Is Total Ankle Arthroplasty Adequately Compensated? A Propensity Score-Matched Comparison of Work Relative Value Units With Other Joint Arthroplasties

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INTRODUCTION:

The prevalence of total ankle arthroplasty (TAA) has been steadily increasing. Despite advancements in implant design and surgical techniques over recent decades, TAA remains one of the most technically demanding joint arthroplasties, requiring relatively long operative times. However, the adequacy of its compensation, particularly when compared to other joint arthroplasty procedures, has not been thoroughly evaluated.

The fee-for-service model in the U.S. healthcare system is based on work Relative Value Units (wRVUs). While multiple factors influence wRVU assignment, physician effort, time, and technical expertise are primary determinants. Across the orthopedic literature, discrepancies have been noted in surgeon compensation and wRVU allocation for more complex procedures within several subspecialties. This study aims to evaluate whether TAA is adequately compensated relative to total knee arthroplasty (TKA), total hip arthroplasty (THA), and total shoulder arthroplasty (TSA) using data from the National Surgical Quality Improvement Program (NSQIP).

METHODS:

The NSQIP database from 2020 to 2022 was utilized. Patients who underwent arthroplasty procedures of the ankle, knee, hip, or shoulder were identified using Current Procedural Terminology (CPT) codes. A 1:1 propensity score matching was performed with the TAA group as reference across groups based on age (±1 year) and sex. The adequacy of TAA compensation was assessed based on wRVUs, operative time, wRVUs per hour (wRVU/hour), and reimbursement rates ($/hour), in comparison to other joint arthroplasties. Postoperative complications within 30 days were evaluated to compare procedural risk profiles. An analysis of Covariance (ANCOVA) was performed to adjust for the impact of postoperative complications on compensation-related outcomes, including operative time, wRVU/hour, and reimbursement rate. An additional ANCOVA was conducted to account for the influence of preoperative comorbidities on compensation-related outcomes, that differed significantly between groups.

RESULTS:

Using 1:1 propensity score matching based on age and sex for each joint arthroplasty group, a total of 511 cases per group were identified.

In terms of compensation outcomes, the TAA group demonstrated a significantly longer operative time compared to other joint arthroplasty groups: TKA, THA, and TSA (135.69 Vs.91.66 Vs.97.82 Vs.96.77 minutes, respectively, P<.001) and a significantly lower mean wRVU/hour (7.17 Vs.13.84 Vs.13.13 Vs.15.86, respectively, P<.001), and reimbursement rate (231.77 Vs.447.81 Vs. 424.73 Vs. 513.12 $/hour, respectively, P<.001). Post-hoc analysis revealed significant differences in all compensation metrics, including operative time, wRVU/hour, and reimbursement rate ($/hour), between the TAA group and each of the other joint arthroplasty groups (TAA Vs. TKA, P<.001; TAA Vs. THA, P<.001; TAA Vs. TSA, P<.001). These trends remained significant after adjusting for the rates of postoperative complications (P<.001) across all compensation outcomes. Furthermore, an additional ANCOVA adjusting for preoperative comorbidities continued to demonstrate that the TAA group was consistently undercompensated (P<.001) across all compensation outcomes.

Clinically, there were no significant differences in primary postoperative complications including mortality, readmission, and reoperation when using the TAA group as the reference. Although the overall reoperation rate showed a statistically significant difference among the groups (P=.025), post-hoc analysis revealed no significant differences in the reoperation rate between the TAA group and the other joint arthroplasty groups (TAA Vs. TKA, P =.316, TAA Vs. THA, P =.204; TAA Vs. TSA, P =.051). Furthermore, no significant difference in secondary postoperative complications between the TAA group and other joint arthroplasty groups was noted except for significantly increased rate of blood transfusion at 72 hours in the THA group compared to other groups (P<.001).

DISCUSSION AND CONCLUSION:

Our results suggest that the current wRVU scale may inadequately compensate for TAA, particularly in comparison to other joint arthroplasty procedures. Despite requiring significantly longer operative time, TAA was associated with substantially lower wRVU/hour and reimbursement rate. These findings highlight the potential need to reevaluate wRVU allocation for TAA to ensure more equitable and appropriate compensation.

Table 1: CPT codes for each arthroplasty group included in the study

Type of Arthroplasty	CPT codes included	No. of Cases
Ankle	27702	511
Knee	27447	157,902
Hip	27130	113,102
Shoulder	23472	13,836

Table 2: Patient demographics and comorbidities

	Available Data (TAA/TKA/ THA/TSA), n (%)		TAA	TKA	THA	TSA	*P* Value
Age, mean ± SD	511 (100)/ 511 (100)/ 511 (100)/ 511 (100)		65.26±9.87	65.26±9.87	65.20±9.89	65.46±9.90	.783
Sex, n (%)	511 (100)/ 511 (100)/ 511 (100)/ 511 (100)	Male Female	303 (59.30) 208 (40.70)	303 (59.30) 208 (40.70)	303 (59.30) 208 (40.70)	303 (59.30) 208 (40.70)	>.999
BMI, mean ± SD	494 (96.67)/ 504 (98.63)/ 505 (98.83)/ 508 (99.41)		31.44 (6.32)	31.30 (5.97)	29.33 (5.93)	31.67 (6.81)	.326
BMI, n (%)	494 (96.67)/ 504 (98.63)/ 505 (98.83)/ 508 (99.41)	Underweight (<18.5) Normal (18.5-24.9) Overweight (25.0-29.9) Obese (30.0-34.9) Morbidly Obese (≥35.0)	1 (0.20) 58 (11.74) 176 (35.63) 144 (29.15) 115 (23.28)	2 (0.40) 62 (12.30) 172 (34.13) 138 (27.38) 130 (25.79)	4 (0.79) 118 (23.37) 178 (35.25) 114 (22.57) 91 (18.02)	5 (0.98) 59 (11.61) 170 (33.46) 143 (28.15) 131 (25.79)	**<.001**
ASA class, n (%)	510 (99.80)/ 511 (100)/ 510 (99.80)/ 510 (99.80)	1-2 3-5	271 (53.14) 239 (46.86)	256 (50.10) 255 (49.90)	250 (48.92) 260 (51.08)	208 (40.70) 302 (59.30)	**<.001**
DM, n (%)	511 (100)/ 511 (100)/ 511 (100)/ 511 (100)	Insulin Non-insulin No DM	14 (2.74) 43 (8.41) 454 (88.85)	14 (2.74) 51 (9.98) 446 (87.28)	8 (1.57) 34 (6.65) 469 (91.78)	28 (5.48) 74 (14.48) 409 (80.04)	**<.001**
Smoking, n (%)	511 (100)/ 511 (100)/ 511 (100)/ 511 (100)	Yes	36 (7.05)	30 (5.87)	32 (6.26)	52 (10.18)	**.035**
Hypertension requiring meds, n (%)	511 (100)/ 511 (100)/ 511 (100)/ 511 (100)	Yes	287 (56.16)	319 (62.43)	260 (50.88)	318 (62.23)	**<.001**
History of CHF in the past 30 days	511 (100)/ 511 (100)/ 511 (100)/ 511 (100)	Yes	7 (1.37)	15 (2.94)	8 (1.57)	12 (2.35)	.263
COPD	511 (100)/ 511 (100)/ 511 (100)/ 511 (100)	Yes	17 (3.33)	6 (1.17)	11 (2.15)	30 (5.87)	**<.001**
Ventilator Dependent	511 (100)/ 511 (100)/ 511 (100)/ 511 (100)	Yes	0 (0)	0 (0)	0 (0)	0 (0)	>.999
Acute Renal Failure	325 (63.60)/ 511 (100)/ 511 (100)/ 508 (99.41)	Yes	0 (0)	0 (0)	0 (0)	0 (0)	>.999
Current Dialysis	511 (100)/ 511 (100)/ 511 (100)/ 511 (100)	Yes	0 (0)	2 (0.39)	0 (0)	0 (0)	.111
Ascites	511 (100)/ 511 (100)/ 511 (100)/ 511 (100)	Yes	0 (0)	0 (0)	0 (0)	0 (0)	>.999
History of Immunosuppressive Therapy	511 (100)/ 511 (100)/ 511 (100)/ 511 (100)	Yes	26 (5.09)	39 (7.63)	30 (5.87)	27 (5.28)	.301
Bleeding Disorder	511 (100)/ 511 (100)/ 511 (100)/ 511 (100)	Yes	10 (2.0)	10 (2.0)	8 (1.57)	4 (0.78)	.384
Disseminated Cancer	511 (100)/ 511 (100)/ 511 (100)/ 511 (100)	Yes	1 (0.20)	1 (0.20)	7 (1.37)	2 (0.39)	**.029**
Preoperative Transfusion	511 (100)/ 511 (100)/ 511 (100)/ 511 (100)	Yes	0 (0)	0 (0)	0 (0)	0 (0)	>.999
Preoperative sepsis	511 (100)/ 511 (100)/ 511 (100)/ 511 (100)	Yes	0 (0)	0 (0)	1 (0.20)	3 (0.59)	.111
Functional status	511 (100)/ 511 (100)/ 511 (100)/ 511 (100)	Independent Partially Dependent Totally Dependent Unknown	497 (97.26) 3 (0.59) 0 (0) 11 (2.15)	509 (99.61) 2 (0.39) 0 (0) 0 (0)	507 (99.22) 4 (0.78) 0 (0) 0 (0)	494 (96.67) 12 (2.35) 2 (0.39) 3 (0.59)	**<.001**

* TAA: Total Ankle Arthroplasty, TKA: Total Knee Arthroplasty, THA: Total Hip Arthroplasty, TSA: Total Shoulder Arthroplasty, SD: Standard Deviation, BMI: Body Mass Index, ASA: American Society of Anesthesiologists, DM: Diabetes Mellitus, CHF: Congestive Heart Failure, COPD: Chronic Obstructive Pulmonary Disease

Table 3: Compensation outcomes

	TAA	TKA	THA	TSA	*P* value	^Adjusted *P* value	^^Adjusted *P* value
**Operative time (min), mean ± SD	135.69±46.22	91.66±29.16	97.82±31.78	96.77±51.52	<.001	**<.001**	**<.001**
wRVU	14.42	19.60	19.60	22.13			
**wRVU/hour, mean ± SD	7.17±2.86	13.84±3.53	13.13±3.69	15.86±5.67	<.001	**<.001**	**<.001**
**Reimbursement rate ($/hour), mean ± SD	231.77±92.62	447.81±114.16	424.73±119.30	513.12±183.29	<.001	**<.001**	**<.001**

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^Adjusted *P* value after analysis of covariance to account for the effect of postoperative complication

^^Adjusted *P* value after analysis of covariance to account for the effect of preoperative comorbidities

**Post-hoc analysis using the Dunnett T3 method demonstrated significant differences in operative time, wRVU/hour, and reimbursement rate ($/hour) for TAA compared to each joint arthroplasty (TAA Vs. TKA, P<.001; TAA Vs. THA, P<.001; TAA Vs. TSA, P<.001)

Table 4: Primary and secondary postoperative complications

	TAA	TKA	THA	TSA	*P* Value
Primary complications					
**Reoperation, % (n)	0.6 (3/511)	0.2 (1/511)	1.4 (7/511)	2.0 (10/511)	**.025**
Readmission, % (n)	1.2 (6/511)	2.3 (12/511)	3.1 (16/511)	2.3 (12/511)	.219
Mortality, % (n)	0.0 (0/511)	0.0 (0/511)	0.2 (1/511)	0.2 (1/511)	>.999
Secondary complications					
Postoperative Wound Complications, % (n) - Superficial infection - Deep infection - Wound dehiscence	 1.8 (9/511) 0.0 (0/511) 0.6 (3/511)	 1.2 (6/511) 0.0 (0/511) 0.0 (0/511)	 1.0 (5/511) 0.2 (1/511) 0.2 (1/511)	 0.2 (1/511) 0.4 (2/511) 0.2 (1/511)	 .112 .624 .413
DVT, % (n)	0.20 (1/511)	0.59 (3/511)	0.39 (2/511)	0.20 (1/511)	.665
Pulmonary embolism, % (n)	0 (0/511)	0.20 (1/511)	0 (0/511)	0.20 (0/511)	.572
Pneumonia % (n)	0 (0/511)	0.20 (1/511)	0.20 (1/511)	0.20 (1/511)	.801
Failed extubation	0 (0/511)	0.20 (1/511)	0.20 (1/511)	0 (0/511)	.572
Reintubation	0 (0/511)	0 (0/511)	0.20 (1/511)	0 (0/511)	.391
Organ space infection	0.39 (2/511)	0.59 (3/511)	0.39 (2/511)	0 (0/511)	.436
Septic shock	0 (0/511)	0 (0/511)	0.39 (2/511)	0 (0/511)	.111
Urinary tract infection	0.39 (2/511)	0.20 (1/511)	0.20 (1/511)	0.20 (1/511)	.896
Acute renal failure	0 (0/511)	0 (0/511)	0.39 (0/511)	0.20 (0/511)	.299
Transfusion in 72 hours after case start	0 (0/511)	0.78 (4/511)	2.94 (15/511)	0.98 (5/511)	**<.001**
Myocardial infarction	0 (0/511)	0 (0/511)	0.20 (1/511)	0.39 (2/511)	.299
Cardiac arrest	0 (0/511)	0 (0/511)	0 (0/511)	0 (0/511)	>.999
Cerebrovascular accident	0 (0/511)	0 (0/511)	0.20 (1/511)	0 (0/511)	.391

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**Post-hoc analysis using the Dunnett T3 method showed no significant differences in reoperation rates between TAA and other joint arthroplasties (TAA Vs. TKA, *P*=.316, TAA Vs. THA, *P*=.204; TAA Vs. TSA, *P*=.051)