Age and Insurance Status are Predictors of Achilles Tendon Tear Treatment: A Social Determinants Analysis

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INTRODUCTION:
There is a growing recognition of the importance of social determinants of health (SDOH) on orthopaedic surgery and their influence on surgical outcomes. Multiple studies have reported positive outcomes for both nonoperative and operative treatment for acute Achilles tendon ruptures as well as with open and minimally invasive techniques. While patient preference can dictate management, SDOH are potentially important factors that could influence treatment choice and outcomes of acute Achilles tendon ruptures. The purpose of this study was to investigate the impact of SDOH on treatment choice as well as clinical and patient-reported reported outcomes of acute Achilles tendon tears.
METHODS:
This retrospective review evaluated data from 2014 to 2023 on patients treated for Achilles tendon tears identified through ICD-10 code S86.0 at a single hospital system. Patients were excluded if they were <18 years of age, had previous Achilles tendon surgery, and/or concurrent fractures. Demographic data including age, sex, body mass index (BMI), race, ethnicity, smoking history, employment, and insurance type was collected from the electronic medial record (EMR). Treatment data and outcomes including complications and re-rupture were documented. ADI and median household income (MHI) were collected using patient home addresses. Patient-Reported Outcome Measurement Information System (PROMIS) scores for Physical Function (PROMIS-PF) and Pain Interference (PROMIS-PI) were collected preoperatively and at multiple postoperative time points. Percent achieving minimum clinically important difference (MCID) was calculated and compared between cohorts. Statistical analysis was performed with a significance level of $P<0.05$.
RESULTS:
A total of 428 patients were included, with 149 nonoperative and 279 operatively treated patients. The nonoperative cohort had a significantly higher mean age than the operative group (50.40 ± 15.47 vs. 43.50 ± 13.45 years; $P<0.001$). Operative patients were more likely to have private insurance (73% vs 58%, $P=0.001$) and less likely to have Medicaid (9% vs. 13%; $P=0.001$) or Medicare (11% vs. 24%; $P=0.001$). No significant differences were found in ADI, MHI, and number of patients presenting with chronic tears. There was a higher proportion of patients treated with minimally invasive surgery Achilles repair in ADI quartile 3 and 4 compared to quartiles 1 and 2 (28.8% and 28.2% vs 3.8% and 12.2%; $P=0.025$). Postoperative complication, re-rupture, and reoperation rate were similar between ADI quartiles. In the nonoperative cohort, no significant differences in complications, conversation to surgery, time to presentation, or time from presentation to physical therapy was found between ADI quartiles. Medicaid (0.430 [0.205-0.906]; $P=0.026$) and age (0.973 [0.954-0.993]; $P= 0.008$) were negative predictors of operative treatment in logistic regression. Operative patients showed significantly greater improvement in PROMIS-PI at 6 weeks (-8.24 ± 9.62 vs. -3.61 ± 10.72, $P=0.006$) and greater improvement in PROMIS PF at 1 year (21.77 ± 10.39 vs. 5.60 ± 10.74; $P=0.010$). Significantly more patients met MCID for PROMIS-PF in the operative group at 1 year compared to the nonoperative cohort (80% vs. 68%; $P=0.242$).

DISCUSSION AND CONCLUSION:
This study found that operatively treated patients were younger and had private insurance with age and Medicaid insurance negative predictors for operative treatment of Achilles tendon tears. Area deprivation index was not significantly associated with treatment choices or outcomes with similar reoperation and re-rupture rates between ADI quartiles. Operative patients had greater improvement in patient reported physical function at one year after treatment. These findings underscore the importance of considering SDOH in the management of Achilles tendon tears to ensure equitable treatment and outcomes for patients.

Table 1. Total Cohort Demographics Table

	Nonoperative (149)	Operative (279)	P Value
Age, mean ± SD	50.40 ± 15.47	43.50 ± 13.45	<0.001*
Sex, n (%)			0.347
Male Percentage	119 (79.9)	233 (83.5)	
Female Percentage	30 (20.1)	46 (16.5)	
Race, n (%)			0.087
White/Caucasian	62 (41.9)	109 (39.1)	
Black/African American	64 (43.2)	112 (40.1)	
Asian	7 (4.7)	6 (2.2)	
Other	4 (2.7)	7 (2.5)	
Unknown	11 (7.4)	45 (16.1)	
Ethnicity, n (%)			
Hispanic /Latino	4 (2.7)	10 (3.6)	0.706
BMI, mean ± SD	30.67 ± 7.10	29.69 ± 5.29	0.147
Employment, n (%)			0.073
Employed	67 (45.0)	123 (44.1)	
Unemployed	2 (1.3)	18 (6.5)	
Retired	7 (4.7)	7 (2.5)	
Unknown	73 (49.0)	131 (47.0)	
Insurance, n (%)			<0.001*
Private	87 (58.4)	205 (73.5)	
Medicare	36 (24.2)	30 (10.8)	
Medicaid	20 (13.4)	25 (9.0)	
Unknown	6 (4.0)	19 (6.8)	
Smoking Status, n (%)			0.621
Never Smoker	97 (66.4)	196 (71.0)	
Former Smoker	28 (19.2)	45 (16.3)	
Current Smoker	21 (14.4)	35 (12.7)	
ADI National Percentile (mean ± SD)	58.56 ± 29.22	57.99 ± 26.42	0.843
ADI Quartile n, (%)			0.316
Q1 (1-25)	21 (14.2)	34 (12.5)	
Q2 (26-50)	44 (29.7)	84 (31.0)	
Q3 (51-75)	31 (20.9)	76 (28.0)	
Q4 (76-100)	52 (35.1)	77 (28.4)	
MHI (mean ± SD)	$76,533 ± $36,519	$74,754 ± $31,332	0.616
Last Follow up (mean months ± SD)	10.78 ± 12.14	12.01 ± 10.46	0.246
% Chronic Tear (>6 weeks since injury at presentation)	23 (15.4)	38 (13.6)	0.609

* indicates P value with significance (<.05).

Table 2. Predictors for operative treatment using multiple logistic regression model in patients with Acute Achilles Tendon Tears.

Covariate	Level	Odds Ratio (95% CI)	OR P-value
Age		0.973 (0.954-0.993)	0.008*
Sex	Male	-	-
	Female	0.872 (0.478-1.591)	0.655
Race	White	-	-
	Black	0.915 (0.530-1.581)	0.751
	Asian	0.389 (0.108-1.404)	0.149
	Other	1.831 (0.326-10.271)	0.492
	Unknown	2.566 (1.044-6.304)	0.040*
Employment	Employed	-	-
	Unemployed	2.038 (0.377-11.007)	0.408
	Retired	2.353 (0.556-9.956)	0.245
	Unknown	1.184 (0.728-1.926)	0.496
Insurance	Private	-	-
	Medicaid	0.430 (0.205-0.906)	0.026*
	Medicare	0.471 (0.216-1.027)	0.058
	Unknown	0.602 (0.174-2.088)	0.424
ADI Quartile	1	-	-
	2	1.848 (0.853-4.001)	0.119
	3	1.539 (0.697-3.398)	0.286
	4	1.241 (0.570-2.703)	0.586

* indicates P value with significance (<.05).

Table 3. PROMIS Outcomes Between Operative and Nonoperative cohorts

	Nonoperative	Operative	P Value
Initial PROMIS-PI	62.43 ± 11.72	64.22 ± 8.72	0.187
Initial PROMIS-PF	32.62 ± 11.13	32.12 ± 10.82	0.745
6 Weeks Postoperative			
PI Difference	-3.61 ± 10.72	-8.24 ± 9.62	0.006*
PF Difference	5.83 ± 12.71	4.49 ± 11.88	0.540
3 Months Postoperative			
PI Difference	-6.52 ± 17.72	-7.76 ± 9.16	0.658
PF Difference	10.05 ± 12.30	10.08 ± 12.54	0.988
6 Months Postoperative			
PI Difference	-5.38 ± 17.98	-11.47 ± 10.08	0.054
PF Difference	12.30 ± 14.73	14.85 ± 13.00	0.454
1 Year Postoperative			
PI Difference	-6.43 ± 10.80	-13.08 ± 8.26	0.140
PF Difference	5.60 ± 10.74	21.77 ± 10.39	0.010*
Proportion meeting MCID at 6 Weeks			
PI, n (%)	23/57 (40.4)	67/103 (65.0)	0.003*
PF	28/53 (52.8)	38/76 (50.0)	0.752
Proportion meeting MCID at 3 Months			
PI	23/46 (50.0)	56/92 (60.9)	0.224
PF	29/42 (69.0)	50/72 (69.4)	0.965
Proportion meeting MCID at 6 Months			
PI	15/26 (57.7)	37/55 (67.3)	0.401
PF	16/23 (69.6)	41/53 (77.4)	0.471
Proportion meeting at MCID 1 year			
PI	4/7 (57.1)	12/13 (92.3)	0.061
PF	2/5 (40.0)	12/13 (92.3)	0.017*

* indicates P value with significance (<.05).