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Can Wound-Site Complications Be Predicted after Open Repair in Acute Achilles Tendon Ruptures?

Akut Aşil Tendon Kopmalarında Açık Onarım Sonrası Yara Yeri Komplikasyonları Öngörülebilir mi?

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Abstract

Aim: To examine the correlation between wound-site complications that arise following open repair of acute achilles tendon ruptures and patient-related factors.

Material and Method: Age, gender, mechanism of injury, time from rupture to surgery, and postoperative complications were analyzed in 39 patients who underwent open surgery by a single orthopedic and traumatology team between 2019 and 2024.

Results: As the time until surgical intervention increased after tendon rupture, wound-site complications were encountered more frequently ($p<0.001$) There was no other significant relationship between patient-based parameters and wound-site complications ($p>0.05$ for each).

Conclusion: The most effective parameter in predicting wound-site complications after open rupture of the AT rupture is the elapsed time between injury and surgery, whereas factors such as age, gender and injury mechanisms are not able to predict wound-site complications in such cases. Patients should be operated on as soon as possible to minimize the risk of wound site problems, which is a common complication of Achilles tendon rupture treatments.

Keywords: Achilles tendon, calcaneal tendon, postoperative wound infections, postoperative complication, hospital stay

Öz

Amaç: Akut aşil tendon rüptürlerinin açık onarımı sonrasında ortaya çıkan yara yeri komplikasyonları ile hastaya bağlı faktörler arasındaki ilişkiyi incelemek.

Gereç ve Yöntem: 2019-2024 yılları arasında tek bir ortopedi ve travmatoloji ekibi tarafından açık cerrahi uygulanan 39 hastada yaş, cinsiyet, yaralanma mekanizması, kopmadan cerrahiye kadar geçen süre ve ameliyat sonrası komplikasyonlar analiz edildi.

Bulgular: Tendon kopmasından sonra cerrahi müdahaleye kadar geçen süre arttıkça, yara yeri komplikasyonlarına daha sık rastlandı ($p<0,001$) Hasta bazlı parametreler ile yara yeri komplikasyonları arasında başka anlamlı bir ilişki yoktu (her biri için $p>0,05$).

Sonuç: Açık aşil tendon rüptüründen sonra yara yeri komplikasyonlarını öngörmede en etkili parametre yaralanma ile ameliyat arasında geçen süredir; yaş, cinsiyet ve yaralanma mekanizmaları gibi faktörler ise bu tür vakalarda yara yeri komplikasyonlarını öngörmede yetersiz kalabilir. Aşil tendon rüptürü tedavilerinin yaygın bir komplikasyonu olan yara yeri sorunları riskini en aza indirmek için hastalar mümkün olan en kısa sürede ameliyat edilmelidir.

Anahtar Kelimeler: Aşil tendonu, kalkaneal tendon, ameliyat sonrası yara yeri enfeksiyonu, ameliyat sonrası komplikasyon, hastane yatış süresi

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INTRODUCTION

The Achilles tendon (AT) has been identified as the most frequently ruptured tendon in the human body, with a reported frequency of 11-37 per 100,000 people per year.[1,2] The area most frequently injured is the hypo-vascular area, located 4-6 cm proximally to the insertion of the AT into the calcaneus.[3-5] In the treatment of acute AT ruptures, surgical treatment is conventionally recommended for cases of full-thickness rupture.[3-5] Primary repair can be performed either through an open approach or percutaneously.[6] Following surgery, it is standard practice to immobilize the ankle in the resting equinus position, and to advise movement restriction for a period of 4-6 weeks.[3-6]

While surgical treatment remains the preferred approach for full-thickness acute AT ruptures; there is an increasing tendency for conservative treatment. In the literature, conservative treatment is associated with a higher risk of tendon re-ruptures, while surgical treatment is more frequently associated with wound complications.[7] Consequently, conservative treatment is being favored by an increasing number of surgeons seeking to treat the condition without the risk of complications from surgery.[8]

Post-operative wound-site complications in the ankle area and around the AT are linked to inadequate soft tissue coverage and impaired nutrition in the region.[9] These complications may result in the necessity for repeated surgical interventions, protracted treatment durations, and diminished functional outcomes. Consequently, the ability to predict and prevent wound complications is a critical factor in ensuring patient satisfaction following acute AT repairs.

The objective of this study was to examine the correlation between wound-site complications that arise following open repair of acute AT ruptures and patient-related factors.

MATERIAL AND METHOD

The study was approved by the local ethics committee (Date: 21/09/2022 Decision No: E1-22-2908). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

All patients aged 18 years and over who were diagnosed with acute AT rupture and treated surgically in the study clinic between 2019 and 2024 were retrospectively evaluated. The study encompassed all acute AT ruptures that underwent open repair, while excluding patients treated with mini open or closed techniques, patients with calcaneal bone fragment fractures, patients treated with anchor sutures, patients who underwent external fixator due to multiple trauma, patients who did not comply with routine postoperative rehabilitation, patients with chronic AT ruptures, and patients with peripheral artery disease or diabetes. The study's final sample size was 39 patients, who met the stipulated inclusion and exclusion criteria. Informed consent form was not signed by all patients due to the retrospective design of the study.

In the study clinic, patients with a preliminary diagnosis of AT rupture are monitored with a long leg splint in plantar flexion until surgery, following an initial evaluation and positive examination findings. All patients are taken to surgery as soon as possible, as permitted by their general condition and comorbidities. The surgical procedure was performed under general anesthesia in the prone position, employing a completely open approach (**Figure 1**) and a Krakow double-row repair (**Figure 2**) with two reinforced sutures of the same brand (Ethibond Excel™ Suture, Ethicon Surgical Technologies, Johnson & Johnson MedTech). In the postoperative period, all patients were subjected to a long leg circular cast in 20º of plantar flexion for a period of six weeks. Thereafter, gradual dorsiflexion was administered using a ROM-Walker apparatus, and patients were subsequently enrolled in a uniform physical therapy and rehabilitation programme in the third month following surgery.

Figure 1. The preferred open approach for open repair of achilles tendon ruptures is shown. Patient is in the prone position and the incision is just medial to the Achilles tendon. , open approach. The open approach preferred for achilles.

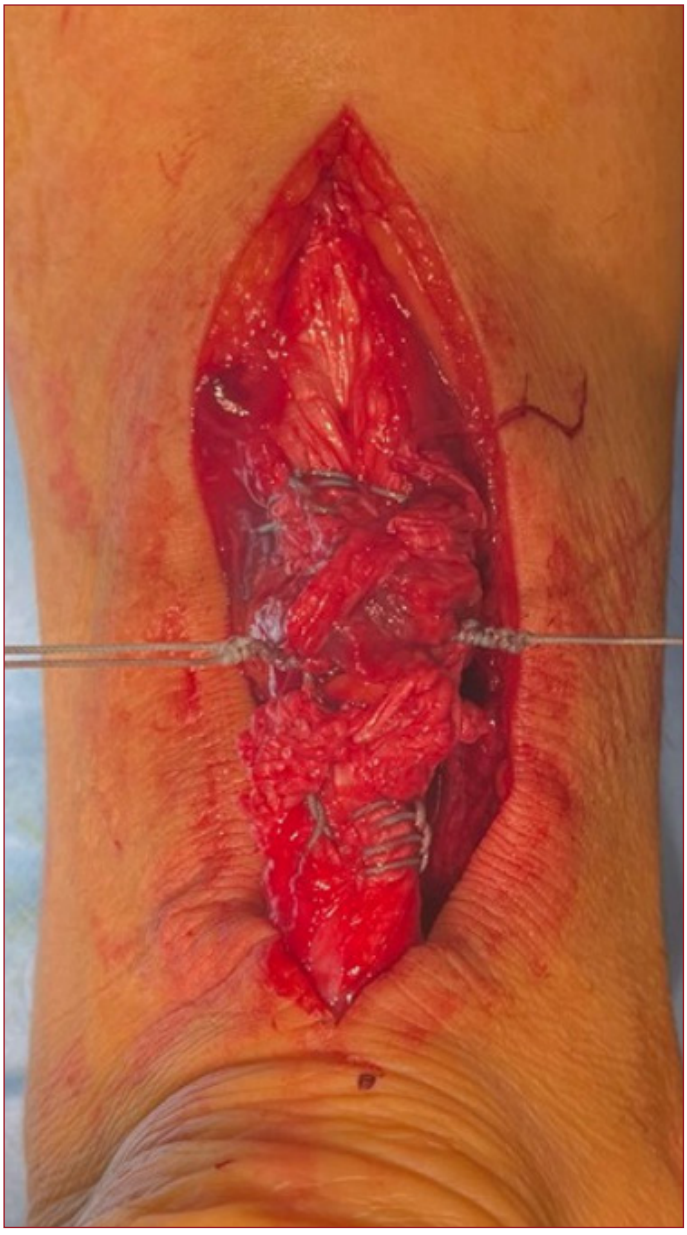

Figure 2. The preferred Krakow double-row repair is shown.

A retrospective review of patient data was conducted from patient files and records. Variables such as age, gender, the mechanism of injury (categorized as sports, penetrating, and blunt injuries, or unspecified), the time interval between trauma and surgery, and complications including re-rupture, wound-site problems, and the necessity for secondary surgery, were documented. Re-ruptures, and secondary operations occurring after six months were not taken into consideration to ensure that any re-ruptures unrelated to the repair procedure were excluded from the analysis.

The data were analyzed using the IBM SPSS Statistics for Windows, Version 22.0. (IBM Corp, Armonk, NY, USA). While the mean±standard deviation (minimum-maximum range) were used as descriptive statistics for numerical data, percentage (frequency) values were utilized to describe categorical data. The numerical data's compliance to normal distribution were examined through both visual (histogram and probability graphs) and analytical (Kolmogorov-Smirnov test) methods. The differences between the groups with and without wound-site problems in the parameters "age" and "time between trauma and surgery", which were found to have a normal distribution, were evaluated using the Independent Samples T Test. For the evaluation of categorical data, the Chi-square Test was employed, and in instances where the Chi-square assumption was not met, Fisher's Exact Test was utilized. P-values less than 0.05 were considered statistically significant.

RESULTS

Among the 39 patients evaluated in the study, 7.7% were female, and the mean age of the patients was 39.87 years (range: 20-57 years.). When the injury mechanisms of AT ruptures were analyzed, it was found that sports injuries ranked first with 46.2%, while 12.8% were caused by blunt trauma and 10.3% by penetrating trauma. The mean time to surgery after AT rupture was 3.08±5.268 days with a range of 1-27 days. Demographic and clinical characteristics of the patients are summarized in **Table 1**.

In terms of complications; six patients (15.4%) exhibited wound-site complications, whereas no re-rupture was observed in any patient after surgery, and no patient required secondary operation. All patients with wound-site complications were treated with frequent dressing changes and oral antibiotherapy and local debridement (**Table 1**).

Table 1. Demographic profile of the patients

	Achilles Tendon Ruptures N=39
Age (years)	39.87±9.707 (20-57)
Gender	
Female	3 (7.7%)
Male	36 (92.3%)
Injury Mechanism	
Penetrating Trauma	4 (10.3%)
Sports Trauma	18 (46.2%)
Blunt Trauma	5 (12.8%)
Unidentified	12 (30.8%)
Time Between Injury and Operation (days)	3.08±5.268 (1-27)
Re-rupture	
None	39 (100%)
Yes	0
Wound-site Complications	
None	33 (84.6%)
Yes	6 (15.4%)
Requirement for Secondary Surgery	
None	39 (100%)
Yes	0

N: number of patients. Mean±standard deviation (minimum-maximum range) were used as descriptive statistics for scale data.

An examination was conducted to ascertain the correlation between the development of wound-site complications and patient-based factors in patients who underwent primary repair following acute AT ruptures. Statistical analyses revealed a significant relationship between the time between injury and operation and the development of wound-site complications (p <0.001). No other significant relationships were observed (**Table 2**).

Table 2. Relationship between wound-site complication and patient-based factors

	Wound-site Problems		p
	Yes (N=6)	None (N=33)	
Age (years)	41.83±14.077 (20-57)	39.52±8.948 (21-55)	0.199
Gender			
Female	1 (6.1%)	2 (16.7%)	0.403
Male	5 (83.3%)	31 (93.9%	
Injury Mechanism			
Penetrating Trauma	2 (33.3%)	2 (6.1%)	0.129
Sports Trauma	1 (16.7%)	17 (51.5%)	
Blunt Trauma	1 (16.7%)	4 (12.1%)	
Unidentified	2 (33.3%)	10 (30.3%)	
Time Between Injury and Operation (days)	8.67±12.028 (1-27)	2.06±1.853 (1-8)	<0.001
Re-rupture			
None	6 (100%)	33 (100%)	N/A
Yes	0	0	
Requirement for Secondary Surgery			
None	6 (100%)	33 (100%)	N/A
Yes	0	0	

N: number of patients. P: statistical significance value. N/A: not applicable. Mean±standard deviation (minimum-maximum range) were used as descriptive statistics for scale data.

DISCUSSION

Despite the fact that AT ruptures are injuries that can be treated both conservatively and surgically, surgical treatment is a preferable option due to the low re-rupture rates and rapid rehabilitation advantages. Notwithstanding these advantages, the main disadvantage of surgical treatment is wound-site complications that are more common than conservative treatment. Wound-site complications not only prolong the healing process but also cause weakening of the tendon, delays in the patient's return to normal functions and increase the risk of chronic complications. The present study was undertaken with the objective of identifying the factors that contribute to wound-site complications. Our most striking finding was the observation that the duration from injury to surgery was a significant predictor of wound-site complications. This finding is at odds with the established knowledge surrounding the regression of soft tissue edema and hematoma that typically follow classical orthopaedic traumas.

In the literature, the mean age at time of rupture has been found to vary between 30 and 46 years.[11-14] Men are two to eight times more likely to rupture their AT than women.[11-14] The findings of this study are consistent with the literature. When the injury mechanism is examined, it is seen that approximately 87% of all AT ruptures occur during sports activities.[15,16] While sports injuries are considered the most significant injury mechanism in our study, in contrast to the literature, only 46.2% of the cases in our series were encountered with acute AT ruptures following sports injuries. A striking point is that a clear injury mechanism was not described in 30.8% of the injuries. Notably, 12 patients presented to the emergency department with hind foot pain that ensued after a solitary ankle sprain, yet no injury mechanism was disclosed. The observed variation in the distribution of injury mechanisms may be attributable to the influence of sociocultural factors that vary across different societies.

The most striking finding of our study is the significant relationship between the duration from injury to surgery and wound-site complications, which contradicts common orthopedic beliefs. It is well established that, in the case of orthopaedic injuries, increased waiting time is routinely associated with regression of edema, relaxation of soft tissue, and resolution of wound complications.[9] Soft tissue edema develops after ankle fractures and poses a risk for open surgery in surgical interventions performed after 24 hours after trauma. Therefore, the AO group recommends waiting at least 4 days after trauma in cases planned to undergo open reduction and internal fixation.[17] In contrast, Westberg et al. reported that the incidence of prosthetic infections rises as the preoperative waiting time increases in the treatment of femoral neck fractures with arthroplasty.[18] In contrast to the findings in the literature, our study observed that increased waiting time is associated with increased wound-site complications. The question arises as to why wound-site complications increase with increased waiting time. The primary and most salient reason that comes to mind is that with increased waiting time, the amount of tendon retraction increases despite the splint in plantar flexion and more dissection is required to bring it back to its place. Moreover, with increasing waiting time, the need to refresh the tendon ends increases. In the end-to-end repair technique applied to AT ruptures, the ruptured tendon ends need to be refreshed more as the time elapsed after the trauma increases, so a tighter repair and consequently a wound-site problem may be encountered.

The present study is subject to certain limitations. Firstly, while it is encouraging that no re-rupture or secondary operations were observed, the absence of such events impacts the investigation of the effect of this situation on the wound-site complications. Obtaining more optimal results would be facilitated by studies with large patient series. Although it was determined that all patients were satisfied after physical therapy and stated that they returned to their normal lives, the lack of functional scoring is an important limitation in this study. The patients were operated on expeditiously, and preoperative magnetic resonance imaging was not available for all of them, which hinders the assessment of the tendon injury severity. The retrospective nature of the study precludes the determination of the injury severity level through surgeon

observation during the perioperative period. Finally, due to the retrospective nature of our study, the study was unable to evaluate height, weight, body mass index, subcutaneous fat tissue, smoking, and metabolic health factors; which could influence wound complications.

CONCLUSION

The present study has demonstrated that factors such as age, gender and injury mechanisms are not able to predict wound-site complications in cases of open rupture of the AT rupture. The most effective parameter in predicting wound-site complications is the elapsed time between injury and surgery. In order to minimize the risk of wound-site complications, which are a common complication after AT rupture repair, patients should be taken to surgery as soon as possible.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Ankara City Hospital No:1 Clinical Researches Ethics Committee (Date: 21/09/2022, Decision No: E1-22-2908).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The authors have no conflicts of interest to declare.

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