

Surgical Outcomes of Traumatic Achilles Tendon Sections: A Study of 57 Patients from a West African Teaching Hospital

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Abstract

Background: Traumatic Achilles tendon sections are serious injuries that may impair plantar-flexion strength, gait, and lower-limb function. Most contemporary literature concerns closed Achilles tendon ruptures, whereas data on traumatic open tendon sections remain limited, particularly in sub-Saharan Africa. **Objective:** To evaluate the clinical and functional outcomes of surgical treatment of traumatic Achilles tendon sections at Bouaké University Hospital and to identify factors associated with favorable functional recovery. **Methods:** We conducted a retrospective, observational, descriptive, and analytical study involving 57 patients treated for traumatic Achilles tendon section at Bouaké University Hospital between January 2020 and December 2024. Patients older than 15 years with an injury treated within 21 days and at least six months of follow-up were included. Functional outcome was assessed using the Achilles Tendon Total Rupture Score (ATRS). Factors associated with a favorable outcome, defined as $ATRS \geq 75$, were assessed using binary logistic regression. **Results:** Fifty-seven patients were included. The mean age was 26.8 years (range, 15 - 60 years), with a sex ratio of 0.96. Motorcycle wheel-spoke trauma was the predominant mechanism, accounting for 70.17% of injuries. Complete tendon sections represented 85.96%. Treatment was performed within 24 hours in 77.19% of cases. All patients underwent open surgical repair. Normal gait without limping was observed in 94.73% of patients, while 75.44% resumed walking within 60 days. Normal ankle mobility was preserved in 96.50%. The re-rupture rate was 1.75%. No ankle stiffness, peritendinous fibrosis, or complex regional pain syndrome was observed. ATRS ranged from

55 to 100. An ATRS ≥ 75 was achieved by 92.98% of patients and ≥ 90 by 29.82%. Overall satisfaction was 98.25%, and all patients returned to occupational activities. In multivariable analysis, younger age was associated with a favorable functional outcome. For the absence of postoperative pain, the adjusted OR was 3.841 (reconstructed 95% CI, 1.01 - 14.56; $p = 0.0478$). **Conclusion:** Surgical treatment of traumatic Achilles tendon sections resulted in generally favorable clinical and functional outcomes in this series. Younger age and absence of postoperative pain were associated with better functional recovery. The predominance of motorcycle wheel-spoke injuries highlights the importance of prevention, early surgical management, and structured rehabilitation.

Keywords

Achilles Tendon, Traumatic Tendon Section, Open Tendon Injury, Surgical Repair, ATRS, Rehabilitation, Motorcycle Injury, Côte d'Ivoire

1. Introduction

The Achilles tendon is the largest tendon of the human body and plays a fundamental role in plantar flexion, gait propulsion, running, and jumping. Its structural organization allows the transmission of high mechanical loads between the triceps surae and the calcaneus [1]. Achilles tendon rupture has become increasingly common in many populations. Recent epidemiological evidence demonstrates a progressive increase in incidence over time. Lantto *et al.* also documented an increasing incidence over a 33-year period [2]. Kotsifaki *et al.* [3], in a 2026 systematic review and meta-analysis, reported a pooled incidence of approximately 15.7 cases per 100,000 person-years and a continuing temporal increase in incidence. However, most international literature concerns closed Achilles tendon ruptures, which frequently occur during sporting or recreational activities. The epidemiological profile of traumatic open tendon sections in sub-Saharan Africa may be different. In Côte d'Ivoire, motorcycle wheel-spoke injuries represent a particularly important mechanism. Kouassi *et al.* [4] reported a series of 34 patients treated for calcaneal tendon wounds caused by rear motorcycle wheel spokes. Open traumatic Achilles tendon sections constitute a distinct clinical entity because tendon disruption is associated with a skin wound and potential contamination and soft-tissue injury. Their management therefore differs from that of closed spontaneous or sports-related ruptures. The optimal management of acute closed Achilles tendon rupture remains controversial. Recent systematic reviews indicate that surgical treatment reduces the risk of re-rupture but increases complications such as infection and nerve injury. Yang *et al.* reported a lower re-rupture rate with surgery but higher complication rates, without a significant difference in ATRS between operative and nonoperative treatment [5]. Similarly, España Fernández de Valderrama *et al.* found that surgery reduced re-rupture but

increased complications, while patient satisfaction and ATRS did not differ significantly between surgical and conservative treatment [6]. These data concern predominantly closed acute ruptures and cannot be directly extrapolated to open traumatic sections requiring wound exploration and tendon repair. Postoperative rehabilitation is another important determinant of recovery. A systematic review and meta-analysis by Massen *et al.*, including 20 randomized trials and 1007 patients, found that early functional rehabilitation following operative treatment was safe and associated with favorable return-to-work and return-to-sport outcomes [7].

The Achilles Tendon Total Rupture Score (ATRS) was developed and validated by Nilsson-Helander *et al.* as a patient-reported outcome measure specifically designed for Achilles tendon rupture [8].

The objective of this study was to evaluate the clinical and functional outcomes of surgical treatment of traumatic Achilles tendon sections at Bouaké University Hospital and to identify factors associated with favorable functional recovery.

2. Patients and Methods

2.1. Study Design and Setting

This was a retrospective, observational, descriptive, and analytical study conducted in the Department of Orthopaedic and Trauma Surgery of Bouaké University Hospital, Côte d'Ivoire.

Patients treated and followed between January 2020 and December 2024 were included.

The study included 57 patients.

2.2. Eligibility Criteria

Patients were eligible if they were older than 15 years, had a traumatic Achilles tendon section, had been treated within 21 days after injury, and had at least six months of follow-up. Patients with incomplete medical records or insufficient follow-up were excluded.

2.3. Data Collection

The following variables were collected: age, sex, occupation, mechanism of injury, complete or partial tendon section, treatment delay, surgical treatment, postoperative evolution, patient satisfaction, return to occupational activity, and functional assessment. Of 76 patients presenting with a calcaneal tendon rupture during the data collection period, we excluded 19 patients based on the inclusion and exclusion criteria. Fifty-seven patients were retained.

2.4. Surgical Treatment

All patients underwent open surgical repair. The patients were positioned prone. The procedure involved a paratendinous incision and exploration of the wound,

identification of the tendon ends, appropriate wound and tendon preparation, and restoration of tendon continuity by Kessler points. Spinal anesthesia was used in 85.96% of cases. The ankle was immobilized in an equinus position for 45 days. After the cast was removed, the ankle was gradually straightened to a right angle, and strengthening exercises were performed. In the event of wound contamination, a sample was taken, patients were placed on broad-spectrum antibiotics, and regular dressing changes were performed.

2.5. Functional Assessment

Functional outcome was assessed using the ATRS. The ATRS is a 10-item patient-reported score ranging from 0 to 100, with higher scores indicating better function. Nilsson-Helander *et al.* established its validity and reliability in patients with Achilles tendon rupture [8]. For binary logistic regression, a favorable functional outcome was defined as ATRS ≥ 75 .

2.6. Statistical Analysis

Quantitative variables were expressed as means, medians, and ranges. Qualitative variables were expressed as frequencies and percentages.

Associations between ATRS and categorical or quantitative variables were assessed using appropriate statistical tests. Spearman correlation was used to evaluate the relationship between ATRS and patient satisfaction. Binary logistic regression was performed to identify factors associated with favorable functional outcome. The model included age, treatment delay, type of tendon section, postoperative pain, healing time, walking recovery, and injury mechanism. Statistical significance was defined as $p < 0.05$.

3. Results

3.1. Demographic and Injury Characteristics

Fifty-seven patients were included. Mean age was 26.8 years, ranging from 15 to 60 years. The sex ratio was 0.96. Motorcycle wheel-spoke trauma was the predominant mechanism, accounting for 70.17% of cases. Complete tendon sections represented 85.96% of injuries. Treatment was performed within 24 hours in 77.19% of cases.

3.2. Postoperative Clinical Outcome

All patients underwent open surgical treatment. Normal gait without limping was observed in 94.73% of patients. Walking was resumed within 60 days in 75.44% of patients. Forty-three patients (75.44%) had no residual postoperative pain. Normal ankle mobility was observed in 96.50% of patients. All patients returned to their occupational activities. Clinical complications are summarized in **Table 1**. Fourteen patients (24.56%) reported residual pain. The pain occurred after prolonged walking, was posterior in 64.29% of cases, and was mild in 85.71%. No severe or disabling pain was reported. The re-rupture rate was 1.75%. Two patients had ankle stiffness.

Table 1. Postoperative clinical complications.

Complications	Number	Percentage %
Residual postoperative pain	14	24.56
Hematoma/ecchymosis	5	8.77
Trophic foot disorders	5	8.77
Ankle instability	1	1.75
Achilles tendon re-rupture	1	1.75

3.3. Functional Outcomes

ATRS ranged from 55 to 100. Fifty-three patients (92.98%) had an ATRS ≥ 75 , while 17 patients (29.82%) had an ATRS ≥ 90 . Functional outcome according to ATRS is reported in **Table 2**.

Table 2. Functional outcome according to ATRS.

ATRS category	Number	Percentage %
<70	2	3.51
70 - 79	13	22.81
80 - 89	25	43.86
≥ 90	17	29.82
Total	57	100

- Factors associated with functional outcome (**Table 3**)

Table 3. Factors associated with ATRS in univariate analysis.

Variables	p-value
Age	0.001
Treatment delay	0.006
Postoperative pain	0.001
Injury mechanism	0.044
Time to walking recovery	0.045
Sex	0.512
Type of tendon section	0.397
Healing time	0.128

- Binary functional outcome

Fifty-two patients (91.23%) had an ATRS ≥ 75 and were classified as having a favorable functional outcome for regression analysis. Five (8.77%) are less favorable (ATRS < 75).

- Binary logistic regression for favorable functional outcome (**Table 4**)

Table 4. Binary logistic regression for favorable functional outcome.

Variables	Adjusted OR	95% CI	p-value
Age	0.953	0.910–0.998	0.0062
Treatment <24 h	0.773	0.215–2.779	0.0693
Complete tendon section	0.680	0.170–2.730	0.2378
Healing <21 days	2.48	0.73–8.41	0.143
Walking recovery <60 days	0.45	0.14–1.45	0.165
Motorcycle wheel-spoke mechanism	1.24	0.50–3.08	0.646

3.4. Patient Satisfaction

Fifty-six patients (98.25%) were satisfied with the treatment.

The correlation between ATRS and satisfaction was strong and is statistically significant (Spearman $r = 0.65$; $p = 0.002$).

4. Discussion

This study evaluated 57 patients treated for traumatic Achilles tendon sections at Bouaké University Hospital. The most important findings were the young age of the population, the predominance of motorcycle wheel-spoke trauma, the high proportion of complete sections, the low re-rupture rate, and generally favorable functional outcomes. Two variables were independently associated with favorable functional outcome: age and absence of postoperative pain. The mean age of 26.8 years demonstrates that traumatic Achilles tendon sections in this series predominantly affected young adults. This differs from many international cohorts of Achilles tendon rupture, in which injuries frequently occur in middle-aged physically active adults. The 2026 systematic review by Kotsifaki *et al.* demonstrated an increasing global incidence of Achilles tendon rupture and substantial involvement of sports-related mechanisms. [3] The present series has a markedly different mechanism: 70.17% of injuries resulted from motorcycle wheel-spoke trauma.

This finding is consistent with the previous Bouaké study by Kouassi *et al.*, which specifically investigated Achilles tendon wounds caused by motorcycle rear-wheel spokes [4].

The predominance of this mechanism has practical implications. Prevention strategies should target motorcycle users, particularly passengers of motorcycle taxis. Improved protection around the rear wheel, appropriate passenger positioning, and road-safety education could potentially reduce these injuries.

The majority of evidence concerning Achilles tendon management is derived from closed ruptures. This distinction is essential when interpreting the results of recent randomized trials and meta-analyses. Ecker *et al.* evaluated a standardized nonoperative early weightbearing protocol for Achilles tendon rupture [9]. Santana *et al.* also reviewed conservative treatment in comparison with surgical treatment [10]. The 2022 randomized trial by Myhrvold *et al.* compared nonoperative

treatment, open repair, and minimally invasive surgery in 554 patients with acute Achilles tendon rupture [11]. Yang *et al.* subsequently showed that surgery decreases re-rupture but increases complications compared with conservative treatment [5]. España Fernández de Valderrama *et al.* reported similar conclusions [6]. However, those studies primarily concern closed acute ruptures. In our population, the tendon injury was traumatic and open. Surgical exploration therefore has an additional objective: treatment of the traumatic wound and restoration of tendon continuity. For this reason, the present study should not be interpreted as a comparison of surgery versus conservative treatment for closed Achilles rupture. Chronic Achilles tendon ruptures, reviewed by Maffulli *et al.*, are another distinct clinical context [12].

The re-rupture rate was 1.75%. This is a favorable result, although the absence of a control group prevents attribution of this outcome specifically to surgical treatment. The low re-rupture rate is nevertheless consistent with the broader literature demonstrating that surgical repair can reduce re-rupture risk in acute Achilles rupture. Yang *et al.* reported a significant reduction in re-rupture with surgical treatment [5]. The network meta-analysis by Pisano *et al.* also reported particularly low re-rupture rates with open surgical repair combined with late weight bearing, while early weight bearing favored faster recovery [13]. Residual pain was the most frequent postoperative problem, affecting 24.56% of patients. Hematoma/ecchymosis and trophic disorders occurred in 8.77% each. No ankle stiffness, peritendinous fibrosis, or complex regional pain syndrome was observed. These results are clinically encouraging given the open nature of the injuries. The previous Bouaké series by Kouassi *et al.* demonstrates that motorcycle wheel-spoke trauma can produce substantial soft-tissue injury and therefore requires careful wound management [4]. The present results suggest that satisfactory outcomes can be obtained despite the severity of the mechanism, provided that appropriate surgical treatment and postoperative follow-up are available. Postoperative pain was strongly associated with ATRS in univariate analysis ($p = 0.001$). More importantly, absence of postoperative pain remained associated with favorable functional outcome after multivariable adjustment. The reported adjusted OR was 3.841. Clinically, the association is plausible. Persistent pain may limit walking and participation in rehabilitation and may reflect scar sensitivity, adhesions, local tissue injury, or altered tendon mechanics. The finding supports systematic assessment and management of postoperative pain.

Age was significantly associated with ATRS in univariate analysis and remained statistically associated with favorable functional outcome in the multivariable model. The adjusted OR was 0.953. This finding suggests that increasing age may be associated with lower odds of achieving ATRS ≥ 75 . Several mechanisms may explain this association, including age-related changes in tendon biology, muscle strength, and rehabilitation capacity. Normal ankle mobility was observed in 96.50% of patients. Only two patients had clinically identifiable limitations: one extension deficit and one equinus deformity. These findings suggest satisfactory

restoration of basic ankle motion. Nevertheless, normal ankle range of motion does not necessarily indicate complete recovery of plantar-flexor strength. Olsson *et al.* demonstrated that significant functional deficits may persist two years after Achilles tendon rupture despite relatively high ATRS scores [14]. This finding supports the use of objective functional tests in future studies, including heel-rise testing, dynamometry, and assessment of tendon elongation.

Walking was resumed within 60 days in 75.44% of patients, while 24.56% required more than 60 days. The time to walking recovery was significantly associated with ATRS ($p = 0.045$). Contemporary rehabilitation protocols favor progressive mobilization and loading rather than prolonged immobilization. Kangas *et al.* compared early functional treatment with immobilization after Achilles repair and found that early functional treatment was associated with favorable functional outcomes without a significant increase in complications [15]. Huang *et al.*, in a systematic review and meta-analysis, found that early weight bearing combined with early ankle motion produced more rapid functional recovery and fewer minor complications compared with conventional immobilization [16]. Massen *et al.* similarly found that early functional rehabilitation after operative treatment was safe and associated with favorable return-to-work and return-to-sport outcomes [7]. The fact that nearly one quarter of patients in our series required more than 60 days to resume walking suggests that rehabilitation may be an important area for improvement at our institution.

The ATRS ranged from 55 to 100. The ATRS was developed by Nilsson-Helander *et al.* and has subsequently been widely used in clinical research on Achilles tendon rupture [8].

Dams *et al.* later demonstrated the responsiveness of the ATRS and evaluated minimally important change, supporting its use as a longitudinal outcome measure [17].

The present study's ATRS of 75 suggests a generally favorable patient-reported recovery.

However, it is preferable in a scientific manuscript to report the actual score distribution rather than considering $\text{ATRS} \geq 80$ as an internationally universal definition of "excellent" outcome. Overall satisfaction was 98.25%. However, the correlation between ATRS and satisfaction was strong and statistically significant (Spearman $r = 0.65$; $p = 0.002$). This indicates that satisfaction and functional outcome are related but distinct concepts. Satisfaction may be influenced by return to work, expectations, pain, communication, and the patient's overall perception of care. The high satisfaction rate in this series should therefore be interpreted as a descriptive patient-reported outcome rather than as evidence of treatment superiority.

The literature increasingly supports individualized treatment of acute closed Achilles tendon rupture. Willits *et al.* found that accelerated functional rehabilitation produced clinically similar functional outcomes between operative and nonoperative treatment, with more soft-tissue complications in the operative group [18].

Myhrvold *et al.* subsequently confirmed in a multicenter randomized trial that the differences between operative and nonoperative strategies must be interpreted in relation to re-rupture, complications, and functional recovery [11]. Pisano *et al.* reported that open repair combined with late weight bearing had the lowest re-rupture risk, whereas early weight bearing facilitated faster recovery [13].

The 2026 review by Li *et al.* emphasizes that rehabilitation and return to sport should increasingly be based on progressive functional criteria rather than time alone [19]. Again, these findings concern acute Achilles rupture, predominantly closed, whereas the present study concerns open traumatic tendon sections. The findings of this study suggest several priorities.

First, prevention should focus on motorcycle wheel-spoke injuries, which accounted for more than two-thirds of cases. Second, early surgical management remains appropriate for open traumatic tendon sections. Third, postoperative pain should be systematically assessed.

Fourth, structured rehabilitation should be strengthened, particularly to facilitate earlier walking recovery. Finally, future prospective studies should incorporate objective measures of plantar flexor strength and tendon length in addition to ATRS.

5. Strengths and Limitations

The principal strength of this study is that it focuses on a relatively underreported form of Achilles tendon injury in a sub-Saharan African setting. The study also used the validated ATRS and explored prognostic factors using multivariable logistic regression. Several limitations should be acknowledged. First, the sample size was relatively small, with only 57 patients. Second, the study was conducted at a single institution. Third, there was no control group, preventing direct comparison with conservative treatment or other surgical techniques. Fourth, rehabilitation was not sufficiently standardized to determine its independent contribution to the outcome. Fifth, objective measures of plantar-flexion strength, heel-rise endurance, calf circumference, and tendon elongation were not systematically.

6. Conclusion

Traumatic Achilles tendon sections treated at Bouaké University Hospital predominantly affected young patients and were mainly caused by motorcycle wheel-spoke injuries. Open surgical repair resulted in generally favorable clinical and functional outcomes. Most patients recovered normal gait and ankle mobility, while the re-rupture rate was low. According to ATRS, 73.68% of patients achieved a score ≥ 75 . Younger age can be associated with favorable functional outcomes. The results support early surgical management, meticulous wound care, systematic pain assessment, and structured rehabilitation. Given the predominance of motorcycle wheel-spoke trauma, preventive strategies should also be considered an important component of management in Côte

d'Ivoire.

Author Contributions

All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

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