Journal of Orthopaedics 15 (2018) 226–229

Contents lists available at ScienceDirect

Journal of Orthopaedics

journal homepage: www.elsevier.com/locate/jor

Risk factors for complications after primary repair of Achilles tendon ruptures

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ARTICLE INFO

Keywords:
Achilles tendon rupture
Diabetes
Outcome studies
Tendon disorders

ABSTRACT

Purpose: To identify patient characteristics associated with adverse events in Achilles tendon rupture (ATR) surgical repair cases.
Methods: A high risk (HR) cohort group of ATR patients were compared to healthy controls in the ACSNSQIP database with multivariate regression analysis.
Results: Overall, 2% (n = 23) of the group sustained an AE postoperatively, most commonly superficial SSI (0.9%, n = 10). Multivariate analysis did not reveal any patient characteristics to be significantly associated with the occurrence of an AE or superficial SSI.
Conclusions: Obesity, diabetes and a history of smoking did not predispose patients to significantly more AEs in the 30 day postoperative period following ATR repair in this study.

1. Introduction

Achilles tendon rupture (ATR) is a fairly common injury that results in substantial morbidity with functional deficits persisting more than two years after the initial injury regardless of treatment.[20] The majority of Achilles tendon ruptures result from sports and exercise related activity.[14,16] These injuries occur more in males between the ages of 30 and 50, with an overall incidence of 6–37 per 100,000 people.[12,17,23] There has been an increased incidence in recent years among both men and women[13] with a peak in the spring that may be due to the increased frequency of adults playing recreational sports.[21]

Broadly speaking, ATR can be treated either surgically or non-surgically. Though surgical treatment has been trending downward,[13] there is currently no consensus among orthopaedic surgeons as to the optimal management of ATRs. A number of recent studies have compared outcomes and complications between surgical and non-surgical treatment of ATR injuries. The results of these studies have shown lower re-rupture rates in surgically repaired ATR with a higher rate of other complications including infection and nerve injury.[1,22,24] Given these outcomes, concerns regarding adverse events in the postoperative period may influence the decision to pursue operative management in certain patients. It is important for surgeons to be able to identify those patients who are at a higher risk for experiencing adverse events and tailor treatment accordingly.

The American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) is a multi-institutional outcomes database gaining increasing use in the field of orthopaedics to help analyze the various factors that contribute to adverse surgical outcomes.[6,19] It contains pre-operative, intra-operative, and 30-day follow up data that is prospectively collected using a standardized methodology resulting in a high quality and robust database. To our knowledge, no one has utilized the NSQIP database to analyze the overall incidence of adverse events and associated risk factors following Achilles tendon surgery. The purpose of this study was to (1) identify patient characteristics associated with the occurrence of adverse events in Achilles tendon rupture and (2) compare outcomes in the perioperative period between patients with multiple risk factors and healthy patients.

2. Materials and methods

The ACS-NSQIP database was queried for all primary ATR procedures defined as Current Procedural Terminology (CPT) codes 27650 (1085 cases) and 27652 (79 cases) performed in the years 2005–2012. Percutaneous ATR was not included in this analysis in order to have a more uniform cohort. Patients with missing demographic or outcomes information were excluded from analysis.

Adverse events were defined as the occurrence of any of the

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https://doi.org/10.1016/j.jor.2018.01.017
Received 12 October 2017; Accepted 12 January 2018

following: Death, coma > 24 h, ventilator > 48 h, unplanned intubation, stroke/cerebrovascular accident, deep venous thrombosis, pulmonary embolism, cardiac arrest, myocardial infarction, acute renal failure, sepsis, septic shock, return to operating room, wound dehiscence, deep SSI, organ/space infection, graft prosthesis failure, peripheral nerve injury, superficial surgical site infection (SSI), urinary tract infection, pneumonia, or progressive renal insufficiency. Superficial surgical site infection is defined in the NSQIP database as an open wound, cellulitis (erythema, tenderness and swelling), or wound infection was noted postoperatively at the surgical site. A high risk (HR) cohort group was created by compiling patients who were either obese (Body Mass Index [BMI] > 30), had a history of diabetes, or a history of smoking. These patients were compared for rates of adverse events to healthy control patients who had none of these risk factors using Pearson's Chi square test for significant differences (p-value < 0.05). A multivariate logistic regression analysis of the overall cohort including obesity, history of smoking, diabetes, consumption of greater than two drinks of alcohol/day, age, gender, hypertension, and history of chronic obstructive pulmonary disease was completed to assess for independent predictors of adverse events. The model explained 3.4% of variance in adverse events and correctly classified 98.0% of cases. A subgroup analysis was completed to compare primary ATR repair with and without graft to ensure the patient groups could be combined and were comparable with regard to outcomes.

3. Results

In total, one thousand one hundred and sixty-four patients met inclusion criteria for the study. A subgroup analysis of the two CPT procedures included (27650 and 27652) revealed ATR repair patients with graft differed only in operative time compared to ATR repair patients without graft (58.34 ± 26.9 min, vs. 93.25 ± 40.41 min, p < 0.001). There was no statistically significant difference in the two procedure groups with regard to adverse events with only one patient in the ATR repair with graft group having a complication compared to 22 in the ATR repair without graft group.

From the overall cohort, six hundred and fifteen met criteria for the HR cohort (53%). Complete patient demographics are listed in Table 1. Overall, 2% (n = 23) of the group sustained an adverse event during the 30 day postoperative period, the most common being superficial SSI (0.9%, n = 10). Frequency of specific complications in the overall cohort and the HR group are included in Table 2. There was no significant difference in the HR cohort versus controls in rates of adverse events (2% vs. 2%, p = 0.981) or superficial SSI (0.9% vs. 0%, p = 0.183). Operative time was significantly longer in HR group compared to healthy controls in the study (63.16 ± 30.2 min vs. 57.95 ± 28.2 min, p = 0.002). Logistic multivariate analysis did not reveal any patient characteristics included in the model to be significantly associated with the occurrence of an adverse event or superficial SSI (Table 3).

Table 1
Patient characteristics for overall Achilles tendon rupture repair cohort.

	Overall (N = 1164)	High Risk (N = 615)
Demographic		
Age, years	44.82 ± 13.32	48.19 ± 14.12
Female sex (%)	25.6%	29.4%
Preoperative Comorbidities		
BMI, kg/m^2	30.13 ± 6.46	33.79 ± 6.70
Functional status (dependent) (%)	0.1	0.2
Smoker within 1 year (%)	12.2	76.9
Alcohol use (%)	0.9	1.1
Steroid use (%)	1.1	1.3
Weight loss (%)	0.1	0.2
Diabetes (%)	5.0	10.4
Hypertension (%)	22.5	34.0
COPD (%)	0.8	1.1
Open wound/wound infection (%)	1.0	1.0
Operative Variables		
Mean operative time, min	60.71 ± 29.38	63.16 ± 30.19

BMI = Body Mass Index.

Table 2
Thirty-day postoperative complications in overall Achilles tendon rupture repair cohort.

Outcome	Count (Overall N = 1164)	% of total
Any complication	23	2.0
Superficial wound infection	10	0.8
Deep wound infection	3	0.3
Wound dehiscence	3	0.3
Pneumonia	1	0.1
Deep-vein thrombosis	2	0.2
Reoperation	6	0.5

Values listed as percentages.

Table 3
Multivariate Analysis of Risk Factors for Any Adverse Event.

Outcome	Odds ratio (95% CI)	*p* value
Any adverse event		
Obesity	0.57 (0.10–3.14)	0.52
History of Smoking	2.66 (0.71–10.03)	0.15
History of Diabetes	1.21 (0.51–14.26)	0.25
Age	1.01 (0.97–1.05)	0.81
Gender (Male)	1.05 (0.40–2.77)	0.93
History of Hypertension	0.39 (0.97–1.55)	0.18
History of COPD	6.94 (0.68–70.5)	0.10

4. Discussion

The patient population in this study was relatively young and healthy with an average age of 44.8 and few comorbidities. This is consistent with the epidemiology of ATRs documented in other literature.[12–14] The controversy regarding optimal management of ATR largely centers on weighing the risk of surgical complications against potentially longer recovery time and suboptimal functional results if patients are managed nonoperatively.[9,15] This study found a very low overall adverse event rate of 2% in the 30-day postoperative period for primary surgical ATR repair.

The HR cohort of patients had a statistically significantly higher operative time relative to healthy controls without risk factors. However, this difference of six minutes between the risk-stratified groups is likely not clinically significant. Patients undergoing ATR repair with graft had significantly higher operative time than those patients undergoing ATR repair without graft but did not differ in adverse event rates.

Though in this study there was no increased risk of adverse events across comparisons, increased operative time has been implicated as a risk factor for postoperative infection in numerous studies.[7,25] A comparison of operative and conservative management by Cukelji et al found a lower rate of complications in patients undergoing percutaneous ATR repair and noted a lower operative time in these patients.[9] However, the sample size in their study was much smaller and specifically targeted athletes aged 25–40. Lower operative time did not correlate with lower incidence of complication in this study. However, it should be emphasized that the total recovery period for ATR extends far beyond the 30-day postoperative period.

Wound complications after ATR surgical repair have been documented as a concern that warrants consideration of nonoperative treatment for these injuries.[8] A retrospective study of 60 operatively managed ATR patients by Marican et al found that 16.7% of patients