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Original Article

High rates of postoperative urinary retention following primary total hip replacement performed under combined general and spinal anaesthesia with intrathecal opiate

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ABSTRACT

Background: Postoperative urinary retention (POUR) occurs frequently following hip replacement.

Methods: 94 consecutive primary hip arthroplasty patients were assessed prospectively for POUR. 80 patients followed our anaesthesia protocol with combined general and spinal anaesthesia using bupivacaine and intrathecal diamorphine.

Results: 29 instances of POUR with higher rates in men and younger patients (under-50s), independent of either pre-existing renal impairment or opiate strength. POUR was observed to increase length of stay by 1.6 days.

Conclusions: We report a 36% overall rate of POUR. Males demonstrated a 3-fold increased risk. Patients should be counselled pre-operatively on the risk of urinary retention.

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1. Introduction

Postoperative urinary retention (POUR) is a common problem with overall rates looking at the entire surgical population quoted between 4% and 6%.^{1,2} Lower limb arthroplasty patients are described as having a 20-fold greater risk³ with much variation in the literature on the account of differences

in anaesthesia and postoperative analgesia regimes. Published incidence rates thus vary widely from 0% to 75%,^{4,5} with little overall difference on meta-analysis.³

Increasing age and male gender have already been identified as independent risk factors.⁶ In men, there is evidence both for and against a link between POUR and either obstructive uropathic symptoms or the International Prostate Symptom Score (IPSS).^{7–9} Propofol along with volatile anaesthesia agents

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used during a general anaesthesia impair the micturition reflex and reduce detrusor contractility.^{10,11} Intrathecal bupivacaine used for spinal and epidural anaesthesia abolishes detrusor control within 5 min and can last up to eight hours.^{12,13} High quality postoperative analgesia is believed to positively impact functional rehabilitation and in-patient hospital stay. Baldieri has summarised that all analgesia modalities have been linked with POUR, with a systematic review showing rates of 33% with postoperative systemic opiates and epidural analgesia, but only 9% with continuous peripheral nerve blocks³; however their quoted summary statistic could not control for anaesthesia modality.

Urinary catheterisation is traditionally advised for bladder volumes distended over 600 ml, to avoid long-term detrusor muscle damage and bladder atony.² Most studies use this as a cut-off to define postoperative urinary retention. Prolonged over-distension leads to ischaemic detrusor muscle injury and impaired function. Subsequent increased post-void residual volumes of static urine predispose to urinary tract infection (UTI) independent of urethral instrumentation.³ Either intermittent in-and-out catheterisation or an in-dwelling urinary catheter with early removal, once a patient is mobile following hip arthroplasty, is used to treat POUR and decompress the bladder. Early removal is important, as a risk of UTI is reported to rise 5% for each day a urinary catheter remains in situ,¹⁴ and associated bacteraemia is linked with deep prosthetic joint infection.^{15–17} Intermittent catheterisation is less favoured in the United Kingdom, as repeated urethral instrumentation has a greater financial burden,¹⁸ and is imagined to increase infection risk despite evidence to the contrary.¹⁹

Our institution is a dedicated tertiary-referral orthopaedic unit with a high volume arthroplasty department comprising six surgeons. Average annual primary hip arthroplasty procedures performed exceeds 850 cases per year,^d with established patient pathways that standardise rehabilitation, anaesthesia, and perioperative surgical care regimes. Our aim was to evaluate the burden of POUR, which is an attempt to identify risk factors and establish if POUR impacts on length of hospital stay, as the unit endeavours to devise and roll-out an effective enhanced recovery protocol.

2. Methods

Any patient undergoing primary total hip replacement during a 6-week consecutive period between October and November 2013, under the care of the six surgeons comprising the arthroplasty department, was included. Data were collected prospectively regarding their demographics, type of anaesthesia, strength of intrathecal opiate administered, pre-operative laboratory-calculated estimated glomerular filtration rate (eGFR), incidence of urinary retention within 24-hours of surgery. According to the format of eGFR values from our laboratory, patients were grouped into four categories of renal impairment: none (eGFR $\geq$ 90 ml/min), mild (60–89), moderate (30–59), severe (16–29), end-stage failure ($<$ 15). These values were chosen based on established principles published by the

National Institute for Health and Clinical Excellence (NICE).^e Length of hospital stay data were collected retrospectively from our internal bioinformatics department, to ensure data accurately reflected weekend discharges, which would otherwise have been missed by our data collection team (RD, EA, EH). Data analysis and parametric statistical tests were performed independently by the lead author (MD) using Microsoft® Excel® for Mac 2011 (version 14.4.2 © 2010 Microsoft Corporation. All rights reserved). Non-parametric statistical tests were performed using GraphPad QuickCalcs (©2013 GraphPad Software, Inc. All rights reserved). Statistical significance was set at a p-value of less than or equal to 0.05.

All patients undergoing primary or complex primary total hip replacement follow a standardised perioperative regime that encompasses pre-medication, antibiotic and venous thromboembolism prophylaxis, anaesthesia, intraoperative fluids, postoperative analgesia and rehabilitation. The standard anaesthesia protocol includes intravenous propofol induction with sevoflurane gas maintenance using a computer-controlled delivery system that tracks brain activity through electroencephalography. The patient is turned from supine to a lateral position (with the operative side uppermost) for administration of supplementary spinal bolus of intrathecal 0.5% bupivacaine and diamorphine, prior to formal surgical positioning, skin preparation and draping. There is some variation in the strength of intrathecal opiate used, as well as locally infiltrated local anaesthesia agent and volume depending on anaesthetist and surgeon preferences respectively. Five of the six surgeons employ a posterior approach for total hip arthroplasty, while the sixth surgeon uses an anterolateral approach. Cementless hip arthroplasty are used for patients under the age of 75, with hybrid systems (uncemented acetabular and cemented femoral components) preferred for older patients. Nursing staff identify patients, who have failed to pass urine within six hours of completion of surgery, and perform bladder scans using a portable ultrasound bladder scanner (BladderScan® BVI 3000, Verathon Medical United Kingdom Ltd., Amersham, UK). Postoperative urinary retention is diagnosed by a residual greater than 700 ml, and a urinary catheter will be placed either by a trained nurse if available or the junior doctor on duty.

3. Results

94 consecutive primary hip replacements were performed during the six-week timeframe selected. Primary hip replacements designated as complex-primary for the purposes of National Joint Registry audit forms were not included. 14 patients received a planned variation from the protocol anaesthesia regime and were excluded from the main analysis, as the small numbers within this group for each anaesthesia variant precluded any meaningful statistical analysis. This left us with a sample size of 80 patients. Each patient had a complete dataset with the exception of one, in whom there was neither a pre-operative estimated glomerular

^d Calculated from internal clinical governance data (July to December 2013).

^e National Institute for Health and Care Excellence (2008), *Early identification and management of chronic kidney disease in adults in primary and secondary care*, CG73 – Quick reference guide.

filtration rate nor a reliable record of length of stay. 47 patients were women and 33 were men. The age range varied from 33 to 85 years, with a mean age of 65.

29 (36%) instances of postoperative urinary retention occurred (95% confidence interval [CI] 26% to 47%). 10 of the 47 (21%) women went into retention within 24 hours of surgery, compared with 19 of the 33 men (58%). Incidence was significantly greater amongst men ($p = 0.0018$, 2-tailed Fisher exact test). Younger patients appeared to have an unexpected higher chance of developing POUR, with six of eleven (55%) patients under-50 years age developing retention compared with 23 of 69 (33%) patients over age 50. However, this observation did not reach significance ($p = 0.1536$, 1-tailed Fisher exact test). We postulated that younger patients with healthier kidneys may produce a larger volume of urine more quickly after surgery and thus be at a greater risk of urinary retention. However, there was no significant difference in chronic kidney disease prevalence as defined by NICE, in our under-50 compared with over-50 cohorts ($p = 0.1935$, 2-tailed Fisher exact test).

There was some variation in strength of opiate being administered intrathecally with the spinal anaesthesia as summarised in Table 1. Intrathecal diamorphine dose varied from 200 to 400 micrograms (mcg), with 250 mcg being the preferred strength in 65% of cases. Again small cohort sizes preclude meaningful statistics. Categorising low strength opiate as less than or equal to 250 mcg, then 22 of 60 (37%) patients developed POUR. We observed urinary retention in 7 of 20 (35%) patients receiving high strength intrathecal opiate greater than 250 mcg. The difference did not achieve significance ($p = 1.0$, 2-tailed Fisher exact test).

Looking broadly at estimated glomerular filtration rate and chronic kidney disease (CKD) as classified by NICE: we had no patients with severe or end-stage CKD within our sample. 29 patients had no kidney disease, amongst whom there were 11 (38%) cases of POUR. 15 (36%) developed urinary retention amongst 42 patients with mild kidney disease, and 3 (38%) of 8 patients with moderate disease. A simple comparison of those with any degree of CKD versus normal renal function again revealed no significant difference in POUR incidence ($p = 1.0$, 2-tailed Fisher exact test).

Finally when analysing data on length of stay, we excluded the single patient in whom no reliable discharge date could be ascertained. The 14 cases that received planned modifications to their anaesthesia regime were included for this part of the analysis. Patients receiving a short-term urinary catheter for POUR ($n = 33$) remained in hospital for 6.6 days (95% CI 4.7 to 8.6 days) following primary hip arthroplasty. In contrast, patients

who did not develop POUR had a hospital stay of 5.1 days (95% CI 4.0 to 6.1 days), a difference of 1.55 days that approached significance ($p = 0.06$, single-tailed Student *t*-test).

4. Discussion

Our data add to the limited evidence available and corroborate surprisingly high rates of postoperative urinary retention following primary hip arthroplasty. While published rates vary broadly, our finding of a 36% incidence of POUR following a unique combined general anaesthesia and spinal anaesthesia using intrathecal opiate is comparable with the 33% rate encountered in patients receiving systemic or epidural opiate analgesia, quoted in the systematic review by Baldieri.³ Men in our series appeared to have nearly a three-fold increased risk of POUR (58% vs. 21%), and this is again supported in the medical literature^{6,8} with benign prostatic hypertrophy a commonly postulated confounder.²⁰

Age-related neuropathic bladder dysfunction is believed partly responsible for increased age up to 70 years being a risk factor for POUR.^{21,9} However, our data hint inexplicably that younger patients under 50 may be at greater risk of POUR. We theorised that our younger patients may have better renal function and be able to filter intravenous fluids administered intraoperatively more quickly, however we failed to find a significant difference in estimated glomerular filtration rates between our under-50 and over-50 populations ($p = 0.324$, 2-tailed Fisher exact test). However, we accept we have not measured differences in surgery duration or the total volume of perioperative intravenous fluid administered.

This series reports high rates of urinary retention amongst hip arthroplasty patients receiving a unique anaesthesia strategy using a combined general and spinal anaesthesia with intrathecal opiate. We have not been able to test if removing the intrathecal opiate component would reduce the rate of POUR while still conferring the benefits of reduced postoperative opiates. Controversy still surrounds this concept as studies have reported both higher²² and lower^{23,24} POUR rates associated with intrathecal opiate. Our data support the published consensus that incidence of POUR is not dose-related to intrathecal opiate.

Healthcare decision-making is being increasingly dominated by cost that has contributed to a recent drive towards enhanced recovery programmes to reduce hospital in-patient stay. Our study certainly warrants a closer look at the impact of postoperative urinary retention on hospital stay, as we have observed a strong trend to suggest that length of stay increases. This has implications on cost, and in theory morbidity would be associated with secondarily acquired infection {CE: Please raise an AQ.}. We recommend patient should be counselled pre-operatively, perhaps as part of the process of informed consent, of a relatively high likelihood of requiring a urinary catheter postoperatively.

Conflicts of interest

The authors have none to declare.

Table 1 – Breakdown of rates of postoperative urinary retention by strength of intrathecal diamorphine used in anaesthesia regime.

Opiate strength	Sample size	Cases of POUR (%)
200 mcg	8	3 (38%)
250 mcg	52	19 (37%)
300 mcg	18	6 (33%)
350 mcg	0	0
400 mcg	2	1 (50%)

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