Indwelling urinary catheterisation may increase risk of complications in hip and knee arthroplasty

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ABSTRACT

INTRODUCTION: Routine use of perioperative indwelling urinary catheterisation in fast-track total hip arthroplasty (THA) and total knee arthroplasty (TKA) is still debatable, as urinary catheterisation may cause complications. The aim of this study was to describe the incidence of re-catheterisation and urologic complications during the initial 30 days following THA and TKA fast-track surgery.

METHODS: We conducted a prospective, observational study of 795 patients ≥ 50 years of age who had undergone elective fast-track THA or TKA with perioperative indwelling urinary catheterisation until the first post-operative morning. Primary outcomes were number of patients keeping their catheter the first post-operative morning and the incidence of re-catheterisations before discharge. Follow-up on post-discharge complications was done by phone 30 days after surgery.

RESULTS: A total of 784 of 795 included patients (98.6%) were analysed for the primary outcomes, and follow-up data were available for 760 patients (95.6%). Three patients (0.4%) kept their catheter after the first post-operative morning and 25 patients (3.2%) were re-catheterised before discharge. The median length of stay was two days (interquartile range: 1-2). The incidence of post-operative urinary tract infections (UTI) was 4.2%, and about 30% of the patients experienced pre-to-post-operative aggravation of their lower urinary tract symptoms.

CONCLUSIONS: Routine use of perioperative indwelling urinary catheterisation in fast-track THA and TKA may increase the risk of post-operative UTI and does not eliminate the need for subsequent re-catheterisation. These findings speak against routine use of perioperative indwelling catheterisation.

FUNDING: The study was supported by the Lundbeck Foundation and registered with clinicaltrials.gov.

TRIAL REGISTRATION: clinicaltrials.gov 8 April 2014 (NCT02133768).

Short-term perioperative indwelling urinary catheterisation was previously standard in total hip (THA) and knee arthroplasty (TKA) to prevent post-operative urinary retention (POUR). Technological advances and implementation of fast-track principles for perioperative care have shifted the preferred strategy towards rapid mobilisation of the patient. However, indwelling urinary catheterisation may potentially interfere with mobilisation. Furthermore, indwelling urinary catheterisation may increase the risk of complications (urinary tract infection (UTI), urethral trauma, haematuria, etc.) and discomfort for the patients. A strategy using ultrasound urinary bladder scanners to guide intermittent catheterisation instead may be a safe alternative [1-4].

However, in a recent meta-analysis in unspecified non-fast-track surgery, the use of indwelling urinary catheterisation removed 24-48 hours post-operatively was superior to intermittent catheterisation in preventing POUR [5]. Furthermore, indwelling urinary catheterisation did not increase the risk of UTI. Consequently, indwelling urinary catheterisation may still be used in some THA and TKA centres to prevent POUR, and this may also be convenient in an elective bed ward with low staffing, especially at night. As the consequences of using perioperative indwelling catheterisation in fast-track THA and TKA is debatable [4-6], this study aimed to describe the incidence of re-catheterisation and urologic complications, including UTI, during the initial 30 days following fast-track THA and TKA surgery in a high-volume elective centre.

METHODS

Study design and participants

This was a prospective, observational study performed in a high-volume, orthopaedic department at a Danish regional hospital that performs elective THA and TKA according to a standardised fast-track protocol for perioperative care. The protocol includes early mobilisation, multimodal opioid-sparing analgesia and functional discharge criteria [7]. The department forms part of the Lundbeck Foundation Centre for Fast-track Hip and Knee Replacement Collaboration and performs about 550 elective THA and TKA annually. At the time of this study, indwelling urinary catheterisation was standard until the first post-operative morning in all patients > 49 years of age, whereas bladder management in younger patients was done by bladder scans

ORIGINAL ARTICLE

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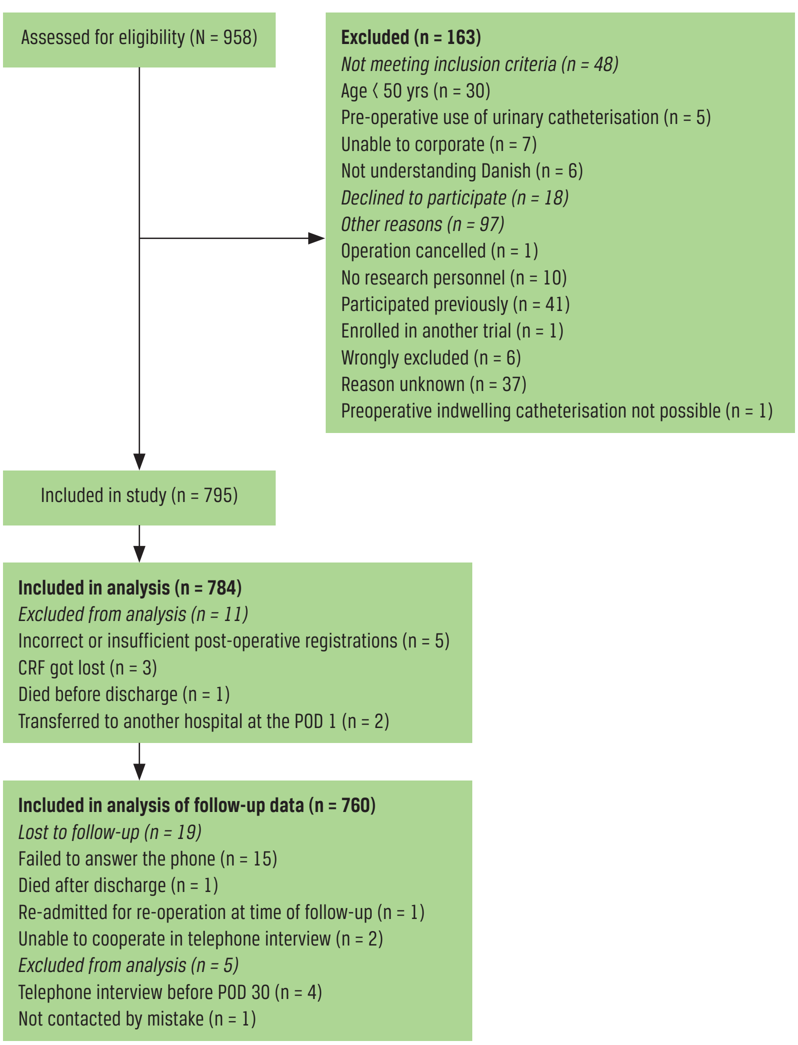
Dan Med J 2019;66(4)A5538

and intermittent urinary catheterisation. Our inclusion criteria were age ≥ 50 years, planned elective, primary THA or TKA and informed oral consent for participation. The exclusion criteria were previous cystectomy, preoperative use of urinary bladder catheterisation, haemodialysis, inability to cooperate for cognitive reasons, not understanding Danish, pregnancy and/or having given birth within the past six months.

Participants were screening for eligibility and given appropriate information at the intraoperative consultation, and informed consent for participation, data collection and the follow-up interview was obtained at the end of the consultation. A copy of the International Prostate Symptom Score (IPSS) questionnaire (Danish version) [8] was given to patients to be completed before surgery.

FIGURE 1

Trial profile.



CRF = case report form; POD = post-operative day.

Ethical standards and trial registration

The need for approval was waived by the Regional Ethics Committees of Region Midtjylland, Denmark. Data storage was according to the standards of the Danish Data Protection Agency, and the study was registered with clinicaltrials.gov.

Surgery, anaesthesia and perioperative care

All patients followed the Department's fast-track principles, including a pre-operative information meeting where a urine dipstick analysis was performed. A positive dipstick analysis was followed by a microbiological analysis, serving to guide a five-day oral antibiotic treatment, which was initiated when the patient was admitted, at the day of surgery. Surgical techniques were according to standard guidelines of the department with all patients receiving prophylactic, intravenous cefuroxime; 1.5 g during surgery and another two doses within the following 24 hours. Standard anaesthesia was low-dose spinal anaesthesia without opioids and optional supplemental propofol sedation. General anaesthesia was given if specifically requested by the patient. Volumes of intraoperative fluids were not standardised but registered. Multimodal, opioid-sparing oral treatment in combination with intraoperative local infiltration analgesia in TKA was used for post-operative analgesia. Epidural or patient-controlled, intravenous analgesia were not used. After surgery, patients stayed in the post anaesthesia care unit until meeting standard criteria for transferal to the surgical ward [9], where they were mobilised within 2-6 hours post-operatively.

Data collection

In addition to standard demographic data, we registered whether patients had any urological comorbidity (self-reported prostate hypertrophy, overactive bladder, prostate cancer, urinary incontinence, previous prostatectomy/prostate resection), neurological comorbidity (multiple sclerosis, Parkinson's disease, neurological sequelae after a discus prolapse or spinal injury, diabetic neuropathy, and/or sequelae after a cerebral insult), or had previously undergone pelvic gynaecological surgery (hysterectomy and/or prolapse surgery), as these factors have been proposed to increase the risk of POUR [10-12]. Also, we registered if the patient had a daily intake of diuretics.

Preoperatively, patients completed the IPSS questionnaire with seven questions on specific LUTS, yielding scores between zero ("symptom never present") and five ("symptom always present"), thus giving total scores between zero and 35 [8]. The IPSS questionnaire was repeated in a follow-up telephone interview at post-operative day (POD) 30, allowing calculation of pre-to-post-operative IPSS differences (diff-IPSS), with a total diff-IPSS ≥ 1 indicating pre-to-post-operative aggravation of LUTS.

Perioperative registrations included type of surgery, anaesthetic technique, total volumes of intraoperative fluids and whether intraoperative bleeding exceeded 500 ml. From POD 1 and until discharge, patients were followed with daily registrations of whether their indwelling catheter had been removed (and the reason, if it was not removed) and whether re-catheterisation had been performed. In case of re-catheterisation, we registered the reason ("POUR", "Post void residual urine" or "Other"), type of catheterisation (indwelling or intermittent), and whether a bladder scan had been performed. POUR was defined by the inability to void despite a full bladder, judged by ultrasound bladder scan or subsequent catheterisation, but with no predefined minimal bladder volume. Finally, we registered all urological complications and UTIs diagnosed after surgery but before discharge.

On POD30, a telephone interview was performed by a trained research nurse who asked whether the patient had had a UTI after discharge and/or had been readmitted to the hospital. In case of confirmatory answers, further details were collected, such as "Who diagnosed the UTI?", "Was a urinary test performed?", "What was the reason for your readmission?" etc. Finally, the patient was asked the seven questions of the IPSS questionnaire.

Outcomes

Our primary outcomes were the number of patients who did not have their indwelling catheter removed on the first post-operative morning and the number of patients who were re-catheterised due to POUR before discharge. Secondarily, we assessed the length of stay (LOS) and the incidences of post-operative UTI, urological complications, and post-operative voiding difficulties (defined as a diff-IPSS ≥ 1) within 30 days from surgery.

Statistical analysis

Continuous variables are reported as means and standard deviations or medians and interquartile ranges (IQR) depending on their distributions, judged by histograms and the Kolmogorov-Smirnov goodness-of-fit test. IPSS and diff-IPSS values were considered continuous variables and are given summarised and for each question score individually. Categorical data are given as counts and group percentages.

A planned analysis to compare urologic complications and diff-IPSS between re-catheterised and not re-catheterised patients was abandoned due to the low overall incidence of re-catheterisations. Data analyses were performed using SAS statistical software version 9.3 (SAS Institute Inc., Cary, NC, USA).

TABLE 1

Baseline characteristics, relevant comorbidity and intraoperative registrations in the 784 patients included in the analysis of the primary outcomes.

Age, mean (± SD), yrs	
Males	69 (± 8.3)
Females	70 (± 8.6)
Total	70 (± 8.5)
BMI, median (IQR), kg/m^2	27.6 (24.7-30.9)
Sex, n (%)	
Males	398 (50.8)
Female	386 (49.2)
Urological comorbidity, n/N (%) [missing]	60/773 (7.8)[a] [11]
Previous gynaecological surgery, females, n/N (%) [missing]	44/383 (11.5) [3]
Neurological comorbidity, n/N (%) [missing]	11/780 (1.4) [4]
Pre-operative use of diuretics, n/N (%) [missing]	192/782 (24.6) [2]
Type of surgery, n %)	
Total hip arthroplasty	523 (66.7)
Total knee arthroplasty	261 (33.3)
Anaesthesia, n (%)	
Spinal	636 (81.1)
General	143 (18.3)
Both	5 (0.6)
Intraoperative bleeding, n/N (%) [missing]	
≤ 500 ml	618/745 (83) [39]
> 500 ml	127/745 (17) [39]
Intraoperative fluids, median (IQR), ml [n (missing)]	1,000 (900-1,331) [740 (44)]

IQR = interquartile range; SD = standard deviation.
a) Including 28 males reporting prostate hypertrophy or previous operation for this condition, 17 males reporting prostatic cancer or previous operation for this condition, 4 males treated with prostate resection or prostatectomy due to unknown causes.

Trial registration: clinicaltrials.gov, 8 April 2014 (NCT02133768).

RESULTS

Between 9 May 2014 and 1 February the 2016, we consecutively screened 958 procedures of THA and TKA and included 795 individual patients. We did not allow each patient to participate more than once. We included data from 784 of the 795 patients (98.6%), except for the analyses of follow-up data, which were available only for 760 patients. (**Figure 1**).

Baseline characteristics, relevant comorbidity and intraoperative data are given in **Table 1** and primary and secondary outcomes in **Table 2**. The median LOS was two days (IQR: 1-2).

Only three patients did not have their indwelling catheter removed on the first post-operative morning (Table 2); one due to confusion, one due to immobilisation and one who requested to keep the catheter because of previous urinary incontinence. Bladder scans were performed on all 12 patients who were re-catheterised because of urinary retention, showing bladder volumes in the 350-785 ml range (median = 470, IQR:

413-596). Of the 25 patients who were re-catheterised before discharge (Table 2), 13 (1.7%) had an indwelling urinary catheter re-inserted. In ten patients (1.3%), these catheters were left in place after discharge.

In addition to the 33 patients who were diagnosed with UTI by a healthcare professional within the first 30 PODs (Table 2), another three (0.4 %) patients reported that they had an UTI after discharge, which, however, was not diagnosed by a healthcare professional.

The median total diff-IPSS was –1 (IQR: –5-1) with 28.5% of the patients having a total diff-IPSS ≥ 1. Four patients (0.5%) were re-admitted due to urological problems; two due to UTIs, one who was febrile and had urinary retention, and one with haematuria and a non-functioning indwelling catheter. Furthermore, one patient experienced spontaneous urinary retention after discharge and had an indwelling catheter placed by his general practitioner, and another was followed by urological specialist due to urinary incontinence. In this patient, video-cystoscopy had been necessary for intraoperative catheterisation due to urethral strictures.

TABLE 2

Primary and secondary outcomes.

Patients who did not get their indwelling catheter removed the morning after surgery, n/N (%)	3/784 (0.4)
Patients re-catheterised, total, n/N (%)	25/784 (3.2)
Reasons for re-catheterisation, n/N (%)	
Urinary retention	12/25 (48.0)
Post void residual urine	8/25 (32.0)
Other	3/25 (12.0)
Unknown	2/25 (8.0)
Patients with PO UTI, total, n/N (%) [missing]	33/782 (4.2) [2]
UTI diagnosed, n/N (%) [missing]	
Before discharge	12/782 (1.5) [2]
After discharge[a]	21/759 (2.8) [1]
Total diff-IPSS, median (IQR) [n total (missing)]	-1 (-5-1) [727 (33)]
Patients with total diff-IPSS ≥ 1, n/N (%) [missing]	207/727 (28.5) [33]

Diff-IPSS = pre-to-post-operative difference in the International Prostate Symptom Score; IQR = interquartile range; PO = post-operative; UTI = urinary tract infection.
a) Only those diagnosed by a healthcare professional.

TABLE 3

Pre-to-post-operative differences in International Prostate Symptom Scores (diff-IPPS). The values are medians (interquartile ranges) [n missing].

	Preoperative (n = 784)	Post-operative (n = 760)	Diff-IPSS (n = 760)
Incomplete emptying: How often have you had the sensation of not emptying your bladder?	0 (0-1) [37]	0 (0-0) [3]	0 (-1-0) [22]
Frequency: How often have you had to urinate less than every 2 h?	1 (0-2) [40]	0 (0-2) [9]	0 (-1-1) [25]
Intermittency: How often have you found that you stopped and started again several times when you urinated?	0 (0-1) [38]	0 (0-0) [9]	0 (-1-0) [23]
Urgency: How often have you found it difficult to postpone urination?	1 (0-2) [37]	0 (0-2) [9]	0 (-1-0) [22]
Weak stream: How often have you had a weak urinary stream?	0 (0-2) [39]	0 (0-0) [10]	0 (-1-0) [24]
Straining: How often have you had to strain to start urination?	0 (0-0) [36]	0 (0-0) [9]	0 (0-0) [29]
Nocturia: How many times did you typically get up at night to urinate?	2 (1-3) [36]	1 (1-3) [3]	0 (-1-1) [19]
Total score	7 (3-12) [48]	5 (2-9) [10]	-1 (-5-1) [33]

DISCUSSION

The results of this study suggest that routine short-term indwelling perioperative catheterisation may increase the risk of UTIs, apparently without reducing the risk of re-catheterisation in fast-track THA and TKA. However, the regime apparently neither increased the median LOS of two days, which is identical to that reported by other centres participating in the Lundbeck Foundation Centre for Fast-track Hip and Knee Replacement Collaboration, [13, 14] nor aggravated pre-to-post-operative LUTS, judged by the median diff-IPSS.

The incidence of post-operative UTIs within 30 days of surgery was 4.2% (Table 2). This is approximately twice as much as the 2% in our randomised controlled trial (RCT) with an intermittent catheterisation strategy in a similar population [14], despite treating patients with preoperative asymptomatic bacteriuria in the present study. For comparison, two large database studies with a total of more than 30,000 primary THA and TKA reported 30-day UTI incidences of 1.9-2.0% [15, 16], whereas Winther and colleagues conducted a prospective one-year follow-up on 920 fast-track hip and knee patients and found an UTI incidence of about 5% [17]. However, none of these studies included details on whether or not patients were screened for bacteriuria before surgery, or reported the strategy used for preventing POUR or included an assessment of voiding difficulties (IPSS score).

Currently, no consensus exists on how to define POUR. Moreover, the literature offers no solid evidence of whether to prefer short-term indwelling catheterisation or intermittent post-operative catheterisation as the standard treatment for POUR in lower-limb arthroplasty [3-6, 18, 19]. Based on a meta-analysis of four 20-30-year-old studies with large heterogeneity regarding study design and POUR definition, a recent Cochrane review [20] suggested that indwelling catheterisation may reduce the incidence of POUR compared with intermittent catheterisation. Another review by Zhang et al [5] also found that “indwelling catheterisation reduced the risk of POUR, versus intermittent catheterisation, in total joint surgery.” However, both reviews included studies comparing overall intermittent catheterisation rates with re-catheterisation rates after indwelling perioperative catheterisation, thereby limiting interpretation.

In the present study, 3.2% of the patients were re-catheterised because of POUR or for other reasons after removal of their indwelling catheter (**Table 3**), which is more than the frequency of re-catheterisation of only 0.8% in the RCT with a urinary bladder volume of ≥ 800 ml before catheterisation [14]. However, as bladder volumes before re-catheterisation were all < 800 ml in the present study, we cannot compare indwelling and intermittent catheterisation to prevent POUR based on these data. Thus, the question of indwelling versus intermittent urinary catheterisation for POUR must be assessed through procedure-specific RCTs under standardised perioperative settings, including a predefined bladder volume as a catheterisation threshold, and with sufficient statistical power to be conclusive about complications.

In the present study, we only included patients < 50 years of age who have been postulated to have more than double the risk of POUR compared with younger patients [11]. However, the influence of age as a risk factor for POUR in fast-track THA and TKA has been questioned [19], and only about 3% of the screened patients were excluded based on their age (Figure 1), minimising the potential underestimation of the true re-catheterisation rate.

Our study is strengthened by its prospective design, the inclusion of a 30-day follow-up with a completion rate > 95% and by the relatively large, consecutive cohort of patients undergoing THA or TKA in a standardised, fast-track setting in a high-volume orthopaedic centre, and by detailed assessment of complications and voiding problems at the 30-day follow-up. Limitations include the observational design and the lack of a specified pre-catheterisation bladder volume to define POUR, which may have led to a higher re-catheterisation rate, which impedes sufficient interpretation as discussed above. Also, the reported incidence of UTI after discharge was based on patient-reported data (telephone interviews), which may have included cases of uncertain diagnostic accuracy.

CONCLUSIONS

The use of standard short-term, perioperative indwelling catheterisation to prevent POUR in fast-track THA and TKA may be questioned due to the reported re-catheterisation rate and a potentially increased risk of UTI.

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ACCEPTED: 31 January 2019
CONFLICTS OF INTEREST: Disclosure forms provided by the authors are available with the full text of this article at Ugeskriftet.dk/dmj
ACKNOWLEDGEMENTS: *) *Lars S. Bjerregaard* and *Morten Homilius* have contributed equally to this study.

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