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2734 17 Avenue SW,
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+15878858911
editorial-office@sciformat.ca

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SURGICAL VS. CONSERVATIVE MANAGEMENT OF ACUTE ACHILLES TENDON RUPTURE: A COMPARATIVE ANALYSIS OF FUNCTIONAL OUTCOMES AND RE-RUPTURE RATES

Weronika Justyna Skoneczna (Corresponding Author, Email: weronika.skoneczna24@gmail.com)
Medical University of Warsaw, Żwirki i Wigury 61, 02-091 Warszawa, Poland
ORCID ID: 0009-0006-9512-0639

Jakub Jan Woźniak
Medical University of Warsaw, Żwirki i Wigury 61, 02-091 Warszawa, Poland
ORCID ID: 0009-0006-6700-127X

Lidia Mądrzak
Medical University of Warsaw, Żwirki i Wigury 61, 02-091 Warszawa, Poland
ORCID ID: 0009-0005-9516-911X

ABSTRACT

Background: Acute Achilles tendon rupture (AATR) is a frequent injury among physically active adults. Despite extensive research, the optimal management strategy (surgical versus conservative) remains controversial due to differences in re-rupture rates, complication profiles, rehabilitation protocols and patient-specific factors. While surgery has traditionally been favored for reducing re-rupture risk, advances in early functional rehabilitation have strengthened support for nonoperative treatment.

Objective: This study aims to compare surgical and conservative management of AATR with respect to re-rupture rates, functional outcomes, complications and time to return to activity.

Methods: A narrative comparative review was conducted using PubMed and PMC databases, including randomized controlled trials, cohort studies and meta-analyses published up to December 2025. Studies involving adult patients with AATR and reporting functional outcomes, complication rates and rehabilitation protocols with a minimum follow-up of approximately six months were included. Cadaveric and non-comparative studies were excluded.

Results: Surgical treatment was associated with a lower re-rupture rate (3.7%) compared with conservative management (9.8%), but demonstrated higher rates of complications, particularly wound infection and nerve injury. Minimally invasive surgical techniques reduced complication risk while preserving efficacy. Functional outcomes such as range of motion, return to work or sport and patient-reported scores (e.g., ATRS) were comparable between treatment modalities when early mobilization and structured rehabilitation protocols were implemented.

Conclusions: Surgical treatment provides a modest advantage in preventing re-rupture but carries an increased risk of complications. Conservative management with functional rehabilitation yields similar long-term functional outcomes. Treatment decisions should be individualized, incorporating patient characteristics, activity level and preferences. Further high-quality studies are needed to optimize rehabilitation strategies and refine treatment selection criteria.

KEYWORDS

Achilles Tendon Rupture, Functional Outcomes, Re-Rupture Rate, Conservative Treatment, Surgical Management, Rehabilitation

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Introduction

The Achilles tendon is essential for normal gait and athletic movement, as it enables plantar flexion of the foot. Although it is the strongest tendon in the human body, it is surprisingly vulnerable to rupture. Acute Achilles tendon rupture (AATR) occurs most often in middle-aged adults who participate in recreational sports such as skiing, football or tennis [1]. In recent decades, the incidence of this injury has increased, with reported rates ranging from 5 to 50 cases per 100,000 people per year [2,4], making its management an increasingly common challenge in everyday clinical practice.

For many years, surgical repair was considered the treatment of choice, mainly because of its lower re-rupture rates and the belief that it allowed for better restoration of tendon length and strength [3]. However, surgery is not without drawbacks. Complications such as wound infection [5,6], sural nerve injury [6] and problematic scarring [7] remain relevant concerns, particularly in older patients and those with comorbidities. At the same time, non-operative treatment has evolved. Protocols based on early mobilization and functional bracing have shown encouraging results, leading many clinicians to reconsider conservative management as a reliable alternative rather than a second-line option [8-10].

Each approach has clear strengths and limitations. Surgical treatment may allow for an earlier return to demanding physical activity but carries the inherent risks of an operative procedure. Conservative management avoids these risks but has traditionally been associated with higher rates of tendon elongation [11-14] and re-rupture [13], especially when immobilization is prolonged or rehabilitation is poorly structured [16,17]. As rehabilitation strategies have improved, the balance between these two approaches has become less clear, contributing to ongoing debate.

Objective:

This study aims to compare the outcomes of surgical and conservative treatment for acute Achilles tendon rupture, with particular focus on re-rupture rates, time to return to activity, functional outcomes and treatment-related complications. The objective is to provide an evidence-based perspective to support clinicians in selecting the most appropriate management strategy for individual patients.

Research question:

In patients with acute Achilles tendon rupture, does surgical treatment lead to superior functional outcomes and lower re-rupture rates compared with conservative treatment?

Materials and Methods

Study Design

This study is a narrative review with a comparative focus on surgical and conservative treatment strategies for acute Achilles tendon rupture. The aim was to summarize and critically assess clinically relevant evidence rather than to perform a quantitative meta-analysis.

Data Sources and Search Strategy

A literature search was performed using the PubMed, PubMed Central (PMC) and Web of Science databases to identify studies comparing operative and non-operative management of acute Achilles tendon rupture. The search included publications available up to December 2025. Key search terms included combinations of “acute Achilles tendon rupture”, “surgical treatment”, “conservative treatment”, “nonoperative management”, “functional outcomes” and “re-rupture rate.” Reference lists of relevant articles were also reviewed to identify additional studies of interest.

Eligibility Criteria

Studies were included if they involved adult patients (≥ 18 years) with acute Achilles tendon rupture and directly compared surgical and conservative treatment approaches. Eligible study designs comprised randomized controlled trials, prospective or retrospective cohort studies and systematic reviews reporting at least one clinically relevant outcome, such as re-rupture rate, functional outcomes (including the Achilles Tendon Total Rupture Score [ATRS]), time to return to work or sport or treatment-related complications. Only human studies published in English with a minimum follow-up of approximately six months were considered.

Studies were excluded if they focused on chronic ruptures, partial tears, re-ruptures or pediatric populations or if they did not include a direct comparison between operative and non-operative management. Case reports, biomechanical or cadaveric studies and non-clinical publications were also excluded.

Data Extraction and Analysis

Data were extracted with particular attention to study design, patient characteristics, treatment protocols, rehabilitation strategies, follow-up duration and reported outcomes. Findings were synthesized narratively, with emphasis on identifying consistent trends, differences between treatment approaches and areas of ongoing uncertainty.

Results

This review addressed the following research question: *In patients with acute Achilles tendon rupture, does surgical treatment lead to superior functional outcomes and lower re-rupture rates compared with conservative treatment?* Evidence from comparative studies, including randomized controlled trials and meta-analyses, was analyzed to evaluate outcomes associated with both treatment strategies. Overall, the findings indicate that surgical treatment offers a modest reduction in re-rupture rates, whereas functional recovery is largely comparable between surgical and conservative management when modern, structured rehabilitation protocols are applied. For clarity, results are presented across three main outcome domains: re-rupture rates, complication rates and functional outcomes.

Re-rupture Rates

Across the literature, surgical treatment consistently demonstrated lower re-rupture rates compared with conservative management. Pooled data from high-quality studies report re-rupture rates of approximately 3.7% following surgical repair [16-18], compared with about 9.8% in conservatively treated patients [20]. While this difference is statistically significant, several studies suggest that the absolute risk reduction may be clinically acceptable in selected patient populations, particularly when weighed against the risks associated with surgery.

Both open repair and minimally invasive surgical techniques were effective in reducing re-rupture rates, with no significant differences observed between these approaches in terms of long-term tendon integrity [19]. Some studies, however, indicate that minimally invasive techniques may preserve the biomechanical benefits of surgery while reducing wound-related morbidity [20-24].

Complication Rates

Surgical management was associated with a higher incidence of treatment-related complications, most commonly involving soft tissues. Reported complications included wound infection, adhesions, and sural nerve injury, with overall complication rates ranging from approximately 4% to 16% [22-24], depending on surgical technique and patient characteristics.

Minimally invasive surgery appeared to offer a more favorable complication profile than open repair, with lower rates of wound complications and improved cosmetic outcomes [28,30]. Conservative treatment largely avoided surgical complications but was associated with a risk of tendon elongation, which may negatively affect strength and endurance in some patients [25-26].

Functional Outcomes

Functional outcomes were generally similar between surgical and conservative treatment when early mobilization and structured rehabilitation protocols were employed. Measures such as ankle range of motion, return to work or sport and patient-reported outcome scores, including the Achilles Tendon Total Rupture Score (ATRS), did not differ significantly between treatment groups at medium to long-term follow-ups [10-13]. These findings suggest that functional recovery is influenced more by rehabilitation strategy than by the choice of operative versus non-operative treatment alone [25-27].

Discussion

This review suggests that both surgical and non-surgical management of an acute Achilles tendon rupture can result in good outcomes when paired with early functional rehabilitation. Instead of pointing to one best method for everyone, the evidence suggests that treatment should be chosen based on each person's needs and circumstances. When selecting a management plan, clinicians should consider patient factors such as age, usual activity level, work demands, other health conditions, and the patient's willingness to accept possible complications.

Surgical repair is linked to lower rates of re-rupture, which matters most for younger patients and those who plan to return to high levels of activity. This potential benefit should be considered alongside the higher risk of treatment-related complications, such as wound infection, sural nerve injury, and adhesions, which are generally less common with conservative management. Minimally invasive approaches have lowered the rate of some surgical complications, but they have not removed these risks entirely.

Recent randomized trials and meta-analyses increasingly suggest that non-operative care, paired with early weight-bearing and functional bracing, can produce functional outcomes that are similar to those seen after surgery. These results call into question the view that conservative management is a lesser choice and point to rehabilitation as a key part of care. Early, carefully dosed loading may support tendon healing by helping collagen fibers align and by reducing excessive tendon lengthening, whether the tendon is treated with surgery or with nonoperative care.

It is hard to compare findings across studies because they use different outcome measures and different study designs. Some studies emphasize time to return to work or sport, whereas others assess patient-reported measures such as the Achilles Tendon Total Rupture Score and functional tests such as heel-rise performance. Rehabilitation protocols, length of follow-up, and patient selection criteria also differ widely across studies. These issues make it hard to compare studies directly and show why future research should use shared outcome measures and clear rehabilitation frameworks.

Another factor to consider is how healthcare resources are used. Surgical treatment typically depends on access to an operating room, anesthesia services, and follow-up care after the procedure, which generally increases the total cost. In many cases, conservative treatment delivered through a structured rehabilitation plan can lower costs while producing similar long-term functional outcomes.

It is important to note the study's limitations. Many of the studies had small participant numbers and only short- to medium-term follow-up. This limits how well they can show small differences between treatment options and whether they capture later problems, such as a re-rupture that happens after a delay or ongoing loss of function. In non-randomized studies, selection bias remains a concern because the choice of treatment may be influenced by baseline activity level or by patient preference. Excluding cadaveric and biomechanical studies helps keep the analysis focused on clinical outcomes, but it limits what can be inferred about the mechanical aspects of tendon healing.

Overall, the available evidence points to managing acute Achilles tendon rupture with a patient-centered approach. Shared decision-making should be guided by clinical evidence, available rehabilitation resources, and each patient's goals, and it should remain a core part of care. More high-quality multicenter studies, using standardized rehabilitation protocols and long-term follow-up, are needed to clarify the best treatment pathways and to support stronger evidence-based clinical guidelines.

Concluding remarks

This review examined studies that compared surgery with non-surgical care for acute Achilles tendon rupture to assess whether operative treatment leads to better patient outcomes. Current studies suggest that surgery may slightly lower the chance of a re-rupture. In contrast, long-term function tends to be similar across surgical and non-surgical care when both are paired with early, planned rehabilitation.

Surgery can bring the tendon ends together under direct visualization, which may improve biomechanical alignment and may be a reasonable option for younger patients or those with high activity demands. This potential benefit should be weighed against the higher risk of complications, such as wound issues and nerve injury, even when minimally invasive techniques are used. Compared with older approaches, current non-surgical protocols that start early movement and use functional bracing are now a dependable choice and are often preferred for many patients, especially those with lower activity needs or a higher risk from surgery.

Current evidence suggests that treatment choices should be made on a case-by-case basis, based on the patient's clinical features and context. Clinical decisions should consider both the details of the injury and the patient's individual context, including age, usual activity level, other health conditions, and personal preferences. Shared decision-making is still necessary to achieve the best possible outcomes.

Future studies should refine how patients are chosen, standardize rehabilitation protocols across sites, and include longer follow-up so we can assess how long outcomes last and detect late complications. More high-quality multicenter randomized controlled trials are needed, with consistent outcome measures and clear cost-effectiveness analysis. More research on rehabilitation approaches, new biologic or add-on treatments, and patient-reported outcomes is needed to strengthen the evidence base for treating acute Achilles tendon rupture.

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