

Case Series

Understanding the clinical and functional outcome of flexor hallucis longus tendon transfer and V-Y plasty for chronic Achilles tendon rupture: a case series

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ABSTRACT

Chronic Achilles tendon rupture secondary to insertional Achilles tendinopathy leads to significant functional disability, and its optimal surgical management remains a topic of discussion. This prospective case series evaluated the clinical and functional outcomes of flexor hallucis longus (FHL) tendon transfer with V-Y plasty in nine patients treated between January and December 2023. Following a standardised postoperative rehabilitation protocol, functional assessment was performed using the American Orthopaedic Foot and Ankle Society (AOFAS) scoring system and ankle range of motion (ROM) at three and six months postoperatively. The mean age of patients was 49.4 ± 7.86 years, and most were male. AOFAS scores improved significantly from 72 ± 2.5 at three months to 92 ± 2.3 at six months ($p=0.001$), and significant gains in dorsiflexion and plantarflexion were observed over the same period ($p<0.001$). At six months, ankle ROM of the operated limb was comparable to the contralateral side, and no clinically relevant weakness of great toe flexion was noted. These findings suggest that FHL tendon transfer combined with V-Y plasty is an effective and reliable technique for managing chronic Achilles tendon rupture due to insertional Achilles tendinopathy, resulting in meaningful restoration of function and range of motion. Further larger-scale comparative studies are warranted to confirm these results.

Keywords: Chronic Achilles tendon rupture, Insertional Achilles tendinopathy, Flexor hallucis longus tendon transfer, V-Y plasty, Ankle range of motion

INTRODUCTION

Achilles tendon rupture is one of the most commonly encountered tendon injuries caused by trauma or conditions such as insertional Achilles tendinopathy, Achilles tendinosis, Haglund deformity or retrocalcaneal bursitis.¹⁻³ Amongst these, insertional Achilles tendinopathy is a degenerative disorder which causes considerable heel pain leading to gait abnormalities with limitation of routine activities.

Appropriate management of this condition may prevent Achilles tendon rupture; however, patients often present with a ruptured tendon following months or years of pain.²

Achilles tendon rupture is mainly a clinical diagnosis. Despite careful clinical examination, 10-25% of ruptures can be missed.⁴ When the condition is left untreated for more than four to six weeks, it is considered a chronic rupture.⁵ Management of these chronic ruptures often requires operative management, with the main aim of surgery being the alleviation of pain and restoration of functionality.

Various surgical options for treating chronic Achilles tendon rupture have been reported in the literature.⁶⁻⁹ V-Y plasty, gastrocnemius-soleus turndown flap, and local tendon transfer, including flexor hallucis longus (FHL) are some of the commonly practiced techniques. Other

procedures include the use of synthetic ligaments. Although multiple procedure is available for the treatment of chronic Achilles tendon rupture, there is still a lack of evidence supporting one technique over another.

FHL tendon transfer for chronic Achilles tendon rupture was first described in 1993 by Wapner et al.¹⁰ FHL tendon has higher durability and more strength than the other nearby tendons, thereby making it a more feasible option for transfer. However, to the best of our knowledge, no international literature on FHL tendon transfer for chronic Achilles tendon rupture from the Asia-pacific region is available. Hence, the aim of this study was to assess outcomes of FHL transfer for chronic Achilles tendon rupture due to insertional Achilles tendinopathy from this part of the world.

CASE SERIES

A single centre prospective case series was conducted between 01 January 2023 and 31 December 2023 at a tertiary centre teaching centre in Jaipur, India. All patients who underwent FHL transfer for chronic Achilles tendon rupture due to insertional Achilles tendinopathy within the mentioned duration were included, after a trial of conservative for up to three months, and non-probability consecutive sampling was performed. Diagnosis of chronic Achilles tendon rupture was made on the presence of Haglund deformity and calcaneal exostosis on radiographs. Skeletally immature individuals (aged <18 years) and individuals with any other skeletal deformities or those diagnosed with congenital syndromes were excluded from the study. Exemption from the ethical review committee (ERC) at our institution was obtained prior to the conduction of the study.

Baseline demographic data, including age, gender comorbidities and site of injury, was recorded for all patients. All surgeries were followed under spinal anaesthesia by a senior professor. All patients were positioned in a prone position, and a tourniquet was applied. After standard preparation and draping, a posteromedial longitudinal incision was made to prevent wound complications. The Achilles tendon was identified, the diseased portion was thoroughly debrided and the gap was measured. Next the deep posterior compartment of the leg was dissected to expose the belly and tendon of FHL. The tendon of the FHL was divided as distally as possible by keeping the ankle and big toe in maximum plantar flexion. In order to prevent damage to the neurovascular structures, the direction of dissection was kept from medial to lateral. The tendon was then sutured with Krakow stitches and passed through the tendon sizer for adequate bone tunnel preparation (Figure 1).

A guide wire was then passed into the calcaneum, just anterior to the Achilles tendon insertion site. Reaming was done over the guide wire in accordance with the FHL tendon diameter. Care was taken not to penetrate the plantar surface of the calcaneum while reaming. With the

help of beath needle, the ends of the suture holding the FHL tendon were then passes into the bone tunnel. The guide wire was pulled through the plantar surface of the calcaneum to place the FHL tendon inside the tunnel, which was reamed, following which tenodesis was done using an interference screw of appropriate size. Tension on the tendon was maintained by applying traction to the suture. The ideal tension at which the FHL should be inserted is one that keeps the ankle at a resting tension equal to that of the contralateral side.

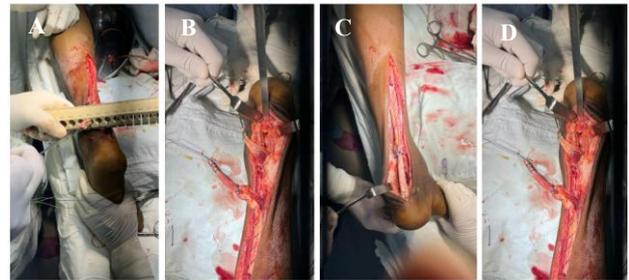


Figure 1 (A-D): Intraoperative steps demonstrating flexor hallucis longus tendon transfer with V-Y plasty for chronic Achilles tendon rupture repair.

After the FHL transfer was completed, tension was given to the Achilles tendon. A proximal V-Y plasty was done to restore the length of the Achilles tendon. V-Y plasty can adequately cover a gap of about 5 cm. A 4.75 mm suture anchor was inserted into the calcaneum, and the Achilles tendon was attached. At this moment, the ankle resting tension should be equal to contralateral side to avoid overtightening. The paratenon was then repaired, and the skin was closed in layers. A well-padded anterior splint with resting ankle tension equal to contralateral ankle was applied.

Post procedure, an anterior below knee back slab was applied, keeping the ankle in a neutral position for six weeks. Non-weight-bearing ambulation was allowed, and all patients were initially followed up in the clinic for the removal of stitches after two weeks. Patients were allowed full weight bearing after six weeks post operatively, and physiotherapy with eccentric exercises to mobilise the ankle and strengthen the Achilles tendon was started. Pre- and post-operative radiographs are shown (Figure 2).

Our primary objective was to assess the functional outcome after the procedure using the American Orthopaedic Foot and Ankle Society (AOFAS) score at three- and six-month post operatively. This score an assessment of the range of ankle motion was also performed at three- and six- month follow up as part of our secondary objective. Data was analysed using statistical package for the social sciences (SPSS) version 21.

All qualitative variables were expressed as percentages, while quantitative variables were represented as mean \pm standard deviation. Independent samples and paired T-test were used where appropriate to identify any associations

and one-way ANOVA was used to compare two means when required. A $p < 0.05$ was considered to be significant.



Figure 2: (A) Pre-operative lateral ankle radiograph demonstrating Haglund deformity, and (B) post-operative lateral view showing insertional repair secured with bioabsorbable screw.

In total, 9 patients were enrolled in study. The majority of the patients were males and there was more incidence of injury on right side in terms of the site of the injury, as depicted in Table 1. The mean age of the study population was 49.4 ± 7.86 years (range: 34-60 years). The mean defect size of the Achilles tendon was noted to be 7.20 ± 1.0 cm. With regards to the functional outcome, the mean AOFAS score at three-months post-surgery was 72 ± 2.5 , significantly improving to 92 ± 2.3 at the six months follow up ($p = 0.001$), as represented in Table 2. Males were also noted to have significantly higher AOFAS scores at their six-month follow up than females ($p = 0.022$).

Table 2: Comparison of AOFAS scores across follow-up intervals and gender.

Independent variables		AOFAS score (mean±SD)	P value
Follow-up duration (months)	3	72±2.5	0.001
	6	92±2.3	
Gender (3-month follow-up)	Male	71.6±2.2	0.67
	Female	71.2±2.6	
Gender (6-month follow-up)	Male	91.4±2.1	0.022
	Female	90.8±2.3	

Table 3: Comparison of post-operative ankle range of motion (dorsiflexion and plantarflexion) at three- and six-month follow-ups.

Ankle range of motion (mean±SD)	Follow up-duration		P value
	Three months	Six months	
Dorsiflexion	11.80±2.89 degree	17.58±2.32 degree	0.001
Plantarflexion	28.59±1.79 degree	42.56±1.35 degree	<0.001

DISCUSSION

The effective treatment of chronic Achilles tendon rupture is critical for restoring normal gait, improving the overall functional status, and enhancing the patient's quality of life, as the rupture causes a loss of plantar flexion and ankle instability, leading to gait abnormalities like a

Table 1: Demographic characteristic of the study population.

Characteristic	Category	No. of participants (%)
Gender	Male	6 (66.7)
	Female	3 (33.3)
Co-morbidities	Diabetes mellitus	4 (44.4)
	Hypertension	3 (33.3)
Smoking status	Smoker	6 (66.7)
	Non-smoker	3 (33.3)
Site of injury	Right	5 (55.6)
	Left	4 (44.4)

Table 3 shows the mean post-operative range of motion at three months and six-month follow-ups. A significant improvement in dorsiflexion and plantarflexion was noted at a six-month follow up compared to three-month post operatively ($p \leq 0.001$ for both). When compared to the normal side, the dorsiflexion and plantarflexion of the affected ankle were significantly lower at the three-month follow-up. However, at the six month follow up, dorsiflexion and plantarflexion at the operated ankle were comparable to the unaffected side. No significant correlation was noted between the length of the Achilles tendon defect and outcome variables, including AOFAS scores and range of motion at three and six months. Smoking status, presence of co-morbidities and side of surgery also had no significant effect on the outcomes.

calcaneal limp. Chronic rupture is defined as a tear left untreated for more than four to six weeks. Surgical management is typically required for these chronic cases to alleviate pain and restore function. Our study aimed to assess the functional and clinical outcomes of combining FHL tendon transfer with V-Y plasty for chronic Achilles tendon rupture secondary to insertional Achilles tendinopathy. The primary finding of this case series is the

significant functional improvement, demonstrated by the mean AOFAS score, a primary measure of functional outcome, which significantly improved from 72 ± 2.5 at three months to 92 ± 2.3 at six months ($p=0.001$). This high six-month score is highly consistent with international literature on FHL transfer for chronic ruptures, validating the technique as an effective method for meaningful functional restoration. For example, Wapner et al, who first described FHL transfer, reported excellent results in their initial series, and more recently, studies by Alhaug et al reported a comparable mean AOFAS score of 92.6, while Lever et al reported a durable mean score of 94.7 at six years.^{1,11,6} Furthermore, restoration of ankle function was achieved, as results showed a significant improvement in both dorsiflexion and plantarflexion between the three and six-month follow-ups ($p<0.001$), with the operated ankle's ROM becoming comparable to the unaffected contralateral side at six months. This is attributed to the FHL tendon's higher durability and strength compared to other transfers (like Peroneus Brevis), and the necessary length restoration provided by the V-Y plasty, which adequately addressed the average 7.20 ± 1.0 cm defect size. Concerning donor site morbidity, our study supports the international consensus that while laboratory weakness may be noted, there is no clinically relevant weakness of great toe flexion or decreased big toe function in overall patient functionality.

CONCLUSION

The results of this prospective case series from a tertiary centre in Jaipur, India, strongly suggest that FHL tendon transfer combined with V-Y plasty is an effective and reliable technique for managing chronic Achilles tendon rupture due to insertional Achilles tendinopathy. The findings successfully replicate the favourable functional outcomes and low donor site morbidity reported in established international literature.

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Ethical approval: Not required

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