



Supplementary Material

10.1302/2633-1462.26.BJO-2021-0020

Table i. Common Procedural Terminology definitions.

Common Procedural Terminology Code	
27447	Isolated total knee arthroplasty (TKA) - Arthroplasty, knee, condyle and plateau; medial AND lateral compartments with or without patella resurfacing
27130	Isolated total hip arthroplasty (THA) - Arthroplasty, acetabular and proximal femoral prosthetic replacement (total hip arthroplasty), with or without autograft or allograft

Table ii. Normal ranges of preoperative blood markers.

Blood marker	Normal range
Albumin	35 to 50 g/l
Estimated glomerular filtration rate	≥ 90 ml/min/1.73m ²
Haematocrit	0.370 to 0.480 L/L < 0.41 in males is anaemia < 0.36 in females is anaemia
Platelets	140 to 400 $\times 10^9/l$
Sodium	135 to 147 mmol/l
White blood cells	4 to 11 $\times 10^9/l$

Table iii. Summary of total knee arthroplasty patients included versus excluded.

Variable	TKA cohort inclusions (2011 to 2018) N = 137,969	TKA exclusions (2011 to 2018) N = 202,547	p-value
Mean age, yrs (SD)	66.6 (9.6)	66.8 (9.6)	< 0.0001
Female sex, n (%)	85,163 (61.7)	123,554 (61.0)	0.0003
Race, n (%)			
White	109,179 (79.1)	134,086 (66.2)	< 0.0001
Black	10,939 (7.9)	14,178 (7.0)	
Other	17,851 (12.9)	54,485 (26.9)	
Independent functional status, n (%)	136,484 (98.9)	200,522 (99.0)	0.4756
Mean BMI, kg/m ² (SD)	33.2 (6.8)	32.8 (6.8)	< 0.0001
Smoker, n (%)	11,766 (8.5)	16,609 (8.2)	0.0006
CHF, n (%)	442 (0.3)	608 (0.3)	0.0134
COPD, n (%)	5,143 (3.7)	6279 (3.1)	< 0.0001
Diabetes, n (%)	25,660 (18.6)	35,041 (17.3)	< 0.0001
Dialysis, n (%)	262 (0.2)	203 (0.1)	< 0.0001
Hypertension, n (%)	91,673 (66.4)	127,807 (63.1)	< 0.0001
Steroid use, n (%)	5,487 (4.0)	3,644 (3.1)	< 0.0001
Bleeding disorder, n (%)	3,111 (2.3)	4,051 (2.0)	< 0.0001
Dyspnea, n (%)	8,387 (6.1)	10,532 (5.2)	< 0.0001
ASA grade, n (%)			< 0.0001
I/II	67,731 (49.1)	106,945 (52.8)	
III/IV	70,238 (50.9)	95,602 (47.2)	
Anaesthesia type, n (%)			< 0.0001
General	70,317 (51.0)	86,690 (42.8)	
Neuraxial	67,652 (49.0)	115,857 (57.2)	
Mean operating time, mins (SD)	92.4 (33.6)	91.2 (38.7)	< 0.0001
Mean length of stay, days (SD)	2.6 (2.4)	2.6 (3.0)	< 0.0001
Discharge destination, n (%)			< 0.0001
Home	106,562 (77.2)	184,115 (90.0)	
Other	31,407 (22.8)	38,686 (19.1)	
Excluded patients consist of those who did not have full blood marker data. ASA, American Society of Anesthesiologists; CHF, congestive heart failure; COPD, chronic obstructive pulmonary disease; SD, standard deviation; THA, total hip arthroplasty; TKA, total knee arthroplasty.			

Table iv. Summary of total hip arthroplasty patients included versus excluded.

Variable	THA cohort inclusions (2011 to 2018) N = 78,532	THA exclusions (2011 to 2018) N = 116,802	p-value
Mean age, yrs (SD)	64.7 (11.4)	65.2 (11.6)	< 0.0001
Female sex, n (%)	42,637 (54.3)	64,118 (54.9)	0.0127
Race, n (%)			< 0.0001
White	64,370 (82.0)	79,357 (67.9)	
Black	6,478 (8.3)	8,230 (7.1)	
Other	7,684 (9.7)	29,215 (25.0)	

Independent functional status, n (%)	77,241 (98.4)	114,586 (982)	0.0014
Mean BMI, kg/m ² (SD)	30.4 (6.3)	30.2 (6.3)	< 0.0001
Smoker, n (%)	10,392 (13.2)	14,516 (12.4)	< 0.0001
CHF, n (%)	259 (0.3)	312 (0.3)	0.0240
COPD, n (%)	3,181 (4.1)	4,289 (3.7)	< 0.0001
Diabetes, n (%)	9,673 (12.3)	13,437 (11.5)	< 0.0001
Dialysis, n (%)	157 (0.2)	233 (0.2)	0.9419
Hypertension, n (%)	44,953 (57.2)	63,345 (54.2)	< 0.0001
Steroid use, n (%)	3,152 (4.0)	3,990 (3.4)	< 0.0001
Bleeding disorder, n (%)	1,620 (2.1)	2,241 (1.9)	0.0319
Dyspnea, n (%)	3,730 (4.8)	4,988 (4.3)	< 0.0001
ASA grade, n (%)			< 0.0001
I/II	44,494 (56.7)	68,202 (58.4)	
III/IV	34,038 (43.3)	48,600 (41.6)	
Anaesthesia type, n (%)			< 0.0001
General	43,515 (55.4)	52,554 (45.0)	
Neuraxial	35,017 (44.6)	64,248 (55.0)	
Mean operating time, mins (SD)	92.5 (38.4)	91.2 (38.9)	< 0.0001
Mean length of stay, days (SD)	2.2 (1.4)	2.7 (3.5)	< 0.0001
Discharge destination, n (%)			< 0.0001
Home	63,529 (80.9)	96,289 (82.4)	
Other	15,003 (19.1)	20,513 (17.6)	
Excluded patients consist of those who did not have full blood marker data.			
ASA, American Society of Anesthesiologists; CHF, congestive heart failure; COPD: chronic obstructive pulmonary disease; SD, standard deviation; THA, total hip arthroplasty; TKA: total knee arthroplasty.			

Table v. Multivariable regression analysis of the association between patient and treatment factors and acute readmission.

TKA	Development (2011-2016)			Validation (2017-2018)			THA			Development (2011-2016)			Validation (2017-2018)		
	Patients, n	Readmissions, n (%)		OR	95% CI	p-value	OR	95% CI	p-value	OR	95% CI	p-value	OR	95% CI	p-value
	82,810	2635 (3.2%)					55,159	1748 (3.2%)		46,889	1623 (3.5%)		31,643	1102 (3.5%)	
Age		1.19	1.08-1.30	0.0006	1.34	1.19-1.50	<0.0001	1.28	1.13-1.45	0.0001	1.38	1.19-1.61	<0.0001		
Female sex		0.72	0.66-0.78	<0.0001	0.74	0.66-0.82	<0.0001	0.91	0.81-1.02	0.0880	0.93	0.81-1.06	0.2944		
Race															
White	Ref.	--	--	--	Ref.	--	--	Ref.	--	--	Ref.	--	--		
Black	1.23	1.07-1.41	0.0003	1.21	1.02-1.43	0.0097	1.06	0.89-1.27	0.1362	0.82	0.66-1.03	0.2990			
Other	0.88	0.77-1.00	0.0009	1.10	0.95-1.26	0.9568	0.84	0.69-1.02	0.0578	0.87	0.70-1.07	0.6967			
BMI		1.02	0.93-1.12	0.6475	1.06	0.95-1.18	0.2929	1.28	1.16-1.42	<0.0001	1.25	1.10-1.42	0.0005		
Smoker		1.29	1.13-1.47	0.0002	1.32	1.11-1.56	0.0014	1.39	1.21-1.61	<0.0001	1.22	1.01-1.47	0.0378		
CHF		1.86	1.25-2.77	0.0024	1.68	1.02-2.75	0.0402	1.06	0.92-1.22	0.3982	0.86	0.72-1.02	0.0845		
COPD		1.56	1.33-1.82	<0.0001	1.72	1.42-2.07	<0.0001	0.78	0.28-2.19	0.6420	2.79	1.45-5.36	0.0021		
Diabetes		1.05	0.86-1.16	0.2906	1.03	0.91-1.16	0.6433	1.48	0.83-2.63	0.1808	1.88	1.10-3.23	0.0214		
Dialysis		1.15	0.64-2.08	0.6437	1.73	0.95-3.15	0.0741	1.43	1.18-1.74	0.0003	1.55	1.23-1.96	0.0002		
Hypertension		1.11	1.00-1.21	0.0435	1.19	1.06-1.35	0.0038	1.15	1.02-1.30	0.0182	1.19	1.03-1.37	0.0205		
Steroid use		1.48	1.26-1.73	<0.0001	1.01	0.80-1.28	0.9093	1.35	1.09-1.67	0.0057	1.47	1.16-1.86	0.0017		
Bleeding disorder		1.50	1.24-1.82	<0.0001	1.13	0.86-1.48	0.3930	1.67	1.31-2.13	<0.0001	1.61	1.18-2.21	0.0027		

Dyspnea	1.12	0.97-1.29	0.1119	1.40	1.18-1.65	<0.0001	1.29	1.07-1.56	0.0076	1.17	1.03-1.37	0.1892
Dependent functional status	1.38	1.05-1.80	0.0196	1.71	1.23-2.38	0.0014	1.53	1.17-2.01	0.0019	1.08	0.75-1.54	0.6902
ASA Class I/II III/IV	Ref. 1.45	-- 1.33-1.59	-- <0.0001	Ref. 1.52	-- 1.35-1.70	-- <0.0001	Ref. 1.40	-- 1.25-1.58	-- <0.0001	Ref. 1.40	-- 1.21-1.62	-- <0.0001
Anesthesia type General Neuraxial	Ref. 0.98	-- 0.91-1.07	-- 0.6989	Ref. 0.95	-- 0.86-1.05	-- 0.2862	Ref. 0.98	-- 0.88-1.09	-- 0.6943	Ref. 0.97	-- 0.86-1.10	-- 0.6291
Operation length	1.15	1.06-1.24	0.0005	1.18	1.09-1.28	<0.0001	1.23	1.13-1.33	<0.0001	1.25	1.13-1.39	<0.0001
Length of stay	1.07	1.02-1.12	0.0095	1.15	1.09-1.22	<0.0001	1.22	1.10-1.36	0.0002	1.11	1.03-1.20	0.0062
Discharge destination Home Other	Ref. 1.28	-- 1.17-1.39	-- <0.0001	Ref. 1.49	-- 1.32-1.68	-- <0.0001	Ref. 1.38	-- 1.23-1.56	-- <0.0001	Ref. 1.59	-- 1.36-1.85	-- <0.0001

Odds ratios (OR) are standardized to demonstrate odds adjustment per two standard deviation incremental increase in each variable, allowing for magnitude comparison between variables. ORs are adjusted for the preoperative lab values for the six blood markers of interest (Table III, main text). Analyses should be interpreted as exploratory.

ASA, American Society of Anesthesiologists; CHF: congestive heart failure; CI, confidence interval; COPD: chronic obstructive pulmonary disease.