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Original Article

Reconstruction of Neglected or Chronic Achilles Tendon Defects Using Peroneus Brevis Tendon Allograft — A Clinical Study

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ABSTRACT

Introduction: *Achilles tendon ruptures, especially neglected or chronic cases, present significant challenges in reconstructive surgery, often requiring robust grafting options. The Peroneus Brevis tendon allograft has emerged as a potential alternative due to its anatomical and biomechanical properties.* ***Methods & Materials:*** *This retrospective study included 25 patients with neglected or chronic Achilles tendon ruptures who underwent reconstruction using the Peroneus Brevis tendon allograft. Preoperative imaging included radiographic and MRI assessments, while intraoperative evaluation focused on graft suitability and the need for soft tissue augmentation. Postoperative assessments were conducted at 3, 6, and 12 months, with outcomes measured through AOFAS scores, range of motion, and patient satisfaction. Statistical analysis was performed using SPSS version 26.* ***Results:*** *The majority of patients were middle-aged males, with the right side more frequently affected. Preoperative imaging revealed large tendon defects in 40% of cases and moderate defects in 48%. Intraoperative findings confirmed adequate graft length and quality in 92% of cases, with only 8% requiring additional grafts. Complications were minimal, with infection in 8% of patients, graft rejection in 4%, and re-rupture in 4%. At 12 months, 68% of patients achieved excellent AOFAS scores, with 76% reporting high satisfaction.* ***Conclusion:*** *The Peroneus Brevis tendon allograft offers a safe and effective solution for reconstructing neglected or chronic*

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Achilles tendon defects, demonstrating high functional recovery and patient satisfaction with low complication rates. This technique provides a viable option for complex Achilles repairs, particularly in settings with limited resources.

Keywords: *Achilles Tendon Reconstruction, Peroneus Brevis Allograft, Neglected Achilles Rupture, Functional Outcomes, Tendon Grafting, AOFAS Score, Patient Satisfaction*

INTRODUCTION

Achilles tendon injuries are common yet complex conditions that often necessitate careful clinical management, especially when left untreated. As the largest and strongest tendon in the human body, the Achilles tendon is integral to mobility and load-bearing activities, underscoring its importance in daily functioning and athletic performance. Tendon injuries are especially prevalent in active populations, such as athletes, with rupture rates estimated at 5–10 per 100,000 individuals annually, particularly among sports participants where rapid acceleration and jumping are common activities[1,2]. Notably, sports-related tendon injuries, including Achilles ruptures, are increasingly observed among recreational athletes, indicating broader demographics at risk due to lifestyle changes[3]. In Bangladesh, such injuries are prevalent in sports like football, cricket, and badminton, where players frequently face environmental and occupational factors that predispose them to tendon injuries[4]. Tendo-Achilles injury (TAI) prevalence among athletes in Dhaka has been documented at 11.5%, highlighting significant occupational and ground-related risks[4]. In rural areas of Bangladesh, Tendo achillis rupture has History of excessive load bearing activities which are our farmers, who works in the fields in bare footed and also housewives who also do their household activities in bare footed. They have also history of heel pain & retro calcaneal bursitis; taking steroid injection over the heel/around the heel which causing rupture of tendo achillis. Another rural patients acute rupture of tendo achillis, were maltreated by village quack doctor which was lateral came to orthopedic surgeon as a neglected or chronic case. Despite awareness of the Achilles tendon's importance, delayed or neglected or chronic Achilles injuries are not uncommon. Untreated tendon injuries often result in significant functional impairments, including calf muscle atrophy, tendon retraction, and scar formation, all of which pose a substantial challenge for reconstructive surgery[5]. The definition of a “chronic" rupture has ranged from those diagnosed and treated more than 48 hours after injury to those diagnosed and treated up to 2 months after injury. There appears to be some consensus that a rupture diagnosed 4 to 6 weeks after injury should be considered a chronic rupture and that these are more difficult to treat than acute injuries. At about 1 week after rupture of the Achilles tendon, any space between the tendon ends fills with scar tissue. If left untreated, the tendon heals elongated, leaving the patient unable to push off on

the affected side. Running, jumping, and activities such as ascending or descending stairs are severely compromised. Calf atrophy usually is present, the Achilles tendon often loses its normal contour, and a visible tendon defect may be present. MRI can be helpful to estimate the gap between the ruptured ends of the tendon. Chronic ruptures appear as an area of low-intensity signal on T1-weighted images and alteration in T2-weighted signal. If posterior heel pain, swelling, or functional impairment is disabling, delayed repair or reconstruction is indicated. In most active adults, repair is preferable but often is not possible. For ruptures more than 3 months old, treatment depends on the patient's physiological age, activity level, and amount of functional impairment. The clinical management of neglected or chronic Achilles tendon defects is complicated by the natural progression of untreated ruptures. Chronic Achilles defects often lead to fibrosis, tendon degeneration, and increased retraction distances, which severely limit the efficacy of primary repair due to the insufficient availability of healthy tendon tissue[6]. Limited surgical resources further compound these challenges in settings like Bangladesh, where healthcare access is variable and resources are constrained. Surgical intervention for neglected or chronic cases often requires more complex approaches, such as tendon transfers or grafting, to bridge gaps created by tissue atrophy and retraction. In addition to the intrinsic challenges posed by the injury itself, neglected or chronic Achilles ruptures are associated with increased complication risks, including infections, re-rupture, and extended recovery times, which are especially pertinent in low-resource settings[7]. In Bangladesh, as elsewhere, limited access to rehabilitation services further complicates the post-operative phase for patients undergoing Achilles tendon repair. This lack of rehabilitative support can delay recovery, increase re-injury rates, and ultimately affect the long-term functional outcomes for patients. Surgical reconstruction options for Achilles tendon defects vary based on the defect size and condition of the tissue. For smaller or acute injuries, primary repair remains the most direct approach and often yields good results[8]. However, in cases with extensive tendon loss or delayed treatment, more advanced surgical techniques are necessary. V-Y advancement flaps are commonly employed to lengthen the gastrocnemius muscle-tendon unit, allowing the surgeon to approximate the tendon ends without excessive tension, though calf atrophy and weakness are reported complications[9]. Tendon transfer techniques, such as the use of the Flexor Hallucis Longus (FHL) tendon, are often preferred for larger defects, as they provide adequate tensile strength and minimize re-rupture risk. Studies comparing FHL transfer to other grafting options have shown FHL's superior functionality and lower complication rates in Achilles tendon reconstruction, making it a viable solution for chronic or neglected injuries[10]. In a study from Bangladesh, FHL transfer was employed successfully in patients with long-standing ruptures,

offering satisfactory functional outcomes and reduced post-operative complications in a cost-effective manner suitable for local clinical contexts[6]. The increasing utilization of allografts presents another promising option for Achilles reconstruction, particularly when donor tissue availability is limited. Allografts are a compelling alternative to autografts due to their ability to restore functionality without compromising donor site integrity. Allograft procedures for tendon repair, while initially associated with a higher complication risk, have demonstrated promising outcomes when using decellularized and cryopreserved grafts, with minimal risk of immune rejection or infection in recent studies[11,12]. In the case of Achilles tendon reconstruction, the Peroneus Brevis tendon emerges as a viable allograft option due to its anatomical and biomechanical properties closely resembling those of the Achilles tendon. A study evaluating the biomechanical properties of Peroneus Brevis tendon transfers demonstrated high failure loads and durability, supporting its use as a strong and accessible grafting solution[13]. Moreover, clinical follow-up on patients who underwent Peroneus Brevis transfers indicated sustained improvements in functional scores and an absence of significant re-rupture rates, further validating its use in Achilles reconstructions[14]. While some studies have noted mild deficits in calf circumference and plantar flexion strength, the overall functionality and patient satisfaction remained high, with most patients regaining the ability to perform weight-bearing and recreational activities without external support[15]. This study will contribute to the limited body of knowledge on reconstructive strategies for neglected or chronic Achilles tendon injuries in Bangladesh, where healthcare access and surgical resources are limited. Using the Peroneus Brevis tendon as an allograft, we aim to address the specific challenges of Achilles tendon repair within a low-resource setting. The proposed approach could offer a cost-effective, clinically effective alternative to traditional grafting techniques, particularly in Bangladesh, where neglected or chronic Achilles injuries remain a significant burden. Our study seeks to evaluate the functional outcomes, complication rates, and recovery profiles of patients undergoing Peroneus Brevis tendon reconstruction for Achilles tendon defects, with a specific focus on its applicability within the Bangladeshi healthcare landscape. This approach could set a precedent for more accessible and effective treatment options for chronic tendon injuries in resource-constrained environments.

METHODS & MATERIALS

The study was conducted in a retrospective manner at Khwaja Yunus Ali Medical College from January 2020 to December 2023. A total of 25 patients, who presented with chronic Achilles tendon ruptures and were diagnosed as having neglected or chronic Achilles tendon defects, were included in the study. These patients were selected based on strict inclusion and exclusion criteria. Patients with a history of infection at the rupture site, poor vascular supply to the lower limb,

or associated comorbidities that could impair wound healing were excluded. Preoperative assessments included a thorough clinical examination, radiographic imaging, and magnetic resonance imaging (MRI) to confirm the extent of the Achilles tendon defect.

The surgical procedure involved harvesting the peroneus brevis tendon allograft through a standard lateral approach. The length and quality of the tendon were carefully evaluated intraoperatively to ensure its suitability for use as an allograft. The reconstruction of the Achilles tendon was performed using an end-to-end repair technique, and the peroneus brevis tendon was secured using suture anchors to bridge the defect. In cases where the defect was large, augmentation with additional soft tissue grafts was considered. Postoperatively, the patients were immobilized in a below-knee plaster cast for six weeks, followed by a gradual rehabilitation protocol involving controlled ankle movements and weight-bearing activities under the supervision of a physical therapist.

The outcomes were assessed using both subjective and objective criteria, including the American Orthopaedic Foot & Ankle Society (AOFAS) ankle-hindfoot score, range of motion (ROM) measurements, and patient-reported satisfaction scores. Follow-up was conducted at regular intervals of three, six-, and twelve-months post-surgery to monitor for complications such as infection, graft rejection, or rupture. The statistical analysis was performed using SPSS version 26.

RESULTS

The study included 25 patients with neglected or chronic Achilles tendon ruptures. Most patients were aged 40-49 (36%), followed by those aged 30-39 (28%) and 50-59 (16%). Males comprised 40% of the sample, while 60% were female. The right side was more commonly affected (56%) than the left (44%) (**Table I**).

Table – I: Basic Characteristics of the Study Population (*n*=25)

Characteristics	Frequency (*n*)	Percentage (%)
Age Range (Years)		
20-29	3	12
30-39	7	28
40-49	9	36
50-59	4	16
60+	2	8
Gender		
Male	10	40
Female	15	60
Side of Rupture		
Right	14	56
Left	11	44

Preoperative imaging revealed that 64% of patients had a complete Achilles rupture, while 36% showed a partial rupture. MRI findings classified defects by size, with 40% of patients having a large defect (>5 cm), 48% a moderate defect (3-5 cm), and 12% a small defect (<3 cm) (**Table II**).

Table – II: Preoperative Imaging Findings (*n*=25)

Imaging Modality	Frequency (n)	Percentage (%)
Radiographic Evidence		
Complete Achilles Rupture	16	64
Partial Achilles Rupture	9	36
MRI Findings		
Large Defect (>5 cm)	10	40
Moderate Defect (3-5 cm)	12	48
Small Defect (<3 cm)	3	12

Intraoperative findings showed that the Peroneus Brevis tendon graft had adequate length and quality in 92% of cases, while 8% required additional grafts. Soft tissue augmentation was needed in 24% of patients, whereas 76% did not require it. Suture anchors were used exclusively for fixation in all cases (100%) (**Table III**).

Table – III: Intraoperative Findings and Procedure Details (*n*=25)

Intraoperative Findings/Procedures	Frequency (n)	Percentage (%)
Peroneus Brevis Tendon Graft Suitability		
Adequate Length and Quality	23	92
Inadequate (requiring additional grafts)	2	8
Soft Tissue Augmentation		
Required	6	24
Not Required	19	76
Type of Fixation		
Suture Anchors Only	25	100

Postoperative complications were minimal, with infection occurring in 8% of patients, graft rejection in 4%, and re-rupture in 4%. The majority of patients had no complications, with 92% showing no signs of infection, 96% with no graft rejection, and 96% without re-rupture (**IV**).

Table – IV: Postoperative Complications (*n*=25)

Complications	Frequency (n)	Percentage (%)
Infection		
Present	2	8
Absent	23	92
Graft Rejection		
Present	1	4
Absent	24	96
Re-Rupture		
Present	1	4
Absent	24	96

At the 12-month follow-up, 68% of patients achieved an excellent AOFAS score (90-100), while 20% had a good outcome (80-89). Fair outcomes (70-79) were observed in 8% of patients, and only 4% scored poorly (<70) (**Table V**).

Table – V: Functional Outcomes (AOFAS Score) at 12 Months (*n*=25)

AOFAS Score Range	Frequency (n)	Percentage (%)
90-100 (Excellent)	17	68
80-89 (Good)	5	20
70-79 (Fair)	2	8
<70 (Poor)	1	4

At 12 months, 76% of patients reported being very satisfied with their outcome, 16% were satisfied, 4% were neutral, and 4% were dissatisfied (**Table VI**).

Table – VI: Patient Satisfaction at 12 Months (*n*=25)

Self-Reported Satisfaction	Frequency (n)	Percentage (%)
Very Satisfied	19	76
Satisfied	4	16
Neutral	1	4
Dissatisfied	1	4

DISCUSSION

The present study aimed to evaluate the effectiveness of reconstructing neglected or chronic Achilles tendon defects using the Peroneus Brevis tendon allograft, assessing functional outcomes, complication rates, and patient satisfaction. Demographic characteristics of the study population revealed a higher incidence of neglected or chronic Achilles tendon ruptures in middle-aged males, with the right side more commonly affected. This aligns with existing studies indicating a predominance of Achilles tendon injuries in males and a typical age range of 40-49 years, as reported by Sheth et al. and Ho et al., who observed similar demographic trends in Achilles injury patients, emphasizing the relevance of targeting middle-aged active individuals for Achilles rupture interventions[16,17]. Furthermore, the predominance of right-side injuries observed in our study reflects findings by Awe et al., who reported similar lateralization, suggesting potential occupational or activity-related risk factors that may predispose individuals to ruptures on the dominant side[18]. Preoperative imaging findings in this study revealed that a majority of patients had complete ruptures (64%), with MRI scans showing large or moderate tendon defects in most cases. This prevalence of severe tissue damage is supported by Zhang's work on MRI findings in Achilles injuries, where complete ruptures constituted the majority of cases, confirming that significant tendon defects are common in neglected or chronic ruptures and critical for surgical planning[19]. Furthermore, Bäcker et al. highlighted the role of MRI in revealing both rupture and degenerative changes, reinforcing the value of imaging in determining the extent of Achilles tendon damage and guiding reconstruction strategies[20]. These imaging findings informed our intraoperative approach, where the

Peroneus Brevis tendon provided adequate length and quality in 92% of cases, although 8% of patients required additional grafts. This high suitability aligns with findings by Maffulli et al., who reported effective use of Peroneus Brevis tendon in chronic Achilles reconstructions with minimal need for additional graft material, underscoring its robustness and biomechanical compatibility with the Achilles tendon[14]. Soft tissue augmentation was required in 24% of our patients, similar to the experience reported by Miškulin et al., who observed that additional grafting in complex cases helped achieve optimal tendon coverage and structural stability, minimizing the risk of subsequent complications[21]. Suture anchors were used for fixation in all cases, ensuring secure attachment of the graft, consistent with Cregar et al.'s findings, where the use of suture anchors contributed to stable graft positioning and favorable postoperative outcomes[22]. Postoperative complications in our study were minimal, with only 8% of patients developing infection, 4% experiencing graft rejection, and 4% re-rupture, suggesting a high level of graft integrity and surgical success. These complication rates are comparable to those reported by Karnovsky and Drakos, who documented a 2-8% re-rupture rate and low infection incidence following Achilles repairs, indicating that meticulous surgical technique and secure graft fixation can reduce re-rupture and infection risks in tendon reconstructions[23]. Furthermore, Mook et al. demonstrated the safety of Peroneus Brevis allografts with low rates of postoperative infection and graft rejection, supporting the viability of this allograft choice in tendon repair settings with similar outcomes to our study[24]. Functional outcomes at the 12-month follow-up in our study were highly favorable, with 68% of patients achieving excellent AOFAS scores and an additional 20% with good scores. This high rate of functional recovery is consistent with the results of Iacono et al., who reported significant AOFAS improvements in patients treated for Achilles tendinopathy, showing that surgical interventions can achieve near-normal functional outcomes in the majority of patients by 12 months[25]. Similar functional success was observed in the study by Carmont et al., where percutaneous repair yielded AOFAS scores around 97, underscoring the efficacy of minimally invasive and allograft techniques in promoting robust functional recovery in Achilles tendon repairs[26]. Patient satisfaction in our study was also high, with 76% of patients very satisfied and 16% satisfied at 12 months. This positive response reflects findings by DeFazio et al., who reported high patient satisfaction and AOFAS scores following complex Achilles reconstruction using free tissue transfer, supporting the importance of using durable graft materials and stable fixation techniques in achieving patient satisfaction[27]. Furthermore, Jain et al. observed similar outcomes with gastrocnemius advancement and Flexor Hallucis Longus (FHL) transfer, where AOFAS improvements were paralleled by high patient satisfaction, reinforcing the concept that well-chosen graft options and stable fixation contribute to

favorable functional and subjective outcomes[10]. In conclusion, this study demonstrates that Peroneus Brevis tendon allografts provide effective solutions for neglected or chronic Achilles tendon defects, yielding strong functional recovery and high patient satisfaction while maintaining low complication rates. The comparative findings from existing literature corroborate our results, suggesting that the Peroneus Brevis allograft is a viable alternative to other tendon grafts, offering specific advantages in achieving stable and durable Achilles reconstruction outcomes. These findings may support broader adoption of Peroneus Brevis allografts, especially in settings with limited resources, where reliable and accessible graft options are essential for managing chronic tendon injuries.

Limitations of the Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

Conclusion

In this study, the use of the Peroneus Brevis tendon allograft for reconstructing neglected or chronic Achilles tendon defects demonstrated promising outcomes, with high functional recovery rates, minimal complications, and strong patient satisfaction at 12-month follow-up. The findings reinforce the Peroneus Brevis tendon as a viable alternative for cases where autografts are limited or unsuitable, providing a robust and accessible option for Achilles reconstruction in resource-constrained settings. Complication rates, including infection and graft rejection, were low, and the functional outcomes, as assessed by AOFAS scores, were comparable to those seen in other reconstructive techniques, indicating that this method offers a safe and effective approach for treating chronic Achilles tendon injuries. These results support further exploration and adoption of the Peroneus Brevis allograft as a primary option for complex tendon reconstructions, especially where healthcare resources are limited.

Ethical approval

The study was approved by the Institutional Ethics Committee

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