Short-Term Complications of Revision Total Hip Arthroplasty of the Acetabular, Femoral, or Both Components

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INTRODUCTION: Revision total hip arthroplasty (THA) is increasingly prevalent in the setting of the rising incidence of primary THA, and as such trends note rising incidence of mechanical failures related to implants, infection, and biological wear. Compared to primary THA, revision THA are often more technical and complex procedures, and are linked with higher rates of infections, mechanical failure, and tissue damage. Indications for revision THA include but are not limited to acetabular cup loosening, polyethylene wear, instability, periprosthetic fractures, femoral stem loosening, and metal-on-metal galvanic reactions. Revision THA is associated with worse outcomes than primary THA. Depending on the wear of implanted components the surgeon can replace the acetabular, femoral, or both components. Understanding the difference in outcomes associated with each type of revision is clinically useful for surgeons and patients alike, therefore the purpose of this study is to elucidate the differential outcomes and complications of revision THA associated with either acetabular, femoral, or both components.

METHODS: Patients who underwent revision THA from January 2010 to December 2020 in the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database were included in this analysis. Propensity score matching was performed based on patient demographics. The independent variable was component(s) replaced. The dependent variables were complications. An ANOVA and chi square tests were used to determine if there was a difference between groups. A binary logistic regression was performed to determine the odds ratio (OR) and 95% confidence intervals. Alpha was set to 0.05.

RESULTS: There were 17,963 revision THA consisting of 12,247 revisions of both components, 2,987 revised acetabular components, and 2,729 revised femoral components (Table 1). Matching the acetabular group to the both components group lead to groups with comparable age, BMI, sex, outpatient status, ASA class, race, functional status, smoking status and comorbidities except for malnourishment and preoperative transfusion being more common in the both group. The rate of adverse events was higher in the both revised components group at 31.6% versus 21.9% in the acetabular group. There was also a greater rate of sepsis (2.4%), pulmonary embolism (PE) (0.6%), transfusion (22.6%), and deep vein thrombosis (DVT) (1.2%) in the both components group compared to the acetabular group (sepsis: 1.5%, PE: 0.3%, transfusion: 12.8%, DVT: 0.7) (Table 2). Matching the femoral group to the both components group lead to groups with comparable age, sex, operative time, outpatient status, ASA class, race, smoking status, and comorbidities except for increased steroid use in the both group and increased BMI and preoperative transfusion in the femoral group. The rate of any adverse events was higher in the femoral group at 38.1% compared to 33.4% in the both group. There was also a greater risk of death (2.1%) and transfusions (29.5%) in the femoral group compared to the both group (1.2% and 25.6%, respectively) (Table 3). The linear regression performed on all THA revisions revealed that female sex (OR=0.722, CI:0.717-0.831), inpatient status (OR=0.505, CI:0.367-0.693), and higher BMI (OR=0.984, CI:0.978-0.989) were protective factors against any adverse event (Table 4). Older age, partial or totally dependent function status, longer operative time, longer length of stay, higher ASA class, congestive heart failure, steroid use, malnourishment, bleeding disorder, and preoperative transfusion were associated with an increased risk of any adverse event following revision THA.

DISCUSSION AND CONCLUSION:

The overall rate of any adverse event for revision THA was 29.8% in the 30-day postoperative period. Compared to revising both components, revising the femoral component had higher rates of any adverse event, death, and transfusion while revising the acetabular component had lower rates of any adverse event, sepsis, pulmonary embolism, transfusion, and DVT. A limitation of this study is the lack of detailed information on the specific indications for revision, the extent of wear of the components, the experience level of the surgeons, and the types of implants used. Identification of these complication rates after revision THA, along with patient risk factors for adverse events can help surgeons be aware of certain complications when specific components need to be revised.

	Acetabular	Both	Femoral	p- value
Patients, N (%)	2,987 (16.6) 67.2 ± 12.4	12,247	2,729 (15.2) 69.8 ± 12.9	
Age (mean ± SD, years)	67.2 ± 12.4	(68.2) 66.8 ± 12.4	69.8 ± 12.9	<0.001
BMI (mean ± SD, kn/m²)	29.6±6.9	29.5 ± 7.0	28.9 ± 7.1	-0.00
Male sex	1,213 (40.6)	5,670 (46.3)	1,260 (46.2)	0.00
Operative Time	126.2 ±	1481+	144.1±	-10.001
(mins) Length of Stay (days)	3.8 ± 4.8	74.4 42±4.7	69.9 5.3 ± 6.0	0.00
Inpatient status	2,909	11,965 (97.7)	2,662	0.586
ASA Class	2.7±0.6	2.7±0.6	(97.5) 2.5±0.6	<0.001
1 – No	32	164	38	
Disturbance 2 - MM	(1.1)	(1.3)	(1.4)	
Disturbance	(35.1)	7.026	(30.4)	
3 - Severe Distarbance	1,732	7,026 (57.4)	1,619 (59.3)	
4 - Life-	(\$8.0) 175	(57.4)	(39.3)	_
Threatening Disturbance	(5.9)	(5.7)	(8.8)	
5 - Moribund	(0.0)	(0.0)	(0.0)	
Race				0.051
White	2,129 (71.3)	9,014 (73.6)	2,668 (73.6)	
Black	223	1.042		
	(7.5)	(8.5)	(8.0)	
Asian	(1.3)	126 (1.0)	34 (1.2)	
American Indian or	18	83	19	
Alaska Native Native Hawaiian or	(0.6)	(0.7)	(0.7)	
Native Hawaiian or Pacific Islander	(0.2)	(0.2)	(0.1)	
Other	0	4	1	
Unknown	(0.0) 572	(0.0)	(0.0)	
		(16.0)	(16.3)	
Dependent	180	714	262	<0.00
Functional Status (partial or total)	(6.0)	(5.8)	(9.6)	
Current smoker	468 (15.7)	1,798	347 (12.7)	0.005
Comorbidities N (%)				
CHF	36	119	48	0.001
Renal failure	(1.0)	(1.0) 23	(1.6)	0.376
Dialysis	(0.1)	(9.2)	(0.3)	0.142
	(0.8)	(0.7)	(1.1)	
Steroid use	207 (6.9)	801 (6.5) 84	545 (5.3)	0.028
Malnourishment	(0.6)	(0.7)	(0.9)	0.360
Bleeding disorder	139	561 (4.6)	190	<0.001
Ascites	(9.9)	(0.0)	(0.2)	0.008
Pre-operative	31	192	Sea	0.00
transfusion Diabetes	(1.0) 438	(1.6)	(3.4)	0.124
IDOM	(14.7)	(14.1)	(14.9)	
	(4.1)	(4.6)	(5.2)	
NIDOM	317	1 163	265	
DOE	(10.6)	(9.5) 656	(9.7)	<0.001
	(4.5)	(5.4)	(6.2)	0.027
COPD	167	706	697	

Table 2: Complications for matched cohorts for

acetabular and		ce	B	oth	D-	
	(27137)			134)	value	
	No.	Rate (%)	No.	Rate (%)		
Any adverse event	658	21.9	957	31.6	<0.001	
Death	13	0.4	22	0.7	0.134	
Wound dehiscence	16	0.5	16	0.5	0.980	
Sepsis	45	1.5	72	2.4	0.013	
Pulmonary Embolism	8	0.3	19	0.6	0.036	
Renal complication	3	0.1	4	0.1	0.714	
MI	16	0.5	14	0.5	0.697	
Cardiac arrest	4	0.1	9	0.3	0.170	
Stroke	2	0.1	3	0.1	0.662	
Transfusion	383	12.8	685	22.6	<0.001	
DVT	21	0.7	37	1.2	0.038	
UTI	36	1.2	39	1.3	0.756	
Pneumonia	16	0.5	28	0.9	0.074	
Intubation issues	12	0.4	14	0.5	0.711	
SSI	138	4.6	163	5.4	0.161	
Return to OR	192	6.4	199	6.6	0.781	

Table 3: Complications for matched cohorts for femoral and both component revisions

	Fem (271			oth 134)	p- value
	No.	Rate (%)	No.	Rate (%)	
Any adverse event	1,039	38.1	925	33.4	<0.001
Death	57	2.1	34	1.2	0.013
Wound dehiscence	12	0.4	12	0.4	0.974
Sepsis	67	2.5	66	2.4	0.868
Pulmonary Embolism	14	0.5	14	0.5	0.972
Renal complication	9	0.3	4	0.2	0.158
MI	27	1.0	20	0.7	0.284
Cardiac arrest	11	0.4	11	0.4	0.975
Stroke	9	0.3	6	0.2	0.423
Transfusion	806	29.5	709	25.6	0.001
DVT	35	1.3	30	1.1	0.497
UTI	55	2.0	45	1.6	0.281
Pneumonia	38	1.4	26	0.9	0.118
Intubation issues	22	0.8	19	0.7	0.608
SSI	132	4.8	111	4.0	0.137
Return to OR	178	6.5	148	5.4	0.066

	Unmatched All		Unmatched Acetabular		Unmatched Both		Unmatched Femora	
	Odds Fatio (55N CI)	p- velue	Odds Ratio (55N CI)	g- relue	Odds Fatio (55% CI	p- velve	Odds Ratio (95% CO	178
Sex	0.722 (0.717 (0.831)	<0.001			0.787 (0.720-	<0.001	0.609 (0.505-	<0.0
Inputiont	0.505	*D.001			0.539 (0.530-	0.001	0.248 (3.090- 0.680)	0.0
Age	1.006 (1.000-	<0.00t			1.006 (1.000-	0.002	1.015 (1.006-	40.0
Functional status	Fartial 2.187 (1.898-2.528) Total: 2.676 (1.748 – 4.097)	<0.001	Partial: 2.223 (1.538 - 5.215) Total: 8.416 (2.829-25.005)	<0.001	Partial: 2.022 (1.687 - 2.425) Total: 1.937 (1.087 - 3.452)	<0.001	Partial: 3.043 (2.348-4.909) Total: 2.519 (3.316-5.684)	40.1
844	0.984 (0.978-0.989)	<0.00t			0.987 (0.980-	<0.001	0.970 (0.957-	<0.
Operation time	1.009 (1.008-	<0.00t	1.006 (1.005-	<0.001	1.009 (1.000-	<0.001	1.008 (1.007-	40.
Length of stay	1.143 (1.191-1.196)	<0.00t	1.162 (1.128 - 1.197)	*0.000	1.145 (1.130- 1.160)	*D.001	1.118 (1.093-	40.
ASA class	1: 1.694 (1.102-2.605) 2: 2.546 (1.656-3.915) 3: 3.567 (2.231-5.514)	<0.00t	8: 8.900 (1.118- 8.416)	0.003	1: 1.668 (1.007- 2.761) 2: 2.452 (1.481- 4.060) 5: 3.233 (1.907- 5.547)	<0.001	3: 4,406 (1,194- 13,921)	<0.
	4 11.790							
CHF	1.624 (1.153- 2.297)	0.006			1.978 (1.286- 3.041)	0.002		
Steroid use	1.295 (1.007 - 1.277)	0.014	1.458 (1.033- 2.057)	0.052	1.204 (1.014- 1.429)	0.054		
Malrourishment	1.600 (1.070 - 2.626)	0.022	3.068 (1.118- 8.416)	0.029	1.873 (1.154- 3.040)	0.011		
Bleeding Disorder	1715 (1468 - 2.004)	<0.00t			1.801 (1.481- 2.189)	<0.001	1.601 (1.129- 2.274)	0.1
Transfusion	3.477 (2.584- 4.677)	<0.00t	5.553 (2.167- 14.238)	<0.065	2.835 (1.963 - 4.093)	<0.001	4.991 (2.958- 8.195)	<0.
Smoke			1.925 (1.000 - 1.758)	0.042				
Dielysis							3.254 (1.509- 8.009)	0.1