

# Identification of risk factors for urinary retention following total knee arthroplasty: a Singapore hospital experience

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## ABSTRACT

**Introduction:** Urinary retention is associated with an increased rate of urinary tract infections and deep sepsis following total joint arthroplasty. This study was carried out to investigate the incidence of urinary retention following total knee arthroplasty in a Singapore hospital, and to identify risk factors associated with the development of this complication in our patient population.

**Methods:** The charts of 125 consecutive patients who underwent primary total knee arthroplasty between January and December 2004 were reviewed. The incidence of postoperative urinary retention was correlated with the following factors: age, gender, choice of anaesthesia, duration of surgery, and analgesic technique. Statistical analysis was performed with univariate and multivariate logistic regression models. There were 109 female and 16 male patients. The mean age of the patients was 67.5 years (range, 50-86 years).

**Results:** Ten patients developed urinary retention, giving an overall rate of 8.0 percent (95 percent confidence interval [CI], 3.9-4.2). Male gender (odds-ratio [OR] is 5.9; 95 percent CI, 1.2-29.5; p-value is 0.03) and epidural analgesia (OR is 7.6; 95 percent CI, 1.7-35.0; p-value is 0.009) were found to be the only factors significantly associated with postoperative urinary retention. Patient age, duration of surgery and choice of anaesthesia were not found to be significantly associated with urinary retention.

**Conclusion:** In our patient population, male patients and patients receiving epidural

postoperative analgesia are at increased risk of developing urinary retention following total knee arthroplasty.

**Keywords:** epidural analgesia, knee replacement, total knee arthroplasty, urinary retention

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## INTRODUCTION

Urinary retention is a common complication following total joint arthroplasty. Reported rates of postoperative urinary retention range from 10% to 33%.<sup>(1-4)</sup> Urinary retention is associated with an increased rate of urinary tract infections, which in turn may lead to haematogenous seeding and infection of the joint.<sup>(5)</sup> It is commonly treated by urethral catheterisation, although this may further increase the incidence of deep infection.<sup>(6)</sup> Previous studies have pointed to male gender, increasing age, a history of bladder outflow problems, epidural postoperative analgesia and patient-controlled analgesia as risk factors for the development of urinary retention following total joint arthroplasty.<sup>(1-4,7,8)</sup>

There is currently little published data on the incidence of urinary retention following total joint arthroplasty in Singapore. This study was carried out to review the incidence of urinary retention following primary unilateral total knee replacement in a Singapore hospital, and to identify risk factors associated with the development of this complication in our patient population.

## METHODS

The charts of 125 consecutive patients who underwent primary unilateral total knee arthroplasty between January 2004 and December 2004 were retrospectively reviewed. The following information was obtained:

- (i) Patient factors – The age and gender of the patient were recorded.
- (ii) Anaesthesia – The type of anaesthesia was classified as general anaesthesia, epidural anaesthesia, spinal

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**Table I. Rates of urinary retention.**

Variable	Total number	Number with urinary retention	Percentage with urinary retention (95% CI)
Gender			
Male	16	4	25.0 (7.3–52.4)
Female	109	6	5.5 (2.0–11.6)
Anaesthesia			
General	76	4	5.3 (1.5–12.9)
Epidural	14	3	21.4 (4.7–50.8)
Spinal	23	0	0 (0–12.2)
Combined spinal-epidural	12	3	25.0 (5.5–57.2)
Postoperative analgesia			
Intramuscular analgesia	16	0	0 (0–17.1)
Patient-controlled analgesia	80	3	3.8 (0.8–10.6)
Epidural analgesia	29	7	24.1 (10.3–43.5)
All	125	10	8.0 (3.9–14.2)

**Table II. Univariate predictors of urinary retention.**

Variable	Univariate	
	OR (95% CI)	p-value
Age	0.98 (0.91–1.1)	0.572
Gender		
Male	5.7 (1.4–23.2)	0.024
Female	1.0	
Duration of surgery	0.99 (0.97–1.02)	0.821
Anaesthesia		
General	1.0	
Epidural	4.9 (0.97–24.9)	0.055
Spinal	0.01 (0–1000)	0.831
Combined spinal-epidural	6.0 (1.2–31.2)	0.033
Postoperative analgesia		
Patient-controlled analgesia	1.0	
Intramuscular analgesia	0.01 (0–1000)	0.811
Epidural analgesia	8.2 (1.9–34.2)	0.004

anaesthesia or combined spinal-epidural anaesthesia.

(iii) Duration of surgery – This was defined as the time from skin incision to the time of application of dressings.

(iv) Postoperative analgesia – The type of analgesia was categorised as epidural analgesia, patient-controlled analgesia or intramuscular analgesia.

(v) Urinary retention – Urinary retention was deemed to have occurred when there was a failure to void spontaneously and catheterisation was performed.

There were 109 female and 16 male patients. The mean age of the patients was 67.5 years (range, 50–86 years). The incidence of urinary retention was correlated with the following factors – age, gender, choice of anaesthesia,

duration of surgery, and type of postoperative analgesia. Statistical analysis was performed with univariate and multivariate logistic regression models, using the Statistical Package for Social Sciences version 13.0 (SPSS Inc, Chicago, IL, USA). Statistical significance was set at  $p < 0.05$ .

## RESULTS

Of the 125 patients, 76 underwent general anaesthesia, 14 received epidural anaesthesia, 23 received spinal anaesthesia, and 12 underwent combined epidural-spinal anaesthesia. The average duration of surgery was 115.6 minutes (range, 60–305 minutes). With regard to postoperative analgesia, 80 were given patient-controlled analgesia, 29 had epidural analgesia, and 16 received intramuscular analgesia.

Ten patients developed postoperative urinary retention, giving an overall incidence of 8.0% (95% confidence interval [CI], 3.9–14.2). The rates of urinary retention in the various subgroups of patients are shown in Table I. All of the patients received indwelling catheters, and the mean duration of catheterisation was 2.4 days (range, 1–3 days). None of the patients developed symptomatic urinary tract infection. There was no case of superficial or deep wound sepsis.

Univariate logistic regression analysis revealed male gender (odds-ratio [OR] = 5.7; 95% CI, 1.4–23.2;  $p = 0.024$ ), combined spinal-epidural anaesthesia (OR = 6.0; 95% CI, 1.2–31.2;  $p = 0.033$ ), and epidural postoperative analgesia (OR = 8.2; 95% CI, 1.9–34.2;  $p = 0.004$ ) to be significantly associated with urinary retention. A summary of the results of this analysis is shown in Table II.

There was expectedly a significant association between the choice of anaesthesia and the subsequent postoperative analgesia (Table III). To account for the

**Table III. Cross-tabulation between types of anaesthesia and postoperative analgesia.**

Postoperative analgesia	Anaesthesia			
	General	Epidural	Spinal	Spinal-epidural
Patient-controlled analgesia	64	0	15	1
Intramuscular analgesia	11	0	5	0
Epidural analgesia	1	14	3	11

**Table IV. Multivariate logistic regression models.**

Variable	Model 1		Model 2	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Age	0.99 (0.91–1.08)	0.848	0.99 (0.91–1.09)	0.939
Gender				
Male	5.9 (1.2–29.5)	0.030	11.7 (2.0–68.6)	0.006
Female	1.0		1.0	
Duration of surgery	0.99 (0.97–1.03)	0.910	0.99 (0.97–1.03)	0.820
Anaesthesia				
General	–	–	1.0	
Epidural	–	–	4.0 (0.7–23.4)	0.119
Spinal	–	–	0.01 (0–1000)	0.795
Combined spinal-epidural	–	–	4.4 (0.7–29.1)	0.120
Postoperative analgesia				
Patient-controlled analgesia	1.0		–	–
Intramuscular analgesia	0.01 (0–1000)	0.865	–	–
Epidural analgesia	7.6 (1.7–35.0)	0.009	–	–

multicollinearity between these two variables, separate multivariate models were generated (Table IV). These models identified male gender (OR = 5.9; 95% CI, 1.2–29.5;  $p = 0.03$ ) and epidural analgesia (OR = 7.6; 95% CI, 1.7–35.0;  $p = 0.009$ ) as the only factors significantly associated with urinary retention. Patient age, duration of surgery and choice of anaesthesia were not found to be significantly associated with urinary retention.

## DISCUSSION

Postoperative urinary retention is associated with an increased rate of urinary tract infections, which in turn may lead to haematogenous seeding and infection in total joint arthroplasty.<sup>(5)</sup> Urinary retention is treated by urethral catheterisation. However, this may further increase the incidence of deep infection.<sup>(6)</sup> Urinary retention in the postoperative period has two main causes. The first is mechanical obstruction of the urinary outflow tract, and the second is altered neural control of the bladder and detrusor mechanism, most commonly due to analgesic drugs.

In this series, male patients and patients receiving epidural analgesia were found to be at increased risk of developing urinary retention. The identification of male gender as a risk factor may be due to the increased

prevalence of mechanical obstruction, in the form of benign prostatic hypertrophy or urethral stricture, in this subgroup of patients.<sup>(5)</sup> However, there was insufficient data in the case records to identify patients with a prior history of bladder outflow problems, and to study this as a separate potential risk factor.

Total knee arthroplasty is a painful procedure.<sup>(9)</sup> Postoperative analgesia is therefore an important aspect of management, as it determines patient comfort and the success of subsequent rehabilitation. The analgesic techniques used after total knee arthroplasty include epidural analgesia, patient-controlled analgesia and intramuscular analgesia. However, analgesic drugs are not without their side effects. Many agents, particularly opioids, cause dysfunction of the autonomic nervous system in the urinary tract. This leads to bladder overdistension, atonia, increased residual volumes, and an increased risk of urinary tract infections.<sup>(5)</sup>

In our study, the use of postoperative epidural analgesia was associated with a significant increase in the rate of development of urinary retention, as compared to patient-controlled analgesia and intramuscular analgesia. 24.1% of patients receiving epidural analgesia were catheterised, as compared to 3.8% and none in the

patient-controlled analgesia and intramuscular analgesia groups, respectively.

While epidural analgesia provides good postoperative pain relief and avoids the systemic side effects of opioids, in particular sedation and respiratory depression, it is associated with adverse effects such as nausea, vomiting, pruritis, hypotension, and urinary retention. Other authors have reported similar increased rates of urinary retention in patients receiving epidural analgesia. Walts et al studied patients undergoing total hip arthroplasty and found an increase in the incidence of postoperative urinary retention from 24% to 62% with the use of epidural analgesia.<sup>(4)</sup> Gedney and Liu found an overall rate of urinary retention of 55% in patients given epidural analgesia for 48 hours following total joint arthroplasty.<sup>(8)</sup>

The overall incidence of postoperative urinary retention in our series was low at 8.0%. This may have been due to the preponderance of females, who are at low risk for mechanical obstruction.<sup>(5)</sup> In addition, the majority of patients in our series received patient-controlled analgesia. The wider use of epidural analgesia may well have resulted in a higher overall urinary retention rate.

In our population, male gender and epidural analgesia have been identified as risk factors for the development of urinary retention following total knee arthroplasty. Male patients should therefore be evaluated preoperatively for symptoms and signs of bladder outflow problems, and

sent for urological review if these are present. In addition, epidural analgesia should be used with caution if urinary retention is to be avoided in the postoperative period.

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