume of greater than 150 ml were causative factors for POUR[16]. In this study, some patients developed complications and infections. The cause of these infections was the use of intermittent catheterisation.

Moving forward, a study published by Alasdair JA et al. 2019 [17] studied the relationship between Total knee Replacement/ total hip replacement surgery and the incidence rate of development of POUR in patients was 8.6% . A total of 303 patients participated in this study; 26(8.6%) developed POUR. The factors which carried risk for POUR were age and continuous use of catheterisation. In this average study lifespan of the patients was 60.4 years. 2019 Markopoulos et al [18] a Prospective study in which 218 patients enrolled, 105 males and 113 females. The mean age of all patients was 69.3%. A total of 9 (4.1%) suffered from POUR. Age was the significant risk factor. Studies indicate that the amount of urine in the bladder after voiding, also known as (POUR) is a frequent complication in patients undergoing non-emergency complete hip or knee replacement surgery. Age, gender, medical history, BMI, operative duration, and intraoperative fluids may increase the risk of developing POUR. A study published in 2021 by Magaldi et al. in the Arthroplasty today journal revealed that the male gender and a history of benign prostatic hyperplasia were associated with an enhanced risk of POUR. The study also found that implementing a urinary catheterisation protocol that involves early catheter removal and bladder retraining could significantly reduce the incidence of POUR. Additionally, post-void residual urine volume greater than 50cc was identified as another risk factor for POUR [19]. Another study was conducted in 2021 by Danial. N et al. indicated that lower BMI, longer operative duration and more extensive intra-operative fluids were significant risk factors for POUR [20].

As we discussed, lower limb surgeries pose a greater risk of POUR than general surgery procedures. The decision to place a catheter should be made carefully preoperatively by evaluating the patients, especially considering the patient's Age, as elderly patients >70 years of age are more vulnerable. Intra-operative catheterisation and intermittent catheterisation are options for older people for better results. The male gender is a risk population in most studies. Both males and females are at risk regardless of gender if they are greater than 70 years. Intra-operative catheterisation can reduce risk in older people. ASA classification here is not significant [21]. POUR can cause long-term adverse effects because of bladder distension caused by urinary retention. This distension can cause bladder ischemia and becomes the reason for future bladder dysfunction and chronic kidney disease. POUR may lead to urinary tract infections (UTIs) that result in longer stays at the hospital, delays in discharge from the hospital and increases the cost of patient management. Analgesics affects the micturition pathways and hence causes bladder distension by urinary retention [22]. Patients administered analgesics, and ASA classification and long duration of operation are important factors to identify before surgery [23]. Another vital factor is preoperative residual bladder volume (PVRV). A preoperative PVRV of more than 50ml is diagnostically significant. PVRV as minimum as 50ml can also be predictable, but mostly it does not give promising results. PVRV of more than 50 and up to 200ml is

diagnostically significant. PVRV >50ml is significant  $p < 0.013$  [19]. Ultrasound-guided catheterisation may prevent POUR in major surgical procedures, but primarily intermittent catheterisation is recommended.

### Conclusions

Conservative measures such as bladder training, intermittent catheterisation, and medications such as alpha-adrenergic agonists and anticholinergics are effective in managing POUR in most cases. However, in severe cases, surgical intervention may be required. Suprapubic catheterisation or urethral dilation can effectively relieve urinary retention, but they carry the risk of complications such as infection, bleeding, and urethral injury . We recommended strategies such as early catheter removal, bladder retraining, and the use of medication or a bladder scanner may be effective in minimising the occurrence of POUR (postoperative urinary retention ) in patients undergoing complete elective hip or knee Arthroplasty, results in improve the outcome of patients, decrease the length of stay in the hospital and reduced the cost.

### Additional Information

#### Disclosures

**Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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