

Bone & Joint Open



Supplementary Material

10.1302/2633-1462.57.BJO-2024-0009.R1

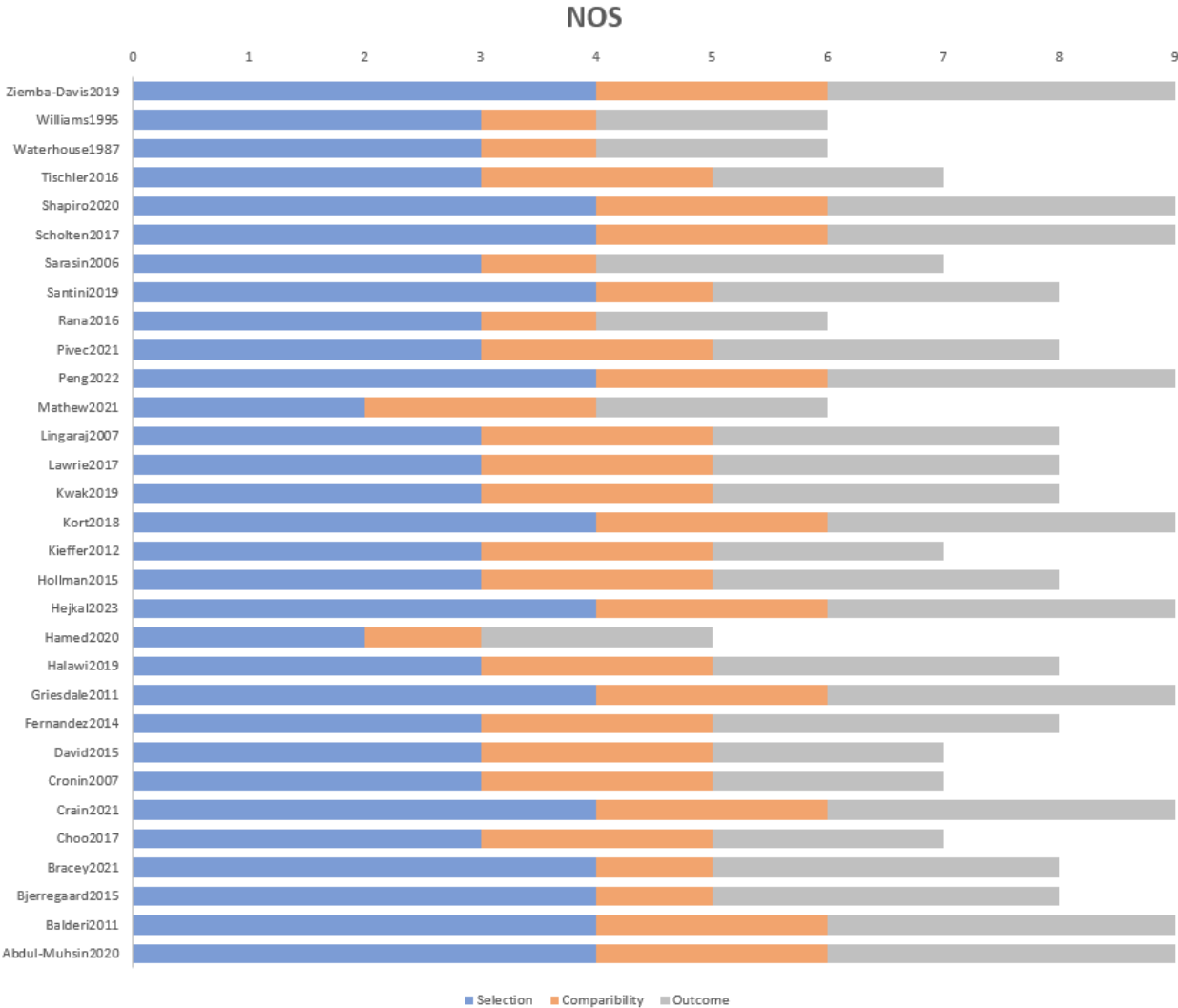


Fig a. Newcastle-Ottawa scale (NOS) stacked bar.

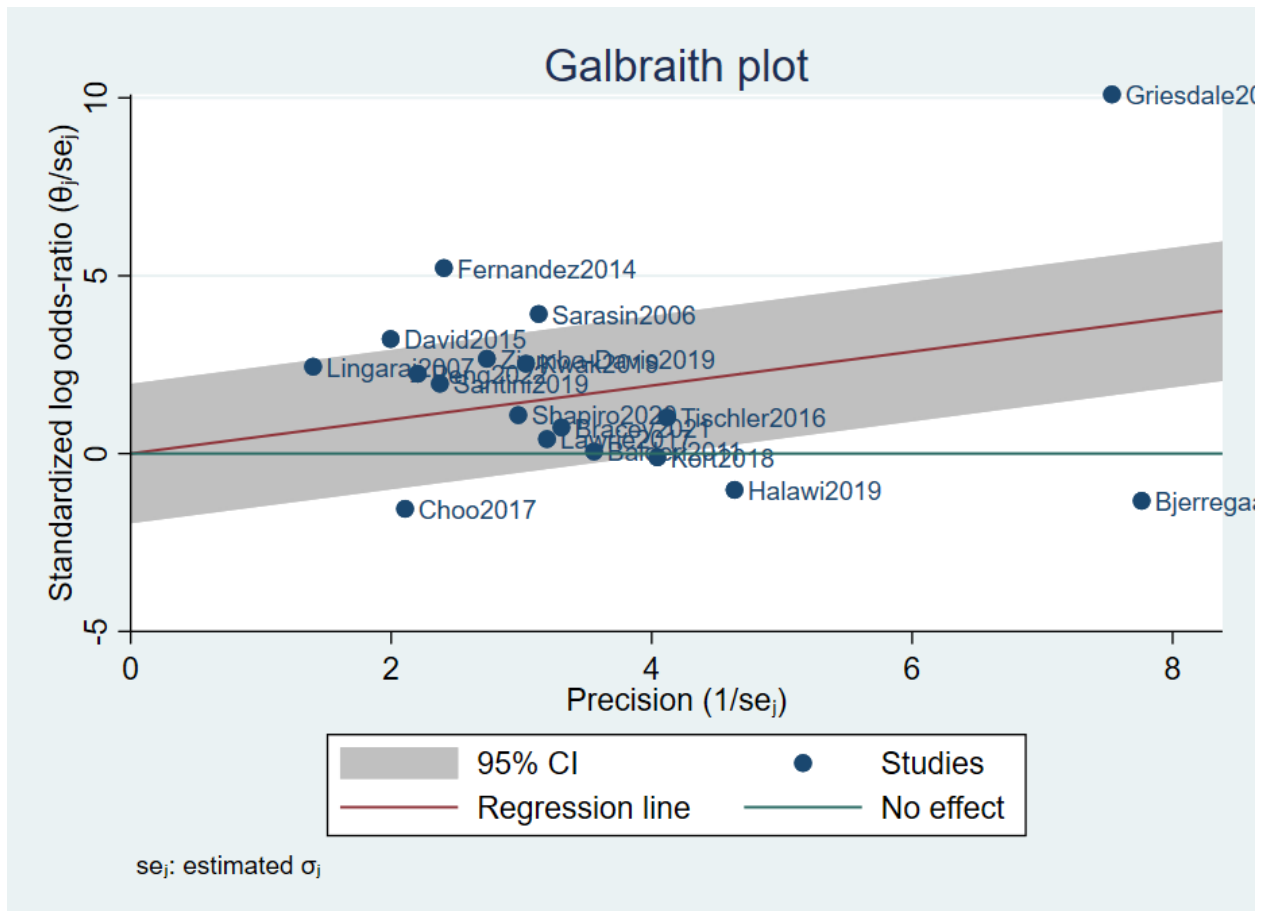


Fig b. Male risk of postoperative urinary retention following total joint replacement Galbraith plot. CI, confidence interval.

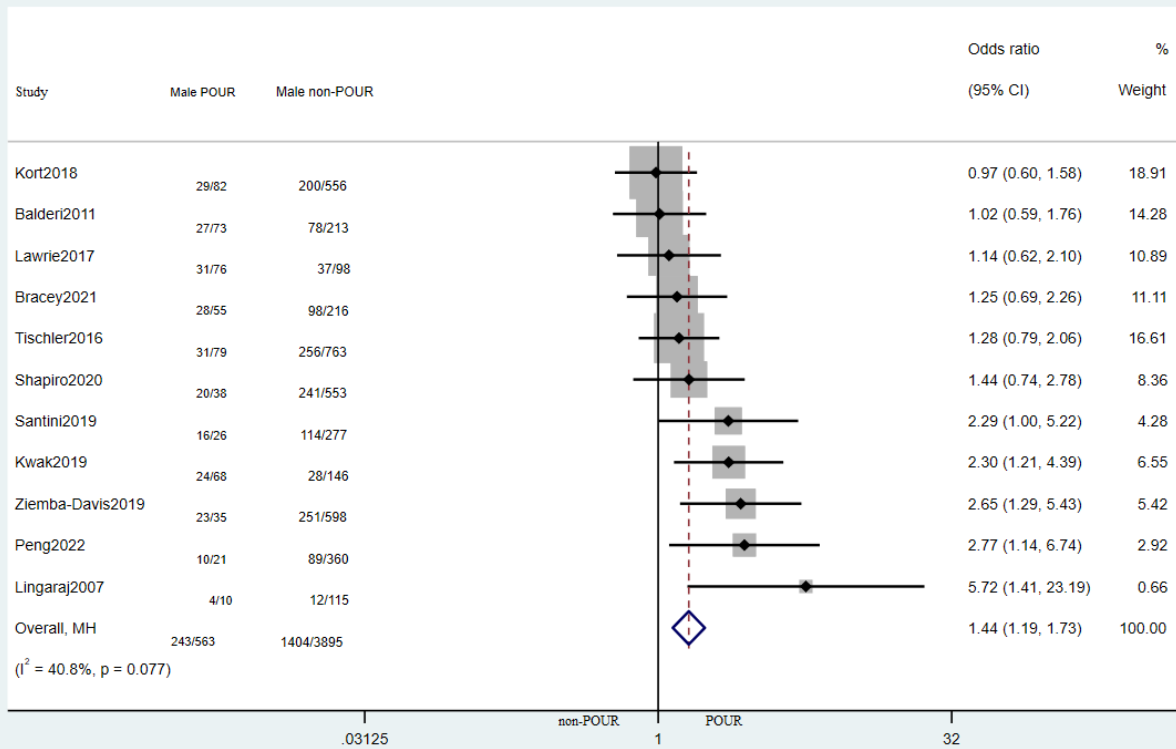


Fig c. Male risk factor of postoperative urinary retention (POUR) following total joint replacement forest plot after the elimination of heterogeneity-causing studies. CI, confidence interval; MH, Mantel–Haenszel.

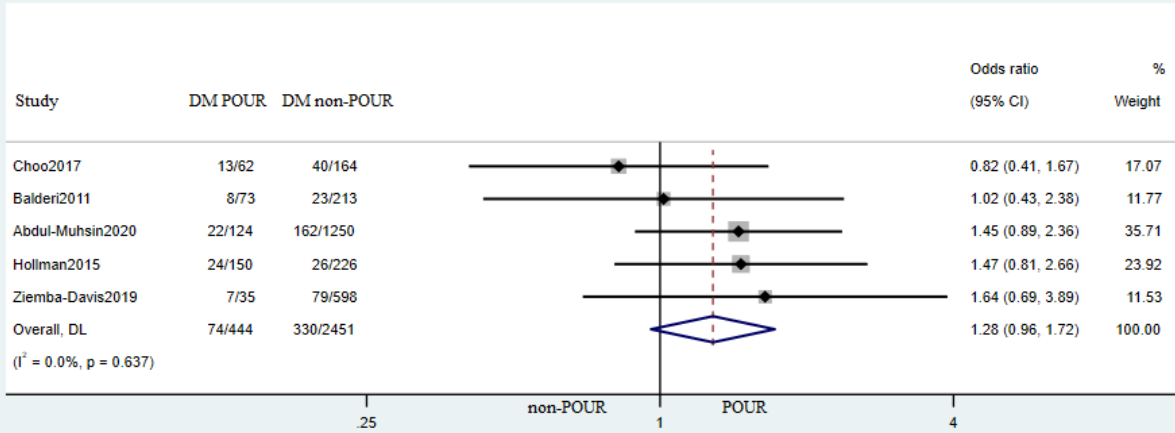


Fig d. History of diabetes mellitus was not a risk factor of postoperative urinary retention (POUR) following total joint replacement, overall odds ratio 1.27 (95% confidence interval (CI) 0.95 to 1.70).

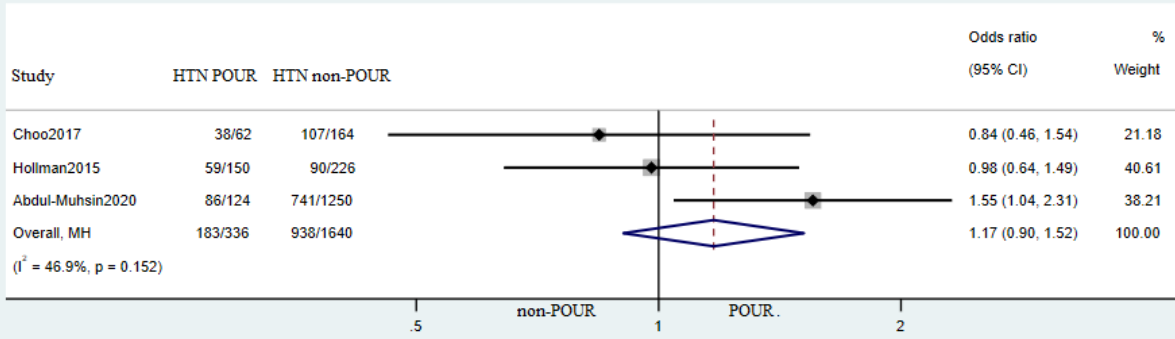


Fig e. History of hypertension (HTN) was not a risk factor of postoperative urinary retention (POUR) following total joint replacement, overall odds ratio 1.17 (95% confidence interval (CI) 0.90 to 1.52). MH, Mantel–Haenszel.

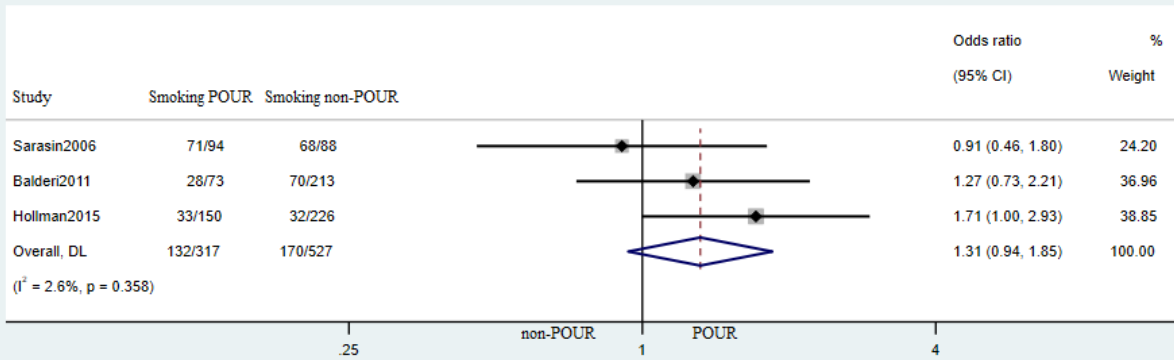


Fig f. History of smoking was not a risk factor of postoperative urinary retention (POUR) following total joint replacement, overall odds ratio 1.00 (95% confidence interval (CI) 0.79 to 1.28).

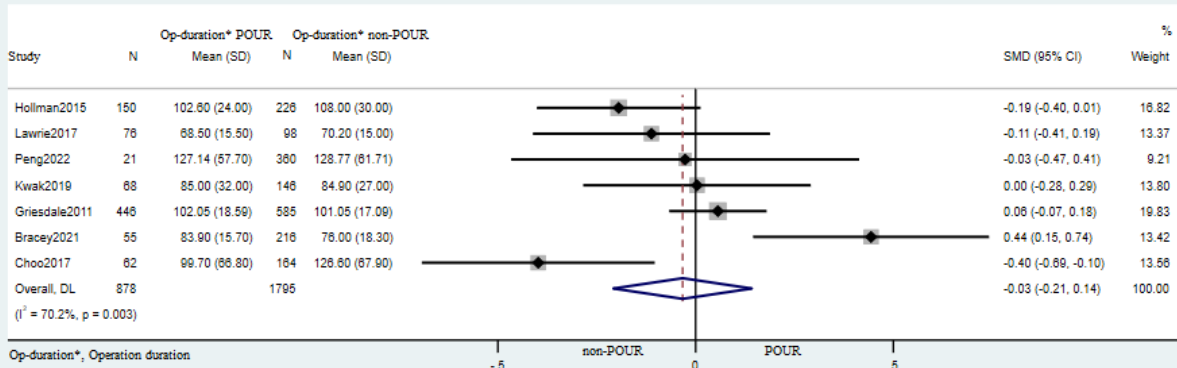


Fig g. Operating time was not a risk factor of postoperative urinary retention (POUR) following total joint replacement, overall standardized mean difference (SMD) -0.03 (95% confidence interval (CI) -0.21 to 0.14).

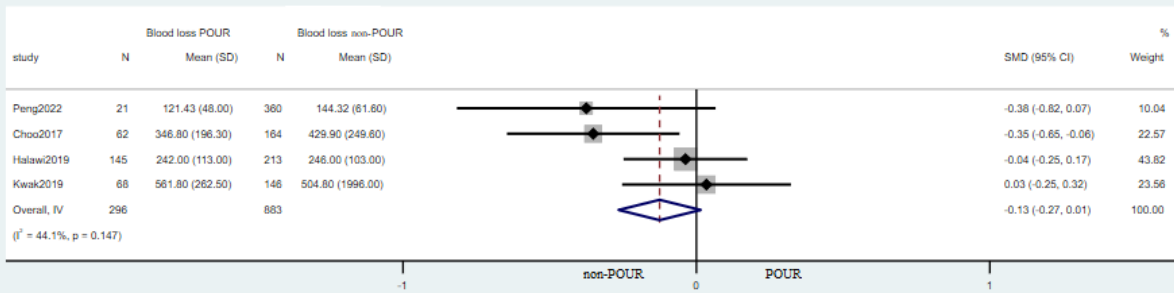


Fig h. Intraoperative blood loss was not a risk factor of postoperative urinary retention (POUR) following total joint replacement, overall standardized mean difference (SMD) - 0.13 (95% confidence interval (CI) -0.27 to 0.01). SD, standard deviation.

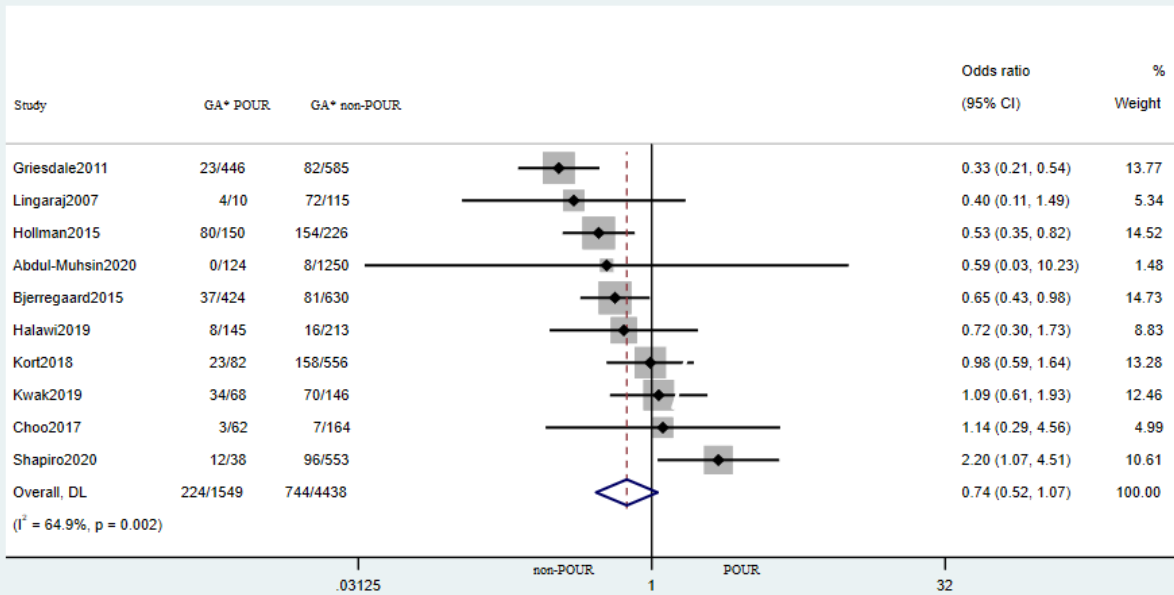


Fig i. General anaesthesia (GA) was not a risk factor of postoperative urinary retention (POUR) following total joint replacement, overall odds ratio 0.74 (95% confidence interval (CI) 0.52 to 1.07).

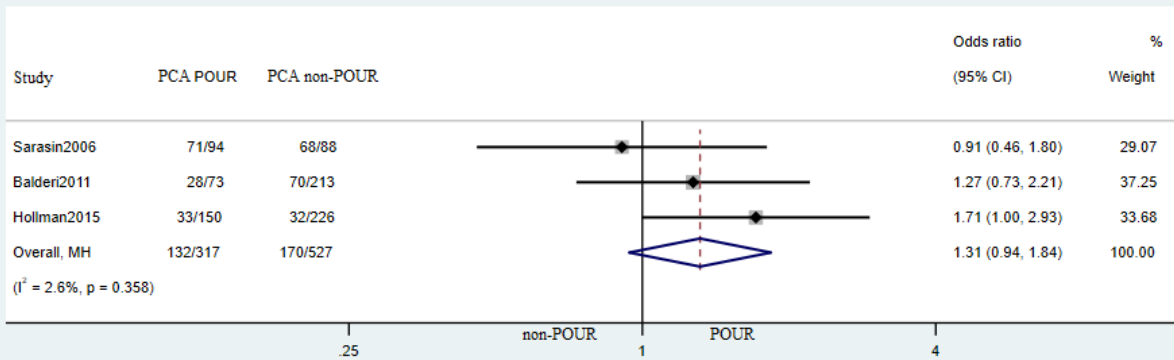


Fig j. Patient-controlled analgesia (PCA) was not a risk factor of postoperative urinary retention (POUR) following total joint replacement, overall odds ratio 1.31 (95% confidence interval (CI) 0.94 to 1.81). MH, Mantel-Haenszel.

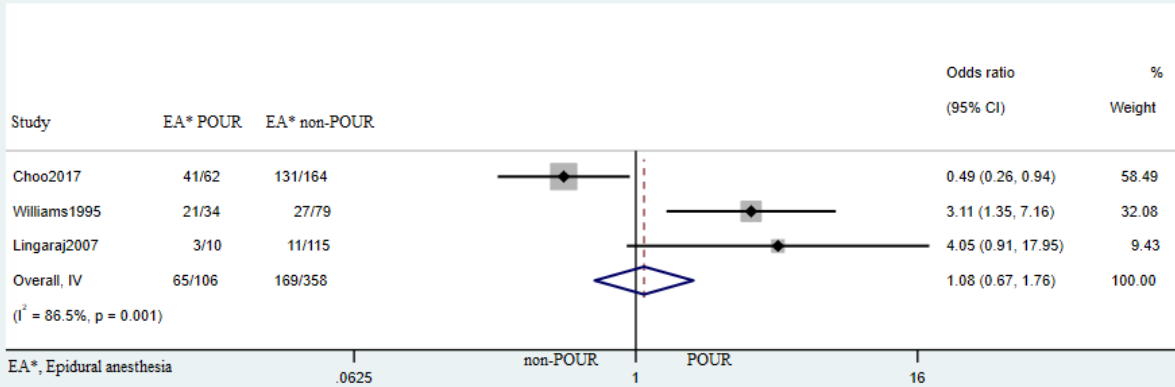


Fig k. Epidural anesthesia (EA) was not a risk factor of postoperative urinary retention (POUR) following total joint replacement, overall odds ratio 1.70 (95% confidence interval (CI) 0.40 to 7.26).

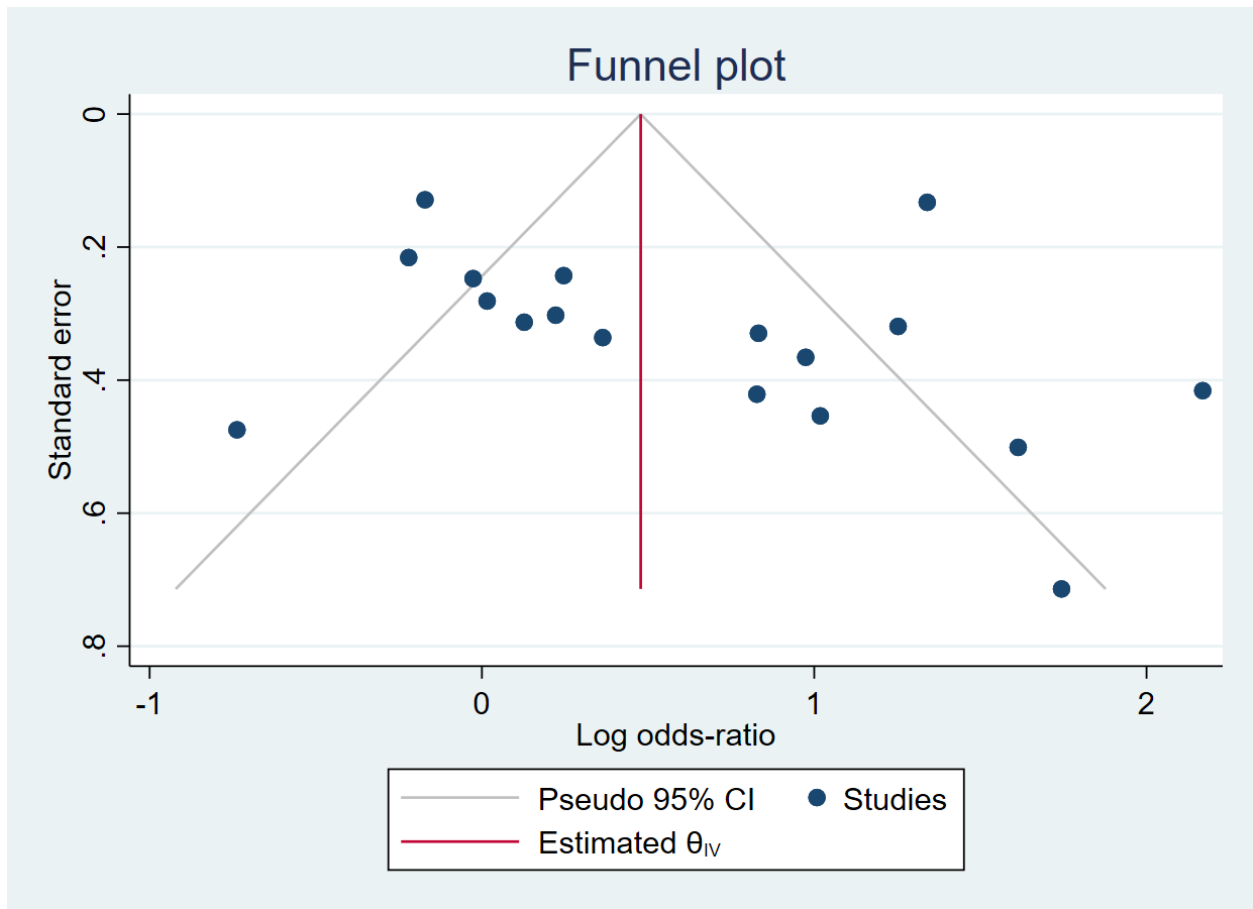


Fig I. Funnel plot for male risk factor of postoperative urinary retention (POUR) following total joint replacement. CI, confidence interval.

Table i. Search strategy for each database.

Database	Search query	Results
PubMed	(("total joint*" [tiab] OR "Joint Replac*" [tiab] OR "Joint Reconstruct*" [tiab] OR "joint prosthe*" [tiab] OR "Arthroplast*" [tiab] OR "Arthroplasty, Replacement" [Mesh] OR "Joint Prosthesis" [Mesh] OR "prosthetic joint*" [tiab] OR "TJA" [tiab] OR "Arthroplasty, Replacement, Ankle" [Mesh] OR "total ankle arthroplast*" [tiab] OR "total ankle replac*" [tiab] OR "TAA" [tiab] OR "TAR" [tiab] OR "Arthroplasty, Replacement, Shoulder" [Mesh] OR "total shoulder arthroplast*" [tiab] OR "total shoulder replac*" [tiab] OR "TSA" [tiab] OR "TSR" [tiab] OR "Arthroplasty, Replacement, Hip" [Mesh] OR "total hip arthroplast*" [tiab] OR "total hip replac*" [tiab] OR "THA" [tiab] OR "THR" [tiab] OR "Arthroplasty, Replacement, Knee" [Mesh] OR "total knee arthroplast*" [tiab] OR "total knee replac*" [tiab] OR "TKA" [tiab] OR "TKR" [tiab] OR "Arthroplasty, Replacement, Elbow" [Mesh] OR "total elbow arthroplast*" [tiab] OR "total elbow replac*" [tiab] OR "TEA" [tiab] OR "TER" [tiab]) AND ("urinary retention*" [tiab] OR "urinary retention" [Mesh] OR "POUR" [tiab] OR "Post operative urinary retention" [tiab] OR "Postoperative urinary retention" [tiab] OR "Post-operative urinary retention" [tiab] OR "UR" [tiab] OR "PUR" [tiab] OR "acute retention*" [tiab] OR "bladder distent*" [tiab]))	304
Web of Science	TS=("total joint*" OR "Joint Replac*" OR "Joint Reconstruct*" OR "joint prosthe*" OR "Arthroplast*" OR "Arthroplasty, Replacement" OR "Joint Prosthesis" OR "prosthetic joint*" OR "TJA" OR "Arthroplasty, Replacement, Ankle" OR "total ankle arthroplast*" OR "total ankle replac*" OR "TAA" OR "TAR" OR "Arthroplasty, Replacement, Shoulder" OR "total shoulder arthroplast*" OR "total shoulder replac*" OR "TSA" OR "TSR" OR "Arthroplasty, Replacement, Hip" OR "total hip arthroplast*" OR "total hip replac*" OR "THA" OR "THR" OR "Arthroplasty, Replacement, Knee" OR "total knee arthroplast*" OR "total knee replac*" OR "TKA" OR "TKR" OR "Arthroplasty, Replacement, Elbow" OR "total elbow arthroplast*" OR "total elbow replac*" OR "TEA" OR "TER") AND TS=("urinary retention*" OR "urinary retention" OR "POUR" OR "Post operative urinary retention" OR "Postoperative urinary retention" OR "Post-operative urinary retention" OR "UR" OR "PUR" OR "acute retention*" OR "bladder distent*")	429
Scopus	(TITLE-ABS-KEY("total joint*" OR "Joint Replac*" OR "Joint Reconstruct*" OR "joint prosthe*" OR "Arthroplast*" OR "Arthroplasty, Replacement" OR "Joint Prosthesis" OR "prosthetic joint*" OR "Arthroplasty, Replacement, Ankle" OR "total ankle arthroplast*" OR "total ankle replac*" OR "Arthroplasty, Replacement, Shoulder" OR "total shoulder arthroplast*" OR "total shoulder replac*" OR "Arthroplasty, Replacement, Hip" OR "total hip arthroplast*" OR "total hip replac*" OR "Arthroplasty,	1,057

	<p>Replacement, Knee" OR "total knee arthroplast*" OR "total knee replac*" OR "Arthroplasty, Replacement, Elbow" OR "total elbow arthroplast*" OR "total elbow replac*" OR "TJA" OR "TAA" OR "TAR" OR "TSA" OR "TSR" OR "THA" OR "THR" OR "TKA" OR "TKR" OR "TEA" OR "TER")) AND (TITLE-ABS-KEY("urinary retention*" OR "urinary retention" OR "POUR" OR "Post operative urinary retention" OR "Postoperative urinary retention" OR "Post-operative urinary retention" OR "UR" OR "PUR" OR "acute retention*" OR "bladder distent*"))</p>	
<p>Embase</p>	<p>('total shoulder arthroplasty'/exp OR 'total knee prosthesis'/exp OR 'total hip prosthesis'/exp OR 'total hip replacement'/exp OR 'total knee arthroplasty'/exp OR 'joint arthroplasty'/exp OR 'total joint arthroplasty'/exp OR 'total arthroplasty'/exp OR "total joint*":ti,ab,kw OR "Joint Replac*":ti,ab,kw OR "Joint Reconstruct*":ti,ab,kw OR "joint prosthe*":ti,ab,kw OR "Arthroplast*":ti,ab,kw OR 'replacement arthroplasty'/exp OR 'joint prosthesis'/exp OR "prosthetic joint*":ti,ab,kw OR "TJA":ti,ab,kw OR 'ankle replacement '/exp OR "total ankle arthroplast*":ti,ab,kw OR "total ankle replac*":ti,ab,kw OR "TAA":ti,ab,kw OR "TAR":ti,ab,kw OR 'shoulder replacement arthroplasty'/exp OR "total shoulder arthroplast*":ti,ab,kw OR "total shoulder replac*":ti,ab,kw OR "TSA":ti,ab,kw OR "TSR":ti,ab,kw OR 'hip replacement'/exp OR "total hip arthroplast*":ti,ab,kw OR "total hip replac*":ti,ab,kw OR "THA":ti,ab,kw OR "THR":ti,ab,kw OR 'knee replacement'/exp OR "total knee arthroplast*":ti,ab,kw OR "total knee replac*":ti,ab,kw OR "TKA":ti,ab,kw OR "TKR":ti,ab,kw OR 'elbow replacement'/exp OR "total elbow arthroplast*":ti,ab,kw OR "total elbow replac*":ti,ab,kw OR "TEA":ti,ab,kw OR "TER":ti,ab,kw) AND ('bladder distension'/exp OR 'postoperative urinary retention'/exp OR "urinary retention*":ti,ab,kw OR 'urine retention'/exp OR "POUR":ti,ab,kw OR "Post operative urinary retention":ti,ab,kw OR "Postoperative urinary retention":ti,ab,kw OR "Post-operative urinary retention":ti,ab,kw OR "UR":ti,ab,kw OR "PUR":ti,ab,kw OR "acute retention*":ti,ab,kw OR "bladder distent*":ti,ab,kw)</p>	<p>855</p>

Table ii. Pooled data on demographic risk factors of postoperative urinary retention following total joint replacement.

Study	Groups	Male	Age, yrs (SD)	BMI (SD)	ASA grade 3 or 4	IPSS (SD)	IPSS (19 to 35)
Balderi 2011	POUR	27	69.2947 (9.0754)	28.2(5.2)	28	NM	NM
	Non-POUR	78	69.6491 (11.1959)	28.98(4.85)	56	NM	NM
Bjerregaard 2015	POUR	159	68 (16.8)	NM	NM	7.3505 (6.6947)	26
	Non-POUR	262	67 (18.3)	NM	NM	6.7006 (5.9442)	44
Bracey 2021	POUR	28	63 (8.4)	27.8 (4.9)	11	NM	NM
	Non-POUR	98	64.6 (7.6)	29.4 (4.6)	82	NM	NM
Choo 2017	POUR	6	79.7 (10)	23.7 (4.9)	21	NM	NM
	Non-POUR	30	69.3 (12.1)	25.2 (4.2)	26	NM	NM
Cronin 2007	POUR	NM	NM	NM	NM	NM	4
	Non-POUR	NM	NM	NM	NM	NM	0
David 2015	POUR	19	NM	NM	NM	NM	NM
	Non-POUR	14	NM	NM	NM	NM	NM
Fernandez 2014	POUR	53	NM	NM	NM	NM	NM
	Non-POUR	167	NM	NM	NM	NM	NM
Griesdale 2011	POUR	288	61.3 (10.5)	28.8(5.4)	NM	NM	NM
	Non-POUR	189	62.2 (10.7)	29.3(5.3)	NM	NM	NM
Halawi 2019	POUR	71	63.1 (12.7)	30 (6)	NM	NM	NM
	Non-POUR	116	60.2 (11.2)	31.2 (5.3)	NM	NM	NM
Hejkal 2022	POUR	NM	69 (15.3)	NM		NM	NM
	Non-POUR	NM	62 (18.5)	NM		NM	NM
Hollman 2015	POUR	NM	68.6 (12.89)	NM	15	NM	NM
	Non-POUR	NM	67 (9.89)	NM	19	NM	NM
Kieffer 2012	POUR	NM	NM	NM	NM	NM	5
	Non-POUR	NM	NM	NM	NM	NM	1

Kort 2018	POUR	29	68.64 (11.04)	28.63 (4.39)	5	NM	NM
	Non-POUR	200	69.42 (8.72)	28.94 (5.97)	20	NM	NM
Kwak 2019	POUR	24	78.7 (6.7)	22.3 (3.6)	57	NM	NM
	Non-POUR	28	78.6 (6.6)	22.2 (3)	120	NM	NM
Lawrie 2017	POUR	31	67 (11.4)	30 (5.7)	59	NM	NM
	Non-POUR	37	65.5 (10.6)	30.4 (5.9)	68	NM	NM
Lingaraj 2007	POUR	4	NM	NM	NM	NM	NM
	Non-POUR	12	NM	NM	NM	NM	NM
Peng 2022	POUR	10	61.43 (17.019)	24.0709 (3.54283)	10	2.14 (2.193)	NM
	Non-POUR	89	61.33 (14.011)	25.928 (4.81865)	51	1.54 (1.905)	NM
Santini 2019	POUR	16	NM	NM	NM	NM	23
	Non-POUR	114	NM	NM	NM	NM	22
Sarasin 2006	POUR	52	69 (9)	30 (5.7)	NM	7(6	NM
	Non-POUR	23	68 (11.1)	30.4 (5.9)	NM	5.5 (5.8)	NM
Shapiro 2020	POUR	20	64.1 (10.9)	31.6 (6.2)	NM	NM	NM
	Non-POUR	241	61.5 (10.9)	31.7 (6.3)	NM	NM	NM
Tischler 2016	POUR	31	NM	NM	NM	NM	NM
	Non-POUR	256	NM	NM	NM	NM	NM
Ziemba-Davis 2019	POUR	23	NM	NM	19	NM	NM
	Non-POUR	251	NM	NM	316	NM	NM

ASA, American Society of Anesthesiologists; IPSS, International Prostate Symptom Score; NM, not mentioned; POUR, postoperative urinary retention; SD, standard deviation.

Table iii. Pooled data on patient comorbidities of postoperative urinary retention following total joint replacement.

Study	Groups	UTI	History of prostate disease	Urological disease	Diabetes	HTN	History of retention	Smoking
Abdul-Muhsin 2020	POUR	0	45	69	22	86	2	NM
	Non-POUR	1	268	580	162	741	13	NM
Balderi 2011	POUR	7	8	10	8	NM	NM	NM
	Non-POUR	8	14	12	23	NM	NM	NM
Choo 2017	POUR	NM	NM	NM	13	38	NM	NM
	Non-POUR	NM	NM	NM	40	107	NM	NM
Griesdale 2011	POUR	NM	NM	NM	NM	NM	NM	121
	Non-POUR	NM	NM	NM	NM	NM	NM	151
Halawi 2019	POUR	NM	NM	NM	NM	NM	NM	4
	Non-POUR	NM	NM	NM	NM	NM	NM	6
Hollman 2015	POUR	NM	NM	NM	24	59	2	24
	Non-POUR	NM	NM	NM	26	90	2	44
Kwak 2019	POUR	6	NM	NM	NM	NM	NM	NM
	Non-POUR	5	NM	NM	NM	NM	NM	NM
Lawrie 2017	POUR	NM	NM	NM	NM	NM	12	NM
	Non-POUR	NM	NM	NM	NM	NM	4	NM
Waterhouse 1987	POUR	NM	8	8	NM	NM	NM	NM
	Non-POUR	NM	59	13	NM	NM	NM	NM
Ziemba-Davis 2019	POUR	NM	1	NM	7	NM	4	NM
	Non-POUR	NM	8	NM	79	NM	17	NM

HTN, hypertension; NM, not mentioned; POUR, postoperative urinary retention; UTI, urinary tract infection.

Table iv. Pooled data on surgery-related risk factors of postoperative urinary retention following total joint replacement.

Study	Group	THA	General anaesthesia	Spinal anaesthesia	Epidural anaesthesia	Epidural analgesia	PCA	Mean operating time, mins (SD)	Mean IFI, ml (SD)	Mean total estimated blood loss, ml (SD)	Mean LOS, days (SD)
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Abdul-Muhsin 2020	POUR	NM	0	119	NM	NM	NM	NM	NM	NM	3.05 (1.04)
	Non-POUR	NM	8	1177	NM	NM	NM	NM	NM	NM	2.83 (0.91)
Balderi 2011	POUR	38	NM	NM	NM	13	28	NM	1,500 (756.2871)	NM	7.3 (2.26)
	Non-POUR	95	NM	NM	NM	14	70	NM	1,175.4577 (373.1981)	NM	6.35 (2.23)
Bjerregaard 2015	POUR	228	37	387	NM	NM	NM	NM	NM	NM	NM
	Non-POUR	352	81	549	NM	NM	NM	NM	NM	NM	NM
Bracey 2021	POUR	NM	NM	18	NM	NM	NM	83.9 (15.7)	1,134 (487.5)	NM	NM
	Non-POUR	NM	NM	93	NM	NM	NM	76 (18.3)	1,185 (737.5)	NM	NM
Choo 2017	POUR	44	3	18	41	NM	NM	99.7 (66.8)	1,320.1 (882.1)	346.8 (196.3)	NM
	Non-POUR	83	7	26	131	NM	NM	126.6 (67.9)	1,357.5 (711.2)	429.9 (249.6)	NM
Crain 2021	POUR	798	NM	NM	NM	NM	NM	NM	NM	NM	NM
	Non-POUR	2247	NM	NM	NM	NM	NM	NM	NM	NM	NM
Griesdale 2011	POUR	289	23	382	NM	NM	NM	102.0513 (18.5932)	NM	NM	3.3504 (0.7437)
	Non-POUR	316	82	462	NM	NM	NM	101.051 (17.0925)	NM	NM	3.3503 (0.7432)
Halawi 2019	POUR	NM	8	NM	NM	NM	NM	NM	1,500 (519)	242 (113)	NM
	Non-POUR	NM	16	NM	NM	NM	NM	NM	1,284 (453)	246 (103)	NM
Hejkal 2022	POUR	72	NM	NM	NM	NM	NM	NM	NM	NM	NM
	Non-POUR	474	NM	NM	NM	NM	NM	NM	NM	NM	NM
Hollman 2015	POUR	NM	80	70	NM	NM	33	102.6 (24)	NM	NM	4 (2.91)
	Non-POUR	NM	154	70	NM	NM	32	108 (30)	NM	NM	4.6 (3.7)
Kort 2018	POUR	51	23	59	NM	NM	NM	NM	941.89 (367.8)	NM	NM
	Non-POUR	272	158	398	NM	NM	NM	NM	881.49 (343.33)	NM	NM

Kwak 2019	POUR	NM	34	34	NM	NM	NM	85 (32)	NM	561.8 (262.5)	14.7 (5.5)
	Non- POUR	NM	70	76	NM	NM	NM	84.9 (27)	NM	504.8 (199.6)	13.8 (5.7)
Lawrie 2017	POUR	NM	NM	NM	NM	NM	NM	68.5 (15.5)	2,254.9 (689.6)	NM	2.1 (1.2)
	Non- POUR	NM	NM	NM	NM	NM	NM	70.2(15	2,037 (503.4)	NM	1.6 (0.85)
Lingaraj 2007	POUR	NM	4	NM	3	7	NM	NM	NM	NM	NM
	Non- POUR	NM	72	NM	11	22	NM	NM	NM	NM	NM
Peng 2022	POUR	13	NM	NM	NM	NM	NM	127.14 (57.697)	1,690.48 (655.671)	121.43 (47.996)	NM
	Non- POUR	125	NM	NM	NM	NM	NM	128.77 (61.714)	1,777.09 (632.431)	144.32 (61.598)	NM
Sarasin 2006	POUR	43	NM	NM	NM	22	71	NM	NM	NM	NM
	Non- POUR	46	NM	NM	NM	20	68	NM	NM	NM	NM
Shapiro 2020	POUR	NM	12	26	NM	NM	NM	NM	NM	NM	3.13 (1.51)
	Non- POUR	NM	96	457	NM	NM	NM	NM	NM	NM	2.61 (1.08)
Williams 1995	POUR	NM	NM	NM	21	NM	NM	NM	NM	NM	NM
	Non- POUR	NM	NM	NM	27	NM	NM	NM	NM	NM	NM

IFI, intraoperative fluid infusion; LOS, length of stay; NM, not mentioned; PCA, patient-controlled analgesia; POUR, postoperative urinary retention; SD, standard deviation; THA, total hip arthroplasty.