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Original Article

Are complications after repairing acute Achilles tendon ruptures related to the surgical approach or the patient's comorbidities?*

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Abstract

Objective: Analyze the postoperative complications after repairing acute Achilles tendon rupture and compare them according to the surgical approach (open surgery (OS) or minimally invasive surgery (MIS)) and the patient's comorbidities.

Methods: A retrospective analytical study including 154 consecutive patients with an acute Achilles tendon rupture submitted to surgery and divided into OS and MIS cohorts. The following relevant comorbidities were analyzed: obesity, diabetes mellitus, smoking, dyslipidemia, gout, chronic corticosteroid use, connective tissue pathologies, transplant history, cancer treatment patients, and postoperative complications.

Results: Seventy-eight patients (50.6%) were treated surgically with an OS technique and 76 (49.4%) with an MIS approach. Twenty patients (13%) had postoperative complications between the two cohorts (OS 11.5%; MIS 14.5%; p = 0.588). No statistically significant difference was found in the logistic regression of the risk of the surgical approaches and complications. Obesity had a significant statistical difference when complications and comorbidities were compared.

Conclusions: Patients with obesity have a higher risk of developing postoperative complications with both OS and MIS techniques. No relationship was found between the type of surgical approach and a higher percentage of postoperative complications in treating acute Achilles tendon rupture.

Levels of Evidence III; Therapeutic Studies; Retrospective Comparative Study.

Keywords: Achilles tendons; Rupture; Minimally invasive surgery; Comorbidities; Postoperative complications.

Introduction

Acute Achilles tendon ruptures are frequent in men between 35 and 60 years, especially in occasional athletes[1,2]. The surgical treatment could achieve a lower rate of re-rupture[3], better functional outcomes, and a shorter recovery time[1,2]. However, the choice of surgical approach is still controversial.

Different surgical techniques and approaches have shown efficacy in repairing the Achilles tendon. There is currently a trend in trauma surgery towards adopting minimally invasive approaches[4-6]. Some studies suggest tendon repair using minimally invasive surgery (MIS) as an advantage compared to open surgery (OS) due to the lower rate of infection[7-9]. Smaller incisions generate less damage to the soft tissues[10,11]. Sural nerve injury has been described in MIS techniques[5,11]. Among MIS, there are completely percutaneous approaches such as the one described by Ma and Griffith; this technique carries the risk of entrapment with the suture thread of the sural nerve[12]. Another MIS technique is the one described by Kupcha and Mackenzie[13], where a small incision is made at the level of the rupture and with instruments such as Foerster-type oval forceps progressed intra-peritendon, avoiding

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entrapment of the sural nerve and its consequences. Later, more sophisticated devices with nonabsorbable and locked sutures were developed, such as the ACHILLON® (Integra) and the PARS® system (Arthrex)[14]. Other MIS techniques do not address the source of rupture, such as the technique described by Dresden in the study by Joannas et al.[15]. On the other hand, authors who endorse OS maintain that directly visualizing the ends and their status usually gives the procedure more reliability and a low complication rate[5,15]. Several series compare different techniques, but there is still no consensus on the best approach[4,5,7,11].

Immunocompromise, venous insufficiency, peripheral vascular disease, diabetes mellitus (DM), tobacco use, and recent corticosteroid use can affect outcomes after surgery for acute Achilles rupture[16]. Obese patients have had more complications than non-obese patients in surgical treatment. Other studies have also described increased complications in patients with decreased albumin values, advanced patient age, chronic obstructive pulmonary disease (COPD), elevated creatinine values, alcohol and drug abuse, psychiatric illnesses (depression and psychosis), and active tobacco use[17].

The aim of the study is to analyze the postoperative complications after repairing acute Achilles tendon rupture and compare them according to the surgical approach (OS or MIS) and the patient's comorbidities.

Methods

A retrospective analytical study including consecutive patients with a complete acute Achilles tendon rupture between February 2011 and March 2020. A fellow and two advanced orthopedics resident doctors collected the electronic medical record (EMR) data after approval by the institutional ethics committee.

Adult patients presenting acute Achilles tendon rupture of total thickness at the central level (2 cm-6 cm)[18] of the insertion treated surgically within 21 days of the event were included. Patients with exposed Achilles tendon section, incomplete EMR, previous Achilles surgery and/or rupture, or who did not complete six months of follow-up were excluded from the study.

The demographic variables and all the comorbidities described in the EMR were studied and grouped as relevant comorbidities: obesity, DM, smoking, COPD, renal failure, dyslipidemia, gout, chronic corticosteroid use, connective tissue pathologies, history of transplant and patients undergoing cancer treatment.

The patients were divided into OS and MIS cohorts. The surgeons chose the surgical technique according to their preference during the pre-surgical consultation.

A postoperative complication is an eventuality that occurs in the expected course of recovery from a surgical procedure with a local or systemic response that can delay healing and put function or life at risk[8]. The local complications revealed were: wound dehiscence, superficial and deep infection, sural nerve injury, re-rupture, and hematoma. All systemic complications were relieved, including deep vein thrombosis (DVT) and pulmonary thromboembolism[4,7,19]. A superficial infection was categorized as an infection that did not extend beyond 2 cm from the outer edge of the surgical skin wound. It could be resolved with wound care and oral antibiotics. On the other hand, a deep infection was characterized by soft tissue involvement exceeding 2 cm, necessitating surgical debridement[20].

Surgical technique

All patients were operated on in ventral decubitus under regional blockade and monitored anesthetic care. The OS was performed through a longitudinal medial Achilles incision (10 cm-12 cm) with suture after tendon through direct vision.

The MIS technique was performed through a minor transverse or longitudinal incision, the ends of the tendons were visualized (2 cm-3 cm) at the level of the tendon hiatus. The proximal and distal ends were crossed inside the paratenon using three suture threads through healthy skin through a Foerster clamp (modified Kupcha technique) or with the PARS device (Arthrex®). The suture threads are extracted from both ends through the mini-approach and tied, returning tension to the injured tendon[13,14].

Both groups followed the same rehabilitation protocol: immobilization with an equinus cast for three weeks, with wound control in the first postoperative week. In the third week, the equinus cast was replaced with a removable boot with a 2 cm posterior enhancement removed 0.5 cm per week, with progressive partial weight bearing up to total weight. After three weeks, the patient progressed to athletic shoes with a heel cup. The patients underwent rehabilitation with kinesiology equipment.

Statistic analysis

Quantitative variables are presented as means with their standard deviation (SD) or median with the interquartile range (IQR) according to the distribution and categorical variables with absolute and relative frequency.

The chi-square test was used to identify differences in categorical variables. The Mann-Whitney test was used for continuous variables because it presented a non-normal distribution.

Univariate analysis was performed using logistic regression; the null odd ratios (ORs) are presented with their 95% confidence interval. The statistically significant value was set at < 0.05.

The STATA software (Stata Statistical Software: version 15, 2017. College Station, TX: StataCorp LLC) was used for statistical analysis.

Results

One hundred and seventy-nine patients were operated on during the study period, and 154 patients met the inclusion

criteria; 78 (50.6%) were treated surgically with an OS, and 76 (49.4%) with an MIS approach. The median follow-up time for the total sample was nine months (IQR: 7-19); for OS, nine months (IQR: 6-19) and for MIS, nine months (IQR: 7-19.5). Risk factors for rupture and the most relevant comorbidities were analyzed (Table 1). As an augmentation technique, a harpoon was used in 56 surgeries (36.4%), 27 (34.6%) in OS, and 29 (38.2%) in MIS.

Twenty patients (13%) had postoperative complications between the two cohorts (OS 11.5%; MIS 14.5%; p = 0.588). Nine patients (45%) required reoperation, six from OS and three from MIS (Table 2). No statistically significant difference was found in the logistic regression of the risk of the surgical approaches and complications (OS 11.5%, MIS 14.5%, p = 0.588). Previously, the different subgroups within the MIS technique (transversal Kupcha, longitudinal Kupcha, and longitudinal PARS) were compared, and no statistically significant differences were found. In the same way, the risk for harpoon placement and complications were analyzed, and no statistically significant differences were found.

When complications and comorbidities were compared, obesity was statistically significant, with a statistical trend for gout and DM (Table 3).

Table 1. Demographic data and comorbidities

	OS (78)	MIS (76)	Total (154)
Male sex, n, (%)	73 (93.59)	71 (93.4)	144 (93.5)
Age, median, (IQR), years	42.5 (37-53)	42 (33-57.5)	42 (36-56)
Comorbidities n, (%)	41 (52)	39 (51.3)	80 (51.95)
Hypothyroidism	1 (1.3)	3 (3.9)	4 (2.6)
Rheumatologic disease	0	1 (1.32)	1 (0.6)
Gout	2 (2.56)	2 (2.63)	4 (2.60)
Diabetes mellitus	3 (3.85)	2 (2.63)	5 (3.25)
Oncological	0	1 (1.33)	1 (0.6)
Transplant	1 (1.28)	0	1 (0.65)
Chronic renal insufficiency	0	0	0
Corticosteroid consumption	2 (2.56)	1 (1.32)	3 (1.95)
Smoking	7 (8.9)	18 (23.6)	25 (16.2)
Arterial hypertension	26 (33.3)	16 (21.05)	42 (27.2)
Dyslipidemia	11 (14.1)	9 (11.8)	20 (13)
Obesity	8 (10.6)	10 (13.1)	18 (11.7)
COPD	2 (2.56)	1 (1.3)	3 (1.9)

OS: Open surgery; MIS: Minimally invasive surgery; IQR: interquartile range; COPD: Chronic obstructive pulmonary disease.

Table 2. Postoperative complications

Complications	OS (78)	MIS (76)	Total
Re-rupture, n	3	5	8
Superficial infection, n	0	2	3
Deep infection, n	0	0	0
Dehiscence, n	2	2	4
Sural lesion, n	0	2	2
DVT, n	1	0	1
PE, n	1	0	1
Harpoon intolerance, n	2	0	2
Reoperations, n, (%)	6 (7.7)	3 (3.9)	9 (5.84)

OS: Open surgery; MIS: Minimally invasive surgery; DVT: Deep venous thrombosis; PE: Pulmonary Embolism.

Discussion

Several meta-analyses and randomized case-control studies have been published, seeking an answer, and some articles compared the most appropriate OS or MIS approach to surgically treating an acute Achilles tendon rupture. The trend in orthopedic surgery favors MIS approaches. Our study presents a comparative series of patients treated with OS and MIS and found no statistically significant difference in postoperative complications. Comparing our results with other published studies, similarities were observed with Hsu et al.[8], who recorded 10% complications in OS and 5% in MIS. Cretnik et al.[21] reported 12.4% and 4.5%, respectively. Open surgery should not be a protective factor for re-ruptures, as found in our patients who suffered a re-rupture in both groups but not statistically significant. A low rate of thromboembolic events was found (OS 1; MIS 0; p = 0.5). The only patient with thromboembolic complications reported had a favorable clinical course. The reported risk of developing pulmonary thromboembolism suggests postoperative thromboprophylaxis[22,23]. In our series, OS did not have a higher prevalence of infections and problems related to the wound, as published in other series[7-9]. These results may be associated with the homogenization of postoperative care in both techniques and the strict control of the soft tissues in the first postoperative weeks.

Burrus et al.[16] reported that obese patients had more wound, infection, and systemic complications than non-obese patients; however, they do not refer to the technique or approach used for surgical resolution. A statistically significant difference was found between patients with obesity and postoperative complications; we did not analyze them separately. Another study concludes that the values of albumin and the patient's age were related to wound complications, COPD with more systemic complications, and renal failure with all complications[24]. Preoperative albumin values were not evaluated, but no differences between chronic renal failure and COPD were found. Alcohol

Table 3. Logistic regression of risk and comorbidities

	OR (CI 95%)	p-value
Gout	7.33 (0.97-55.32)	0.053
Diabetes mellitus	4.85 (0.76-31.04)	0.095
Obesity	4.36 (1.41-13.42)	0.010

OR: Odds ratio; CI: Confidence interval.

and drug abuse, psychiatric illnesses (depression and psychosis), and obesity are related to a higher incidence of surgical site complications[17]. Stavenuiter et al.[25] have concluded that the factors associated with a higher risk of postoperative complications are the patient's advanced age and active tobacco use. In our series, no relationship between postoperative complications and the approach used was found[17,25]. Also, no association between smoking and patient age was found, although we analyzed them as older and younger than 40 years. On the other hand, Pean et al.[26] have not found statistically significant differences for any comorbidity with postoperative adverse events. A positive trend for DM and gout was found, although both were not statistically significant, probably due to our low sample. An exhaustive preoperative evaluation to select surgical treatment, considering each patient's comorbidities, could be a more effective way to reduce postoperative complications in acute Achilles tendon repair, regardless of the surgical technique used.

The limitations of our study are typical of a retrospective design. The publications that have analyzed comorbidities during the repair of acute Achilles ruptures have examined a high variability of factors. Increasing the variables analyzed in a retrospective study is a limitation of these designs; prospective studies should consider them more widely.

Conclusions

Patients with obesity have a higher risk of developing postoperative complications with both OS and MIS techniques. No relationship was found between the type of surgical approach and a higher percentage of postoperative complications in treating acute Achilles tendon rupture.

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