Complications, Implant Survival, and Functional Outcomes of Conversion Total Knee Arthroplasty with Prior Hardware

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INTRODUCTION: End-stage knee osteoarthritis in the setting of retained periarticular hardware is a frequent scenario encountered by the arthroplasty surgeon. When indicated, conversion total knee arthroplasty (TKA) leads to excellent outcomes but poses unique challenges. The evidence supporting retention vs. removal of hardware during TKA is controversial.

METHODS: One-hundred-fifty-five patients who underwent TKA with prior hardware between 2009 – 2019 were identified in an institutional database and 148 patients were included in the analyses. Data collected included patient demographics and surgical details and hardware factors. Patient-reported outcomes were retrieved from the recording system. Ninety-day postoperative complications and incidence of implant failure were primary outcomes of interest.

RESULTS:

Mean follow up was 60.1 months. The complication rate in this cohort was 28/148 (18.9%). Documentation of the use of a quadriceps snip as opposed to a medial parapatellar arthrotomy alone was associated with a higher number of complications (OR 20.7, $p < 0.05$), implant failure (OR 13.9, $p < 0.05$), and lower Veteran Rand 12 Mental score (VR-12 MS) (-14.8, $p < 0.05$). Hardware removal vs. retention and use of single vs. multiple incisions were not associated with complications or implant survival. Removal of all hardware was associated with significantly higher (+7.3, $p < 0.05$) VR-12 MS compared to retention of all hardware.

DISCUSSION AND CONCLUSION: TKA with prior hardware is associated with more complications, implant failure, and lower VR-12 MS when a quadriceps snip is performed compared to medial parapatellar arthrotomy alone. This probably reflects the level of difficulty of the procedure, rather than the surgical approach used. Hardware removal or retention is not associated with complications or implant failure; however, removal rather than retention of all prior hardware is associated with increased general health outcomes.

Variables	n (%)	Mean (SD)	Median [IQR]
Gender Male:Female	80 (54.1):68 (45.9)		
Side Right:Left	65 (43.9):83 (56.1)		
Age at surgery (year)		59.7 (10.8)	
BMI (kg/m^2)			29.1 [26.1,33.9]
ASA class			
1	14 (9.5)		
2	87 (58.8)		
3	47 (31.7)		
Charlson cormobidity index (CCI)			2 [1,3]
Diagnosis (possible more than one)			
Osteoarthritis	125		
Post-traumatic	67		
Rheumatoid arthritis	3		
Post-ligament reconstruction/repair	54		
Post-realignment osteotomy	22		
Post-TTO	6		
Other (conversion of knee fusion, osteonecrosis, post-septic)	3		
Surgical approach			
Medial parapatellar	142 (95.9)		
Quadriceps snip	5 (3.4)		
Tibial tubercle osteotomy	1 (0.7)		
Separate incision			
None	88 (59.5)		
None with extended anterior incision	39 (26.4)		
Medial side	3 (2.0)		
Lateral side	17 (11.5)		
Flap coverage due to soft tissue defect	1 (0.7)		
Operative time (minutes)			133 [111,159]
Intraoperative blood loss (milliliters)			100 [50,200]
Length of hospital stay			3 [2,3]
Follow up time (months)		60.1 (44.7)	

Table 2: Implants and bone defect management.

Variables	n (%)
Implant type	
Cruciate retained	21 (14.2)
Posterior stabilized	105 (70.9)
Varus-valgus constrained (VVC)	21 (14.2)
Rotating hinged knee (RHK)	1 0.7
Type of fixation	
Cemented	146 (98.6)
cementless	2 (1.4)
Bone defect management	
None	117 (79.1)
Bone graft	22 (14.9)
Metal augment	9 (6.0)
Stem	
None	105 (70.9)
One side required (femur or tibia)	28 (18.9)
Both tibia and femur	15 (10.1)
Metal cut for partial hardware removal	
None	139 (93.9)
Plate cut	1 (0.7)
Screw cut	2 (1.3)
Staple cut	5 (3.4)
Other	1 (0.7)
Category of retained hardware	
All retained	27 (18.2)
Partial retained on femur	28 (18.9)
Partial retained on tibia	12 (8.1)
Partial retained on femur and tibia	9 (6.1)
Partial retained on patella	70 (47.3)
All removed	2 (1.4)
Retained hardware	
Plate on femur	7
Plate on tibia	3
Screw/anchor on femur	27
Screw/anchor on tibia	7
Screws on both femur and tibia	2
Staple on femur	8
Staple on tibia	6
Staples on both femur and tibia	1
Endobutton on femur	8
Intramedullary rod femur	7
Intramedullary rod tibia	2
Patella screw/wire	2

Table 3: Complications

Complications	n (%)
Wound problem	9 (6.1)
Periprosthetic knee infection	7 (4.7)
Stiff TKA (need manipulation)	4 (2.7)
Persistent postop pain	3 (2.0)
Unstable TKA	2 (1.4)
Patellofemoral instability/maltracking	1 (0.7)
Fracture of femur	1 (0.7)

Table 4: Multivariate analysis of factors associated with complications.

	Odds Ratio	Lower 95%	Upper 95%	p-value
Age (years)	0.93	0.88	0.98	0.007
Body mass index	1.06	0.96	1.16	0.252
ASA 2 vs. ASA 1	4.35	0.46	40.80	0.198
ASA 3 vs. ASA 1	0.78	0.05	11.29	0.854
Operation time (minutes)	1.01	0.99	1.02	0.272
Quadriceps snip vs. medial parapatellar	20.71	1.90	226.08	0.013
Stem: one side vs. none	1.70	0.49	5.92	0.407
Stem: both sides vs. none	1.15	0.20	6.66	0.874
Separate incision vs. none	2.27	0.78	6.65	0.134

Table 5: Multivariate analysis of factors associated with implant survival.

	Odds Ratio	Lower 95%	Upper 95%	p-value
Age (Years)	0.96	0.89	1.03	0.242
Male vs. Female	4.52	0.73	28.05	0.106
Operation time (minutes)	1.01	0.99	1.03	0.209
Quadriceps snip vs. medial parapatellar	13.92	1.39	139.59	0.025
Augment vs. none	1.76	0.06	49.43	0.739
Bone graft vs. none	3.26	0.62	17.12	0.162
Stem: One side vs. none	2.93	0.55	15.51	0.207
Stem: Both sides vs. none	0.96	0.06	14.45	0.978
Separate incision vs. none	2.24	0.42	11.82	0.343

Table 6: Multivariate analysis of factors related to change in VR-12 Mental scores.

	Estimate	Lower 95%	Upper 95%	p-value
Operation time (minutes)	-0.1	-0.1	0.01	0.103
Quadriceps snip vs. medial parapatellar	-14.8	-27.4	-2.3	0.022
Stem: One side vs. none	-2.3	-7.8	3.3	0.418
Stem: Both sides vs. none	-6.0	-15.1	3.0	0.185
Hardware: all removed vs. all retained	7.3	1.0	13.7	0.024
Hardware: partial removed vs. all retained	4.6	-2.2	11.4	0.179