Risk factors of postoperative urinary retention following total hip and knee arthroplasty

a systematic review and meta-analysis

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Aims

The aim of this meta-analysis was to determine the pooled incidence of postoperative urinary retention (POUR) following total hip and knee arthroplasty (total joint replacement (TJR)) and to evaluate the risk factors and complications associated with POUR.

Methods

Two authors conducted searches in PubMed, Embase, Web of Science, and Scopus on TJR and urinary retention. Eligible studies that reported the rate of POUR and associated risk factors for patients undergoing TJR were included in the analysis. Patient demographic details, medical comorbidities, and postoperative outcomes and complications were separately analyzed. The effect estimates for continuous and categorical data were reported as standardized mean differences (SMDs) and odds ratios (ORs) with 95% CIs, respectively.

Results

A total of 31 studies were included in the systematic review. Of these, 29 studies entered our meta-analysis, which included 3,273 patients diagnosed with POUR and 11,583 patients without POUR following TJR. The pooled incidence of POUR was 28.06%. Demographic risk factors included male sex (OR 1.81, 95% CI 1.26 to 2.59), increasing age (SMD 0.16, 95% CI 0.04 to 0.27), and American Society of Anesthesiologists grade 3 to 4 (OR 1.39, 95% CI 1.10 to 1.77). Patients with a history of benign prostatic hyperplasia (OR 1.99, 95% CI 1.41 to 2.83) and retention (OR 3.10, 95% CI 1.58 to 6.06) were more likely to develop POUR. Surgery-related risk factors included spinal anaesthesia (OR 1.44, 95% CI 1.19 to 1.74) and postoperative epidural analgesia (OR 2.82, 95% CI 1.65 to 4.82). Total hip arthroplasty was associated with higher odds of POUR compared to total knee arthroplasty (OR 1.10, 95% CI 1.02 to 1.20). Postoperatively, POUR was associated with a longer length of stay (SMD 0.21, 95% CI 0.02 to 0.39).

Conclusion

Our meta-analysis demonstrated key risk variables for POUR following TJR, which may assist in identifying at-risk patients and direct patient-centered pathways to minimize this postoperative complication.

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Take home message

- This meta-analysis found a pooled incidence of 28.1% for postoperative urine retention following total joint replacement.
- Significant risk factors include male sex, advanced age, a history of benign prostatic hyperplasia, total hip arthroplasty, and the use of spinal anaesthesia and epidural analgesia.

Introduction

Arthroplasty (total joint replacement (TJR), consisting of total hip (THA) and total knee arthroplasty (TKA)) is a highly successful surgery used to treat end-stage osteoarthritis, with increasing demand in the elderly population.[1] The overall prevalence of THA and TKA in the USA is 0.83 and 1.52%, respectively.[2] With the rising demand for TJR in the elderly population to achieve greater mobility and quality of life, this procedure is expected to reach an annual volume of four million by 2030.[3] Unfortunately, various age-related postoperative complications may hinder the recovery process and overall satisfaction in this patient population. One common problem in the arthroplasty population is postoperative urinary retention (POUR), with a reported incidence as high as 46%.[4]

POUR might not be associated with a high risk of morbidity; however, if left untreated, it can lead to permanent bladder overdistention along with other complications associated with catheter use, such as urinary tract infection (UTI).[5,6] POUR may lead to prolonged hospitalization and increase the patient's risk of nosocomial complications and overall cost burden.[7] The existing literature is quite variable with regard to risk factors for developing POUR after arthroplasty. Considering the push to increase the volume of same-day or outpatient TJR in many centres around the world, delineating the risk factors for POUR would help the surgeon and the perioperative team improve preoperative assessment and minimize this complication.[8]

To address this knowledge gap, the aim of this meta-analysis was to determine the pooled incidence of POUR following total hip and knee arthroplasty, and to evaluate the risk factors and complications associated with POUR.

Methods

Search strategy and screening

This meta-analysis was carried out in accordance with the Preferred Reporting Items for Systematic reviews and Meta-analyses (PRISMA) statement standards.[9] This review followed a predetermined methodology that was recorded in the Prospective Register of Systematic Reviews (PROSPERO) (CRD42022372290).

Two authors (NJ, MT) conducted searches in PubMed, Embase, Web of Science, and Scopus. The last data update was made in May 2023. The following keywords or associated Medical Subject Headings (MeSHs) were used: "total joint*"[tiab] OR "Arthroplast*"[tiab] OR "Arthroplasty, Replacement"[Mesh] OR "TJA"[tiab] OR "THA"[tiab] OR "TKA"[tiab] AND "urinary retention*"[tiab] OR "POUR"[tiab] OR "Post operative urinary retention"[tiab]. Please see Supplementary Table i for further descriptions of the search strategy. Studies were screened using Covidence, a web-based software for systematic reviewing.[10] Two authors (NJ, MT) screened each study independently based on the title and abstract, removed duplicates, and reviewed the full text. Eligible studies were selected as per inclusion-exclusion criteria. Any conflicts that arose between reviewers were resolved with the help of consensus meetings presided over by the third author (AA).

Eligibility criteria

Eligible studies that reported the rate of POUR and associated risk factors for patients undergoing total hip and knee arthroplasty were included in the analysis. The following criteria for exclusion were used: 1) insufficient data to estimate odds ratio (OR) or standardized mean difference (SMD); 2) reviews, technique articles, case reports, conference abstracts, animal studies, cadaver studies, and expert-opinion studies; 3) studies with no control group for comparison; and 4) studies including patients undergoing surgeries other than arthroplasty. Of note, no limitations were established regarding the method of POUR diagnosis i.e. all methods were included.

Data extraction and quality assessment

Data were extracted after reviewing the full texts of the included studies, which consisted of basic information such as author and year of publication, nationality, study design, sex ratio, age, sample size, and BMI. Potential risk factors for POUR were extracted, which included American Society of Anesthesiologists (ASA) grades, type of arthroplasty, type of anaesthesia, and type of analgesia. Postoperative complications, including blood loss and length of stay, were also collected. Conflicts were resolved by the third reviewer (AA). The Newcastle-Ottawa Scale (NOS) was used for assessing the quality of observational studies.[11] The NOS consists of eight items, which are separated into three categories: selection (representativeness, selection of unexposed subjects, and measurement of exposure), comparability, outcome definition (in the case of cohort studies), and exposure definition (method of evaluation of outcomes, duration, and adequacy of follow-up in the case of case-control studies). The use of a scoring system makes for a semi-quantitative reviewing tool, except for the comparability index (given two marks). The most rigorous studies score up to 1 star per component. The NOS covers scores from 0 to 9 (selection = 4, comparability = 2, and outcome = 3).[12]

Statistical analysis

Stata v. 17.0 (StataCorp, USA) was used to conduct the data analyses. We did not use computation methods to handle missing data. Mean (SD) for continuous variables and n (%) for categorical ones were extracted. Hedges' g SMDs were used to evaluate continuous outcomes.[13] The effect estimate for all categorical data was chosen to be the OR with associated 95% confidence intervals (CIs), generated using the Mantel-Haenszel method. A fixed-effects model or a random-effects model was used to pool study-specific effect sizes, depending on the degree of variability. Heterogeneity was evaluated with the Q-test and the I^2 statistic. I^2 values of 25%, 50%, and 75%, respectively, were considered to represent low, moderate, and high heterogeneity.[14] A fixed-effect model was applied if $p > 0.1$ and $I^2 < 50\%$; otherwise, a random-effects model was applied. By excluding one study at a time and assessing the impact of each study separately, a sensitivity analysis (backward elimination) was also carried out. Egger's test was run to evaluate the publication bias.[15] Galbraith plots were drawn to identify

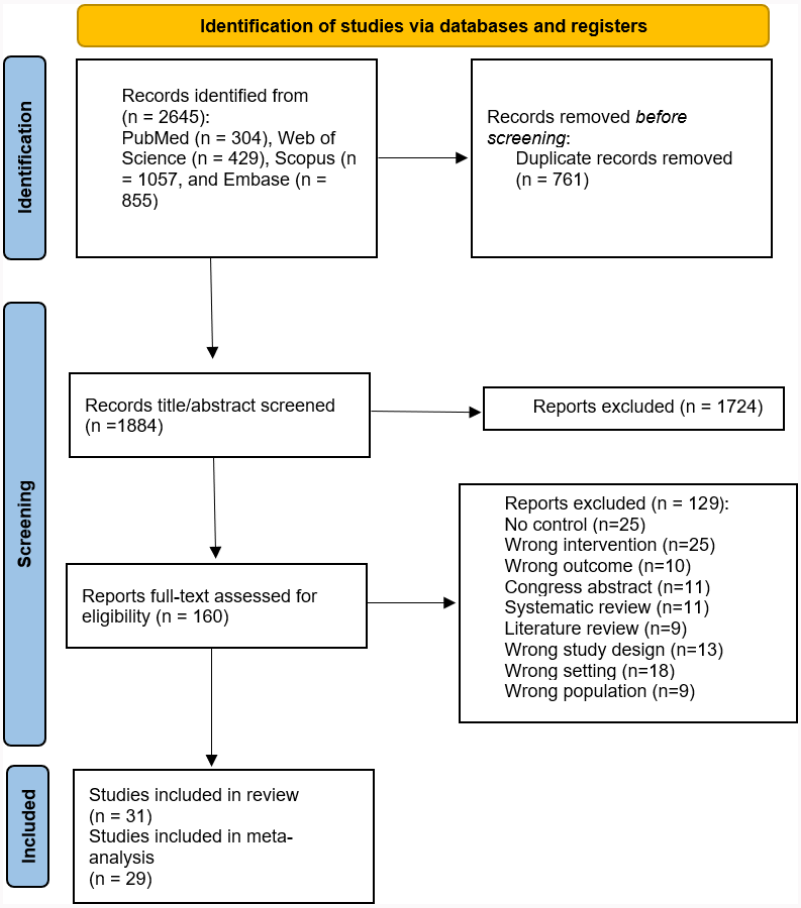

Fig. 1
PRISMA flow diagram.

the source of heterogeneity between studies. A p-value < 0.05 was used to denote statistical significance for all data analyses, except for heterogeneity. All p-values were two-sided.

Results

Study selection

A total of 2,645 studies were found in the initial systematic search of databases, of which 761 duplicates were removed. Next, 1,884 records underwent title/abstract screening, of which 1,724 irrelevant studies were excluded. Full texts of the remaining 160 studies were reviewed, of which 31 met the inclusion criteria and were included in the systematic review. Of these, 29 studies were deemed eligible for meta-analysis (Figure 1). Most of the included studies had a NOS score of 7 or above,[5,7,16–39] with a mean NOS of 7.77 (SD 1.15), denoting a total low risk of bias. Five studies showed a moderate to high risk of bias with the NOS of 5 and 6 (Supplementary Figure a).[40–44]

Baseline characteristics

The meta-analysis included 3,273 patients diagnosed with POUR and 11,583 control patients without POUR following TJR. The pooled incidence of POUR was 28.1%; however, the incidence varied across studies, which may be due to different diagnostic methods: 24.7% using sonography, 38.4% based on postoperative catheterization, and 29.4% based on patient symptoms. Males made up 45% of the POUR population, versus 42.5% of the non-POUR population. The mean ages of POUR and non-POUR patients were 67.6 years (58.9[41] to 79.7[18]) and 65.4 years (55.4[41] to 78.6[29]), respectively. POUR was diagnosed based on three methods in the included studies: sonography postoperative catheterization use, and patient symptoms (Table I).

Risk factors of POUR following TJR

Table II summarizes our results of marked statistical importance. The following demographic factors were calculated to be risk factors in POUR patients (Supplementary Tables ii, iii, and iv): male sex (OR 1.81, 95% CI 1.26 to 2.59) (Figure 2), increasing age (SMD 0.16, 95% CI 0.04 to 0.27) (Figure 3), and lower BMI (SMD -0.13, 95% CI -0.20 to -0.06) (Figure 4). After the elimination of studies found to be the sources of heterogeneity via the Galbraith plot (Supplementary Figure b),[16,18,21–24,35] male sex remained a risk factor for POUR (OR 1.44, 95% CI 1.19 to 2.39) (Supplementary Figure c).

ASA grade 3 to 4 (OR 1.39, 95% CI 1.10 to 1.77) and mean preoperative International Prostate Symptom Score (IPSS)[4] (SMD 0.13, 95% CI 0.02 to 0.24) were significant risk factors for POUR. History of benign prostatic hyperplasia (BPH) (OR 1.99, 95% CI 1.41 to 2.83), UTI (OR 2.65, 95% CI 1.20 to 5.85), urological disease (OR 3.27, 95% CI 1.05 to 10.15), and retention (OR 3.10, 95% CI 1.58 to 6.06) were significant risk factors for POUR (Figure 5). History of diabetes (Supplementary Figure d), hypertension

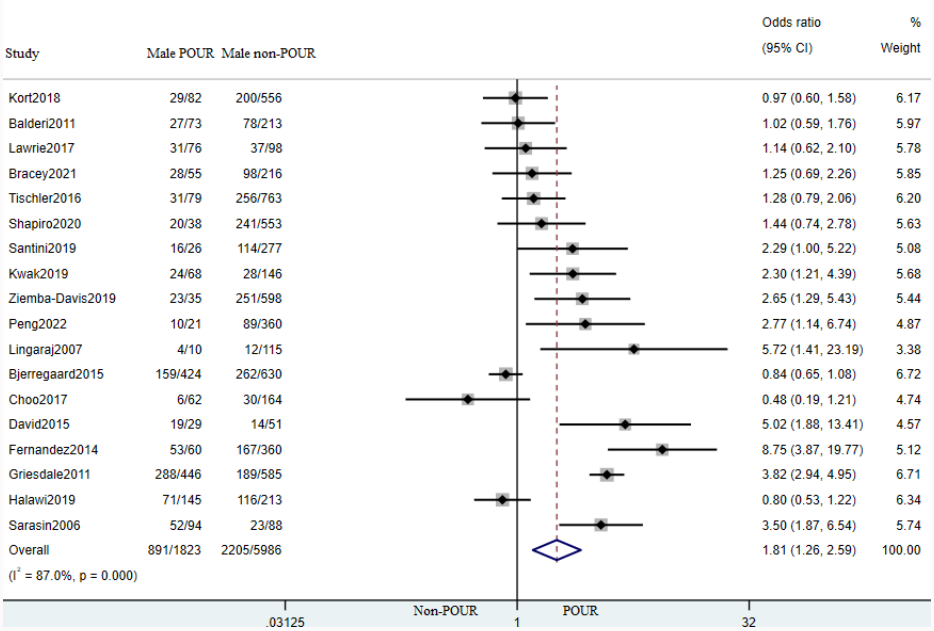

Fig. 2
Male sex as a risk factor of postoperative urinary retention (POUR) following total joint replacement.

(Supplementary Figure e), and smoking (Supplementary Figure f) were not risk factors for POUR.

Greater intraoperative fluid infusion (IFI) (SMD 0.19, 95% CI 0.07 to 0.31), spinal anaesthesia (OR 1.44, 95% CI 1.19 to 1.74), and postoperative epidural analgesia (OR 2.82, 95% CI 1.65 to 4.82) were risk factors for POUR (Figure 6). THA was associated with higher odds of POUR compared to TKA (OR 1.10, 95% CI 1.02 to 1.20). Postoperatively, POUR was associated with a longer length of stay (LOS) (SMD 0.21, 95% CI 0.02 to 0.39) (Figure 7).

Operating time (Supplementary Figure g), intraoperative blood loss (Supplementary Figure h), general anaesthesia (Supplementary Figure i), use of patient-controlled analgesia (PCA) (Supplementary Figure j), and epidural anaesthesia (Supplementary Figure k) were not risk factors for POUR.

Publication bias

Publication bias was gauged based on the risk factor containing the highest number of studies, which was male sex. No publication bias was detected, according to funnel plot asymmetry and Egger's test (p = 0.074) (Supplementary Figure l).

Discussion

The present systematic review and meta-analysis demonstrated that the pooled incidence of POUR after TJR was 28.1%. Our findings further revealed that various demographic (male sex, increasing age), comorbid (preoperative prostate dysfunction such as BPH), and surgical factors (spinal anaesthesia and postoperative epidural analgesia) were associated with a higher risk of developing POUR.

Male sex and increasing age were noteworthy risk factors for POUR. The detrusor muscles undergo a variety of neurogenic and myogenic alterations as people age, which may reduce their ability to contract and exert pressure, ultimately leading to urine retention.[38] A loss in muscular mass would also make older patients more sensitive to tiredness and postoperative discomfort, which could lead to void depression.[32] With regard to the moderate heterogeneity in the studies that identified male sex as a risk factor, variations in patient characteristics (small sample size,[35] different definitions of POUR (different cut-offs for sonography > 200 ml,[39] > 600 mL),[28] surgical techniques (fast-track TJR setting),[16,24] and postoperative care (six different surgeons)[21,22] between studies may have contributed to this observed heterogeneity. The diagnosis of POUR based on patient symptoms is subjective and unreliable.[18] Studies that utilize fast-track discharge protocols and outpatient TJR raise the additional concern of underestimating the true rate of POUR. This may lead to complications of retention in an unmonitored environment, unnecessary referrals to the emergency department, or readmissions that may not be captured in the meta-analysis.[45]

A history of urological dysfunction was an expected risk factor for POUR. Prostatic hypertrophy leads to compression of the urethra.[39] These disorders can increase the risk of urine retention in the postoperative period when paired with the effects of anaesthesia and postoperative pain.[46] Another surgical risk factor found in our meta-analysis was THA, which may be due to the positioning of the patient on their side with their legs in a flexed and abducted position, which can put pressure on the bladder and make it harder to empty completely.[16] In contrast, during TKA, patients are positioned supine with no pressure on their bladder, which may be less likely to cause urinary retention.[16,17]

Increased operative duration in TJR is a noted risk factor for POUR, with a 25% increased risk of developing POUR for every additional 15 minutes spent in the operating theatre.[38] Although operating time did not differ between cases and controls, it should be remembered that operating time is also correlated with the surgeon's level of experience, which could theoretically lead to between-study variation. In surgeries of longer duration, more intravenous fluids are expected to be given. A large

Table I. Main demographic characteristics of the included studies.

Study	Country	Design	Group size, n		Male/Female, n		Mean age, yrs (SD)		TJR type		Diagnosis criteria
			POUR	Non-POUR	POUR	Non-POUR	POUR	Non-POUR	TKA	THA	
Abdul-Muhsin 2020[7]	USA	Retrospective cohort	124	1,250	-	-	72.35 (8.27)	68.7 (10.49)	812	562	Sonography
Balderi 2011[5]	Canada	Retrospective cohort	73	213	27/46	78/135	69.3 (9.1)	69.65 (11.2)	153	133	Sonography
Bjerregaard 2015[16]	Denmark	Prospective cohort	424	630	159/265	262/368	68 (16.8)	67 (18.3)	474	580	Postop catheterization use
Bracey 2021[17]	USA	Prospective cohort	55	216	28/27	98/118	63 (8.4)	64.6 (7.6)	271	0	Sonography
Choo 2017[18]	Korea	Prospective cohort	62	164	6/56	30/134	79.7 (10)	69.3 (12.1)	99	127	Patient symptoms
Crain 2021[19]	USA	Retrospective cohort	2,387	7,193	-	-	68.3 (10.7)	64.9 (10.6)	6,535	3,045	Sonography
Cronin 2007[20]	Ireland	Prospective cohort	45	73	45/0	73/0	68.9	63.8	28	90	Patient symptoms
David 2015[21]	UK	Retrospective cohort	29	51	19/10	14/37	-	-	0	80	Sonography
Fernandez 2014[22]	UK	Retrospective cohort	60	360	53/7	167/193	-	-	142	178	Sonography
Griesdale 2011[23]	Canada	Retrospective cohort	446	585	288/158	189/396	61.3 (10.5)	62.2 (10.7)	426	605	Postop catheterization use
Halawi 2019[24]	USA	Retrospective cohort	145	213	71/74	116/97	63.1 (12.7)	60.2 (11.2)	191	187	Sonography
Hamed 2020[40]	UK	Retrospective cohort	38	62	23/15	22/40	-	-	-	-	-
Hejkal 2022[25]	USA	Retrospective cohort	183	1,214	95/88	461/753	69 (15.3)	62 (18.5)	775	622	Sonography
Hollman 2015[26]	Netherlands	Retrospective cohort	150	226	150/0	226/0	68.6 (12.89)	67 (9.89)	0	376	Sonography
Kieffer 2012[27]	UK	Prospective cohort	38	54	38/0	54/0	-	-	55	45	Sonography
Kort 2018[28]	France	Retrospective cohort	82	556	29/53	200/356	68.64 (11.04)	69.42 (8.72)	315	323	Sonography
Kwak 2019[29]	Korea	Retrospective cohort	68	146	24/44	28/118	78.7 (6.7)	78.6 (6.6)	-	214	Sonography
Lawrie 2017[30]	USA	Prospective cohort	76	98	31/45	37/61	67 (11.4)	65.5 (10.6)	0	174	Sonography
Lingaraj 2007[31]	Singapore	Retrospective cohort	10	115	4/6	12/103	-	-	125	0	Postop catheterization use
Mathew 2021[41]	USA	Retrospective cohort	-	-	-	-	58.9	55.4	0	409	Postop catheterization use
Peng 2022[32]	China	Prospective cohort	21	360	11/12	89/271	61.43 (17.02)	61.33 (14.01)	243	138	Sonography
Pivec 2021[33]	USA	Retrospective cohort	13	241	13/0	241/0	-	-	-	-	Sonography
Rana 2016[42]	USA	Retrospective cohort	11	89	-	-	-	-	100	0	Sonography

(*Continued*)

(*Continued*)

Study	Country	Design	Group size, n		Male/Female, n		Mean age, yrs (SD)		TJR type		Diagnosis criteria
Santini 2019[34]	UK	Prospective cohort	26	276	16/10	114/162	-	-	151	151	Postop catheterization use
Sarasin 2006[35]	UK	Prospective cohort	94	87	52/42	23/65	69 (9)	68 (11.1)	92	89	Sonography
Scholten 2017[36]	Netherlands	Prospective cohort	-	-	-	-	-	-	-	-	Sonography
Shapiro 2020[37]	USA	Retrospective cohort	38	553	20/18	241/312	64.1 (10.9)	61.5 (10.9)	382	209	Sonography
Tischler 2016[38]	USA	Prospective cohort	79	763	31/48	256/507	-	-	401	441	Postop catheterization use
Waterhouse 1987[43]	UK	Prospective cohort	11	92	11/0	92/0	68.2	66.3	0	103	Patient symptoms
Williams 1995[44]	UK	Prospective cohort	34	79	-	-	-	-	0	113	Postop catheterization use
Ziemba-Davis 2019[39]	USA	Retrospective cohort	35	598	23/12	251/347	64	62.2	356	277	Sonography

POUR, postoperative urinary retention; THA, total hip arthroplasty; TJR, total joint replacement; TKA, total knee arthroplasty.

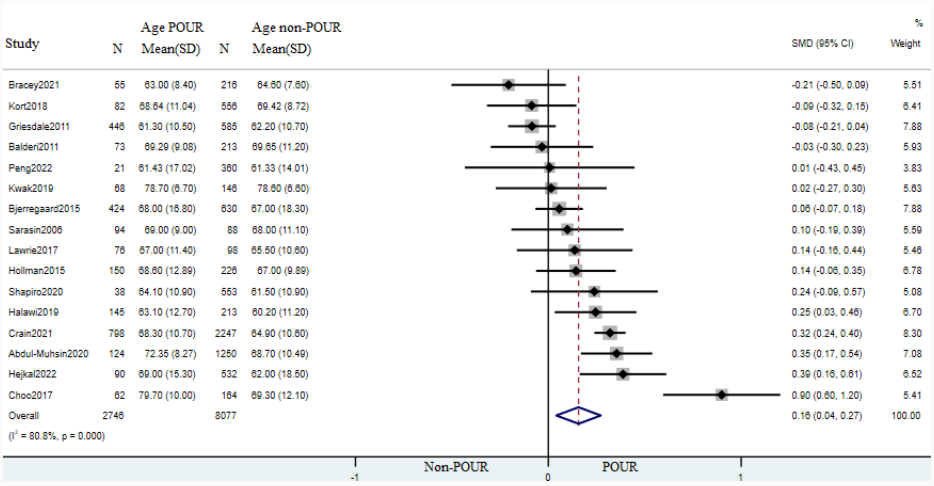

Fig. 3
Age as a risk factor of postoperative urinary retention (POUR) following total joint replacement. SMD, standardized mean difference.

amount of intravenous fluid can cause the detrusors to become less active, which can then result in POUR.[47] Other important surgical factors found in our meta-analysis include anaesthesia and analgesia type. Spinal anaesthesia is a safe and increasingly common anaesthesia used in TJR, but its use often impairs the sensation of bladder fullness.[38] This is consistent with current knowledge on the physiology of the micturition reflex (blocking the nerves that regulate the bladder and urinary sphincter muscles).[16] Postoperatively, the use of epidural analgesia was also a risk factor, as it affected the detrusor activity that is innervated by nerves in the epidural space.[44] On the other hand, general anaesthesia is more commonly used in TKA.[48] PCA as a postoperative analgesic also has fewer direct effects on the nerves innervating the bladder. These may serve to explain why general anaesthesia and PCA use were not significant risk factors for POUR in our meta-analysis.

It should be noted that the results of a few meta-analyses revealed low effect sizes (SMDs and ORs), i.e. certain factors may not be as clinically significant as the statistics tend to show. The associative factors that have been found for POUR after TJR offer clinicians important information on risk assessment prior to surgery, perioperative care, and patient management. While some factors cannot be modified, such as male sex, advancing age, higher ASA grade, history of BPH, UTI, urological disease, and prior urinary retention, their identification enables more customized

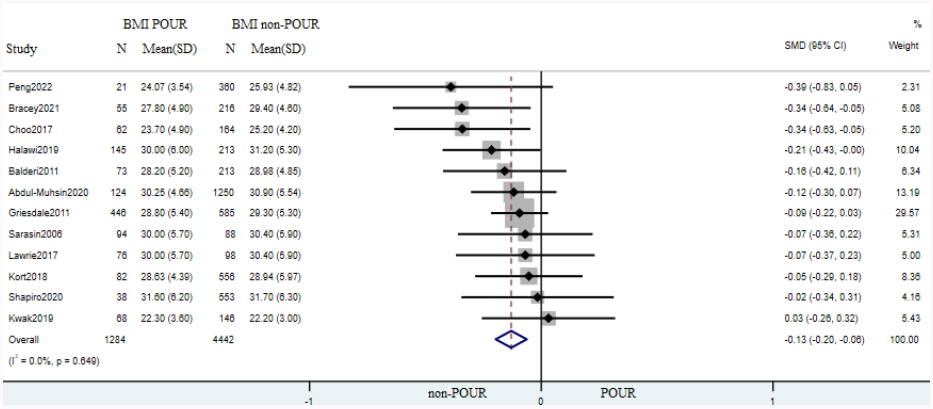

Fig. 4
BMI as a risk factor of postoperative urinary retention (POUR) following total joint replacement. SMD, standardized mean difference.

Table II. Summary of significant associations with postoperative urinary retention.

Variable	Sample size	Results	OR/SMD (CI)
Male	18 studies (n = 7,809)	Increased odds of POUR for male sex	OR 1.81 (1.26 to 2.59); I^2 = 87%; p = 0.001
Age	16 studies (n = 10,823)	SMD in age between patients with vs without POUR of 0.16 years	SMD 0.16 (0.04 to 0.27); I^2 = 80.8%; p = 0.008
BMI	12 studies (n = 5,726)	SMD in BMI between patients without vs with POUR of 0.13 kg/m^2	SMD -0.13 (-0.20 to 0.06); I^2 = 0.0%; p < 0.001
ASA grades 3, 4	10 studies (n = 4,573)	Increased odds of POUR for patients with ASA grade 3 or 4	OR 1.39 (1.10 to 1.77); I^2 = 66.8%; p = 0.006
IPSS	3 studies (n = 1,334)	SMD in IPSS between patients with vs without POUR of 0.13 units	SMD 0.13 (0.02 to 0.24); I^2 = 0.0%; p = 0.023
History of BPH	4 studies (n = 1,856)	BPH is associated with a significantly increased odds of POUR	OR 1.99 (1.41 to 2.83); I^2 = 0.0%; p < 0.001
History of UTI	3 studies (n = 1,874)	Statistically significant increased odds of POUR	OR 2.65 (1.20 to 5.85); I^2 = 0.0%; p = 0.016
History of urological disease	3 studies (n = 1,763)	Statistically significant increased odds of POUR	OR 3.27 (1.05 to 10.15); I^2 = 81.6%; p = 0.041
History of retention	4 studies (n = 2,557)	History of POUR is associated with a significantly increased odds of POUR	OR 3.10 (1.58 to 6.06); I^2 = 0.0%; p = 0.001
IFI	7 studies (n = 2,334)	SMD in millilitres of fluid infused between patients with vs without POUR of 0.19 ml	SMD 0.19 (0.07 to 0.31); I^2 = 76.8%; p = 0.002
Spinal anaesthesia	9 studies (n = 5,775)	Statistically significant increased odds of POUR	OR 1.44 (1.19 to 1.74); I^2 = 66.8%; p < 0.001
Epidural analgesia	3 studies (n = 593)	Increased odds of POUR for epidural analgesia	OR 2.82 (1.65 to 4.82); I^2 = 81.9%; p < 0.001
THA	10 studies (n = 15,374)	Statistically significant increased odds of POUR	OR 1.10 (1.02 to 1.20); I^2 = 80.4%; p = 0.015
Length of stay	7 studies (n = 4,046)	SMD in length of stay was higher in POUR patients at 0.21 days	SMD 0.21 (0.02 to 0.39); I^2 = 78.2%; p = 0.027

ASA, American Society of Anesthesiologists; BPH, benign prostatic hyperplasia; IFI, intraoperative fluid infusion; IPSS, International Prostate Symptom Score; OR, odds ratio; POUR, postoperative urinary retention; SMD, standardized mean difference; THA, total hip arthroplasty; UTI, urinary tract infection.

perioperative planning. Furthermore, the correlation between POUR and surgery-related factors, such as increased intraoperative fluid infusion, spinal anaesthesia, and postoperative epidural analgesia, emphasizes the significance of optimizing preventive management strategies, such as judicious fluid management, tailored anaesthetic techniques, and proactive postoperative monitoring. That said, these risk factors can act as indicators for the employment of preventive interventions, such as tamsulosin.[49]

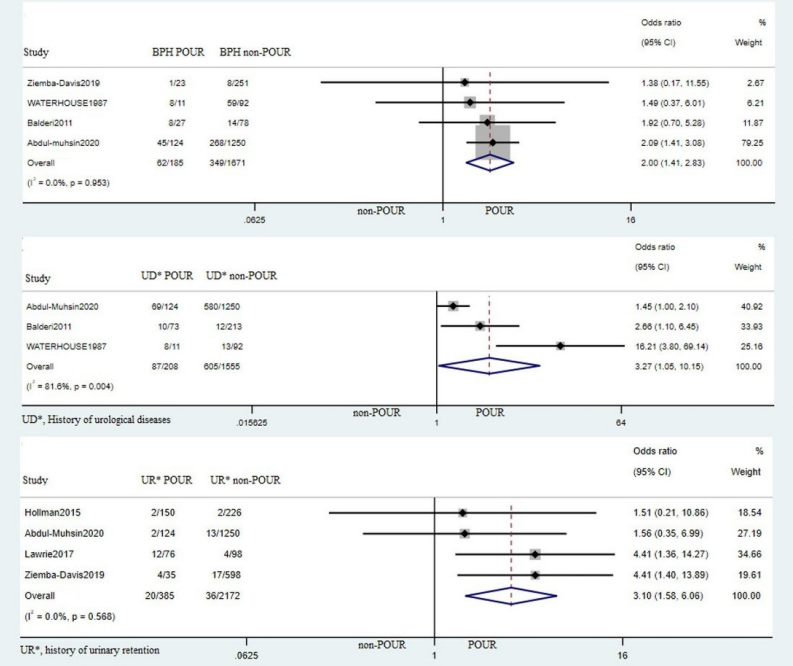

Fig. 5

History of benign prostatic hyperplasia (BPH), urological diseases (UD), and urinary retention (UR) were risk factors of postoperative urinary retention (POUR) following total joint replacement. CI, confidence interval.

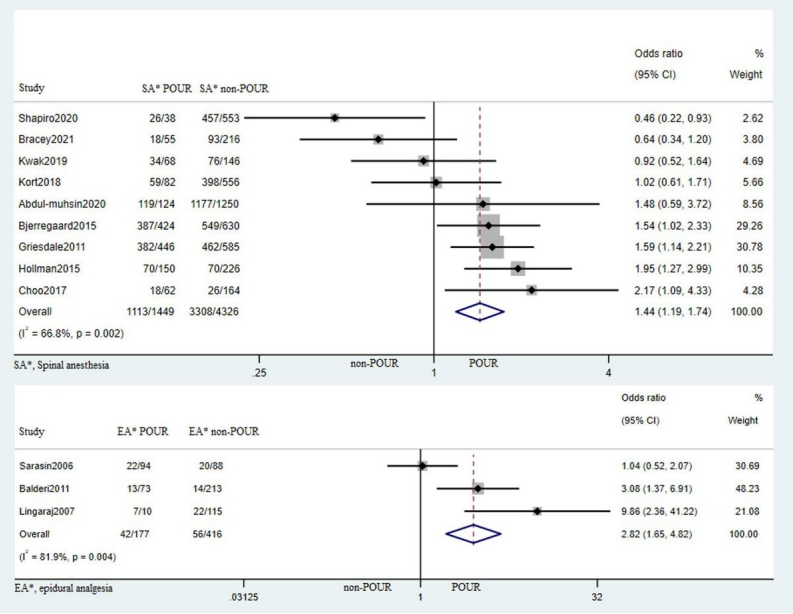

Fig. 6

Spinal anaesthesia (SA) and epidural analgesia (EA) were risk factors of postoperative urinary retention (POUR) following total joint replacement. CI, confidence interval.

The present study has several limitations that must be addressed. First, different methods of diagnosis for POUR precipitated shifts in the conclusion of our analysis. Moreover, different cut-offs for sonographic diagnosis raised substantial heterogeneity. The second limitation is that our meta-analysis was limited by the quality of the available studies. The lack of available randomized controlled trials or high-level comparative studies introduces potential sources of bias due to confounding factors. The third limitation is that many risk factors were not presented in all the included studies, which should be addressed in future studies on this topic. Lastly, various post-TJR patient-care protocols placed across studies limited our interpretation of the treatment course of POUR. The strength of our study is the large sample size of included studies and patients in the meta-analysis.

In conclusion, our meta-analysis found a pooled incidence of 28.1% for POUR after TJR. We identified numerous key risk variables for postoperative urine retention following

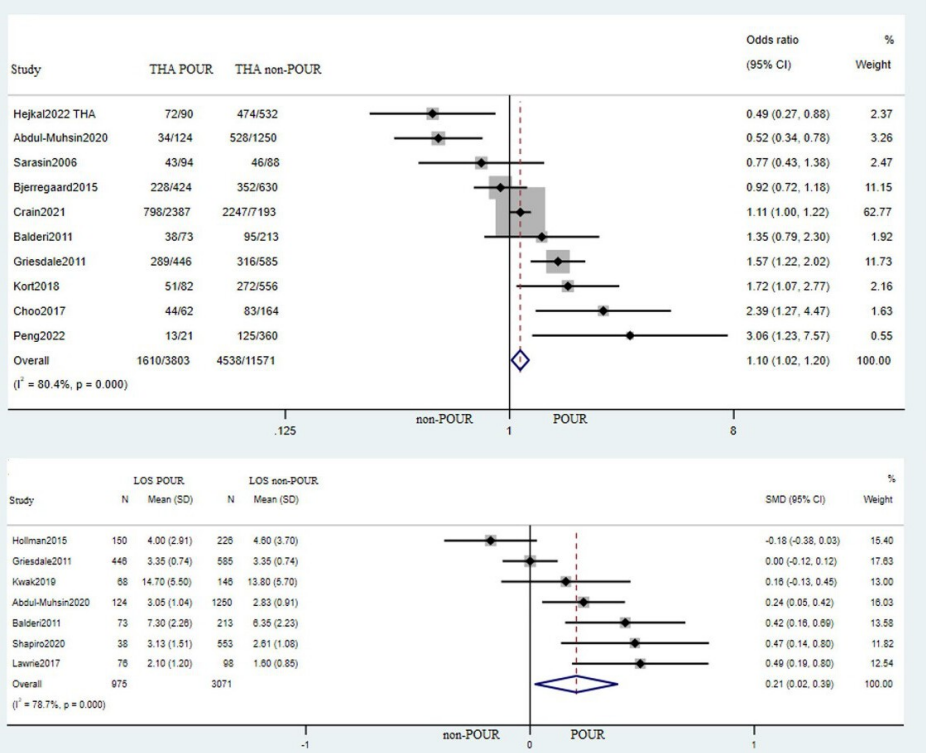

Fig. 7
Total hip arthroplasty (THA) was a risk factor of postoperative urinary retention (POUR) following total joint replacement. Postoperatively, POUR was associated with longer length of stay (LOS). CI, confidence interval; SD, standard deviation; SMD, standardized mean difference.

arthroplasty, including male sex, advanced age, a history of benign prostatic hyperplasia, undergoing THA, and the use of spinal anaesthesia and epidural analgesia. These results can influence surgeons to identify at-risk patients and direct patient-centred pathways to minimize this complication following TJR.

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Supplementary material

Descriptions of the search strategy and data tables for the evaluated risk factors.

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Data sharing
The datasets generated and analyzed in the current study are not publicly available due to data protection regulations. Access to data is limited to the researchers who have obtained permission for data processing. Further inquiries can be made to the corresponding author.

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