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Research Article

Comparison of Radiological Outcomes in Surgical Vs. Non-Surgical Treatment of Acute Achilles Tendon Rupture

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Abstract
Background: Acute Achilles tendon rupture is a common and significant injury, especially among active individuals. The optimal management—whether surgical or non-surgical—remains a subject of debate. **Objective:** This study aims to compare the radiological outcomes between surgical and non-surgical treatments for acute Achilles tendon rupture. **Methods:** A retrospective cohort study was conducted involving 80 patients with acute Achilles tendon ruptures, divided equally between surgical (n=40) and non-surgical (n=40) treatment groups. Radiological outcomes, including tendon gap reduction and tendon integrity, were assessed through imaging techniques. Functional outcomes, healing time, and re-rupture rates were also evaluated. **Results:** Surgical treatment resulted in significantly better radiological outcomes compared to non-surgical treatment. The surgical group showed greater tendon gap reduction (mean 4.2 mm, SD=1.6) compared to the non-surgical group (mean 2.5 mm, SD=1.3) with a p-value <0.001. Tendon integrity scores were also higher in the surgical group (mean 8.4, SD=0.9) than in the non-surgical group (mean 7.1, SD=1.1), with a p-value of 0.002. Additionally, the surgical group exhibited faster healing times and lower re-rupture rates. Functional recovery scores and range of motion were superior in patients undergoing surgery. **Conclusion:** Surgical treatment of acute Achilles tendon ruptures is associated with superior radiological outcomes and reduced re-rupture rates compared to non-surgical management. These findings support the use of surgical intervention in suitable patients to optimize tendon healing and functional recovery.

Keywords: Achilles Tendon Rupture, Surgical Treatment, Radiological Outcomes

INTRODUCTION

The Achilles tendon is one of the most crucial tendons in the human body, providing essential leverage for walking, running, and jumping. Despite its robustness, the Achilles tendon is vulnerable to injuries, particularly acute ruptures, which are common in both athletic and general populations. The management of acute Achilles tendon rupture (AATR) remains controversial with two main approaches: surgical and non-surgical treatment. The choice of treatment often depends on several factors, including the patient's age, activity level, and the severity of the tendon rupture.[1][2]

The debate between surgical and non-surgical treatment revolves around various outcomes, with the primary concern being the risk of re-rupture and long-term functional capacity. Surgical intervention has been traditionally favored for active individuals due to lower re-rupture rates and better functional outcomes. However, surgical risks such as infection, nerve damage, and complications related to anesthesia cannot be overlooked. On the other hand, non-surgical treatment avoids surgical risks and has been supported by advancements in rehabilitation techniques that may improve outcomes and decrease re-rupture rates.[3][4] Recent studies have increasingly focused on the radiological outcomes of these treatments as they provide objective measures of tendon healing and integrity. Radiological assessments typically involve imaging techniques such as ultrasound and magnetic resonance imaging (MRI), which can evaluate tendon thickness, gap formation, and the quality of the tendon tissue post-injury. These radiological markers are critical as they can correlate with functional outcomes and the risk of re-rupture.[5]

Aim

To compare the radiological outcomes between surgical and non-surgical treatments in patients with acute Achilles tendon rupture.

Objectives

1. To assess the difference in tendon healing as evidenced by imaging techniques between surgical and non-surgical groups.
2. To evaluate the correlation between radiological findings and functional recovery in both treatment groups.
3. To analyze the incidence of complications and re-rupture rates associated with each treatment modality.

MATERIAL AND METHODOLOGY

Source of Data

Data was retrospectively collected from patient records who underwent treatment for acute Achilles tendon rupture at our institution.

Study Design

This was a retrospective cohort study comparing the radiological outcomes of surgical versus non-surgical management of acute Achilles tendon rupture.

Study Location

The study was conducted at a tertiary care hospital specializing in orthopedic injuries.

Study Duration

Data collection covered a period from January 2022 to December 2024.

Sample Size

A total of 80 patients were included in the study, with 40 patients in each treatment group.

Inclusion Criteria

Patients included were those aged 18-60 years, diagnosed with acute Achilles tendon rupture, and had received either surgical or non-surgical treatment within 48 hours of injury.

Exclusion Criteria

Excluded were patients with previous Achilles tendon injuries or surgeries, systemic diseases affecting tendon health (e.g., rheumatoid arthritis, systemic lupus erythematosus), and those who did not complete the prescribed follow-up and rehabilitation protocol.

Procedure and Methodology

Patients in the surgical group underwent open tendon repair followed by rehabilitation. Non-surgical patients received conservative treatment involving immobilization with a cast or boot and followed a structured rehabilitation protocol. Both groups underwent regular follow-up visits at 1, 3, 6, and 12 months post-treatment.

Sample Processing

Radiological evaluation was conducted using MRI and ultrasound to assess tendon gap, fiber continuity, and overall tendon health at each follow-up interval.

Statistical Methods

Data were analyzed using SPSS software. Descriptive statistics, chi-square tests for categorical variables, and t-tests for continuous variables were employed. A p-value of less than 0.05 was considered statistically significant.

Data Collection

Data were collected from electronic medical records, radiological images, and physical examination notes documented during each patient's follow-up visits.

OBSERVATION AND RESULTS:

Table 1: Comparison of Radiological Outcomes Between Treatments

Parameter	Surgical Mean (SD)	Non-Surgical Mean (SD)	95% CI Surgical	95% CI Non-Surgical	
Tendon gap reduction (mm)	4.2 (1.6)	2.5 (1.3)	3.8 - 4.6	2.1 - 2.9	
Tendon integrity score	8.4 (0.9)	7.1 (1.1)	8.1 - 8.7	6.8 - 7.4	0.002

This table evaluates the radiological outcomes between surgical and non-surgical treatments for acute Achilles tendon rupture. The surgical group showed a significantly greater mean reduction in tendon gap, averaging 4.2 mm with a standard deviation of 1.6, compared to 2.5 mm (SD = 1.3) in the non-surgical group, with the difference being highly significant ($p <$

0.001). Similarly, the tendon integrity score was higher in the surgical group with a mean of 8.4 (SD = 0.9) versus 7.1 (SD = 1.1) in the non-surgical group, also showing statistical significance (p = 0.002).

Table 2: Assessment of Tendon Healing via Imaging Techniques

Parameter	Surgical Mean (SD)	Non-Surgical Mean (SD)	95% CI Surgical	95% CI Non-Surgical	P value
Healing time (weeks)	10 (2)	14 (3)	9.4 - 10.6	13.2 - 14.8	<0.001
Tendon thickness (mm)	5.5 (0.7)	4.8 (0.6)	5.3 - 5.7	4.6 - 5.0	0.004

In this table, healing outcomes based on imaging techniques were compared between the two groups. The surgical group demonstrated a faster healing time with a mean of 10 weeks (SD = 2) compared to 14 weeks (SD = 3) in the non-surgical group, with the results being statistically significant (p < 0.001). Additionally, tendon thickness was greater in the surgical group with a mean thickness of 5.5 mm (SD = 0.7) versus 4.8 mm (SD = 0.6) in the non-surgical group, further underscoring the efficacy of surgical treatment (p = 0.004).

Table 3: Correlation Between Radiological Findings and Functional Recovery

Parameter	Surgical Mean (SD)	Non-Surgical Mean (SD)	95% CI Surgical	95% CI Non-Surgical	
Functional Score Post-Treatment	85 (10)	78 (12)	82 - 88	75 - 81	0.012
Range of Motion (degrees)	140 (15)	120 (20)	135 - 145	115 - 125	0.001

This table explores the relationship between radiological findings and functional recovery outcomes. The surgical group scored better in functional recovery post-treatment with a mean score of 85 (SD = 10) compared to 78 (SD = 12) in the non-surgical group, showing a statistically significant difference (p = 0.012). Furthermore, the range of motion was significantly better in the surgical group, with a mean of 140 degrees (SD = 15) compared to 120 degrees (SD = 20) in the non-surgical group (p = 0.001).

Table 4: Incidence of Complications and Re-Rupture Rates

Parameter	Surgical	Non-Surgical	95% CI Surgical	95% CI Non-Surgical	P value
Complications n(%)	5 (12.5%)	3 (7.5%)	4.5% - 20.5%	1.6% - 13.4%	0.257
Re-rupture rate n(%)	2 (5%)	6 (15%)	0.6% - 9.4%	5.7% - 24.3%	0.046

Table assesses the incidence of complications and re-rupture rates associated with each treatment modality. While the incidence of complications was not significantly different between the groups (12.5% in surgical vs. 7.5% in non-surgical; p = 0.257), the re-rupture rate was significantly lower in the surgical group at 5% compared to 15% in the non-surgical group, demonstrating a statistically significant difference (p = 0.046).

DISCUSSION:

Table 1: Comparison of Radiological Outcomes Between Treatments The significant differences in tendon gap reduction and tendon integrity scores between the surgical and non-surgical groups underscore the superior mechanical and structural benefits of surgical intervention. Surgical repair often results in closer approximation of tendon ends, which can be critical for restoring the mechanical properties of the tendon. Studies like those by Murdock CJ et al.(2023)[6] and Amendola F et al.(2022)[7] have also observed superior radiological outcomes with surgical methods, particularly in younger, more active patients.

Table 2: Assessment of Tendon Healing via Imaging Techniques The quicker healing times and greater tendon thickness in the surgical group suggest a more robust repair process, possibly due to the immediate coaptation of tendon ends allowed by surgical treatment. These findings are in line with the work of Westin O et al.(2020)[8], which reported that surgical intervention could accelerate the healing process by reducing the incidence of tendon elongation and improving overall structural integrity.

Table 3: Correlation Between Radiological Findings and Functional Recovery Functional scores and range of motion were better in the surgical group, correlating strongly with the superior radiological outcomes observed. This relationship highlights the importance of structural tendon integrity for functional recovery. This finding is supported by Reito A et al.(2022)[9], who found that improved radiological healing correlates with better functional outcomes in terms of strength and range of motion.

Table 4: Incidence of Complications and Re-Rupture Rates Despite higher complication rates associated with surgical intervention, the difference was not statistically significant, suggesting that surgical risks might be comparable to those of non-surgical management. However, the significantly lower re-rupture rate in the surgical group aligns with the findings of Su AW et al.(2020)[10], emphasizing the long-term benefits of surgical treatment in reducing the risk of recurrence.

CONCLUSION:

This study rigorously examined the radiological outcomes of acute Achilles tendon ruptures treated through surgical and non-surgical methods. The findings clearly indicate that surgical intervention results in significantly improved radiological outcomes compared to non-surgical treatment. Specifically, patients undergoing surgery experienced greater tendon gap reduction and higher tendon integrity scores, which directly correlate with enhanced functional recovery as evidenced by superior functional scores and increased range of motion.

Moreover, the surgical group demonstrated faster healing times and thicker tendons on imaging assessments, underscoring the effectiveness of surgical repair in facilitating a more rapid and robust healing process. These advantages likely contribute to the observed lower rates of tendon re-rupture among surgically treated patients, highlighting an important long-term benefit of surgical management.

Although the surgical approach is associated with a slightly higher but statistically insignificant rate of complications, the significant benefits in terms of reduced re-rupture rates and better radiological and functional outcomes justify considering surgery as a preferred option for suitable patients. Decisions regarding the choice of treatment should, however, continue to be tailored based on individual patient profiles, including age, activity level, and overall health status to maximize recovery and minimize the risk of complications.

This study contributes valuable insights to the ongoing debate on the optimal management of acute Achilles tendon ruptures, suggesting that surgical treatment can offer substantial benefits in terms of both immediate and long-term tendon recovery. Future research should aim to refine surgical techniques and postoperative care protocols to further enhance patient outcomes and minimize complication rates.

Limitations of Study:

1. **Retrospective Design**: The retrospective nature of the study limits the ability to control for potential confounding variables that could influence outcomes. Prospective randomized controlled trials would provide a higher level of evidence by minimizing selection bias and better controlling for confounders.
2. **Sample Size**: With only 80 participants divided into two treatment groups, the sample size may be too small to detect smaller differences between groups or to adequately power the study for subgroup analyses. This limitation could affect the generalizability of the findings.
3. **Heterogeneity in Treatment Protocols**: The study did not standardize treatment protocols across participants. Variations in surgical techniques, non-surgical treatment modalities, and rehabilitation protocols can influence outcomes but were not controlled for in this study.
4. **Single-Center Study**: Conducted at a single tertiary care center, the results might not be generalizable to other settings with different patient demographics or different levels of surgical expertise.
5. **Subjective Measures of Function**: Although the study employed radiological

outcomes as objective measures, the functional recovery assessments were based on scores that can have subjective interpretation. This could introduce bias in evaluating functional outcomes.

6. **Short Follow-up Duration**: The follow-up period may not have been long enough to capture long-term complications or late re-ruptures, which are important considerations in the management of Achilles tendon ruptures.
7. **Lack of Patient-Reported Outcomes**: The study did not include patient-reported outcome measures such as pain, satisfaction, or quality of life, which are crucial for understanding the full impact of the treatments on patients' lives.
8. **Exclusion of Certain Demographics**: By excluding patients with previous Achilles injuries or systemic diseases affecting tendon health, the study results may not apply to all individuals suffering from Achilles tendon ruptures.

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