

Variation in the Value of Hip Arthroscopy: A Time-Driven Activity-Based Costing (TDABC) Analysis

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DISCLOSURES: None

INTRODUCTION: Despite growing interest in maximizing the value of orthopedic care, the variation and drivers of patient value following hip arthroscopy remain unknown. This study aimed to characterize associations between value and patient-specific demographics, comorbidities, preoperative patient-reported outcome measures (PROMs), and intraoperative variables.

METHODS: This study included 154 patients undergoing primary arthroscopic acetabular labral repair from 2015-2020. Value was calculated by dividing 2-year postoperative International Hip Outcome Tool-33 scores by time-driven activity-based costs. To protect confidentiality, the study average for value was normalized to 100. Bivariate analyses and multivariable linear regression were used to identify patient characteristics and case-specific features underlying variation in value. Sensitivity analyses explored the robustness of value drivers across complementary PROMs.

RESULTS: The normalized value of hip arthroscopy ranged from 26.1 to 196.0, with a 2.9-fold variation between the 10th and 90th percentile patients. In unadjusted analyses, higher value was significantly associated with female gender, no previous contralateral hip surgery, smaller alpha angles, less intensive osteoplasty procedures, no bone marrow aspirate concentrate or microfracture, and smaller labral tears ($p < 0.05$ for all). In adjusted analyses, higher value was significantly associated with no prior contralateral hip arthroscopy (23.5-point increase, $p = 0.018$), higher preoperative PROMs (0.42-point increase per 1-unit increase, $p = 0.008$), less intensive osteoplasty procedures (12.8-point increase, $p = 0.029$) and no bone marrow aspirate concentrate or microfracture (33.9-point increase, $p < 0.001$). Altogether, patient and operative characteristics explained 34.1% of the observed variation in value. In sensitivity analyses, value drivers varied across different PROMs.

CONCLUSION: We found wide variation in the value of hip arthroscopy that was most strongly associated with procedure type and preoperative PROMs, with minimal impact from patient characteristics. Additionally, the method of value measurement influenced which factors emerged as value drivers.

SIGNIFICANCE/CLINICAL RELEVANCE: These findings may promote optimization of the hip arthroscopy care pathway to reduce variation and deliver higher-value care.

ACKNOWLEDGEMENTS: Conine Family Fund for Joint Preservation

Table 1. Multivariable linear regression model evaluating characteristics underlying variation in value.

Variable	Mean difference	95% CI		P value
		Lower	Upper	
Patient characteristics				
Age, per 1-year increase	-0.07	-0.59	0.46	0.808
Male gender	-5.02	-16.43	6.38	0.386
Previous contralateral surgery	-23.45	-42.81	-4.09	0.018
Preoperative iHOT-33 score, per 1-unit increase	0.42	0.12	0.73	0.007
Pre- or intraoperative findings				
Outerbridge grade, per 1-unit increase	-3.01	-9.48	3.46	0.359
Tönnis grade 1*	-9.92	-20.21	0.37	0.059
Case-specific factors				
Femoral acetabuloplasty†	-12.74	-24.16	-1.31	0.029
Simple labral repair‡	4.56	-13.20	22.32	0.613
BMAC or microfracture	-33.93	-45.25	-22.61	<0.001

*Reference: Tönnis 0. †Reference: acetabuloplasty or femoroplasty. ‡Reference: labral repair with capsular augmentation. Multiple

$R^2 = 0.341$. Boldface denotes statistical significance.

Abbreviations: CI, confidence interval; iHOT-33, International Hip Outcome Tool-33; BMAC, bone marrow aspirate concentrate.