International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Reconstruction of Chronic Insertional Achilles Tendon Rupture Treated by Surgical Repair using Interference Screw and Augmentation with Flexor Hallucis Longus Tendon Transfer

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Abstract: ***Background: Achilles tendon ruptures are frequent to occur. Even then one-fourth of the ruptures present as chronic injuries. As a result, a large gap is created, which makes chronic insertional rupture difficult to treat. There are a number of treatment modalities for tendon repair, our study aims at surgical repair using interference screw and augmentation using FHL. Methods: A total of 14 patients were included in the study who underwent debridement and surgical repair of tendon with FHL transfer fixed using interference screws. Pre and post-operative functional outcomes were assessed using AOFAS-AH Score at intervals of 6 and 12 months. The strength of plantar flexion was assessed using the standing heel-rise test. Results: The mean age group was 52.28±12.18 yrs. The average time interval from trauma to the surgery was of 7.2±2 weeks depicting the chronicity of the ruptures. In the pre-operative period, the mean AOFAS-AH score was 42.9±11.7 out of 100 points showing substantial disability due to tear. The mean AOFAS-AH at 6 months was 74.7±12.7 and at 12 months it was 92.07±5.2 showing significant improvement in the functional outcome. At the last follow-up, the strength of the plantar flexion was more than 50% compared to the normal limb was achieved. Conclusion: For chronic insertional Achilles tendon rupture with a gap of 5-10 cm, surgical repair using interference screw and augmentation with FHL transfer achieved excellent outcomes at our latest follow-up.***

Keywords: AOFAS-AH, Interference Screw, Achilles Tendon, FHL, Tendon Transfer

1. Introduction

The Achilles tendon is the strongest and most vulnerable tendon in the body to get ruptured with sports activities. Injuries to the Achilles tendon are relatively common in middle-aged athletes and the frequency of these injuries increased to 10/100,000 in 2010. If the treatment for primary rupture is not done, it leads to the healing of the tendon in elongation which makes the patient unable to push off. Daily activities like walking and climbing stairs are affected. Therefore, there is a dire need for the management of these neglected ruptures. The treatment of chronic ruptures is quite challenging as the ends of the tendon are retracted and atrophied with fibrous tissue bridging between the ends. Improper treatment can result in scarring, chronic pain, bad healing, and re-ruptures. The expected outcome after treatment of these ruptures may not bear fruitful results in comparison with the repair done in acute ruptures.

There isa variety of surgical procedures described for the reconstruction of chronic Achilles tendon ruptures like V-Y myotendinous advancement[1] or a turn-down procedure described by Bosworth[2]. Surgical techniques such as tendon transfer use flexor hallucis longus[3], peroneus brevis[4], flexor digitorum longus[5] in place of Achilles tendon.

2. Aims and Objectives

To assess the functional outcome and strength of plantar flexion in patients with chronic insertional Achilles tendon rupture treated surgically with interference screw and augmentation with Flexor hallucis longus tendon transfer.

3. Material and methods

A prospective interventional study was conducted in the dept of orthopaedics, in a tertiary care hospital between May 2020 and September 2022. A universal sampling technique was adopted in this study. The patient cohort consists of 14 patients with chronic Achilles tendon rupture undergoing repair with interference screw and augmentation with FHL tendon.

Inclusion criteria:

- The chronic rupture was diagnosed after 4 weeks of injury.
- Insertional ruptures with tendon gaps ranged between 5-10cm.

Exclusion criteria:

- Patients with uncontrolled diabetes mellitus, and peripheral vascular disease, on immunosuppressants.

After obtaining the informed written consent the patients fulfilling the inclusion criteria were included in the study. After routine preoperative workup and pre-anesthetic

evaluation patients were posted for surgery. The patient is positioned prone under the effect of spinal anesthesia with a pillow underneath the ankle joint. The Achilles tendon was exposed by a posteromedial approach to the ankle joint. The sural nerve identifies and retracted. Paratenon incised and debridement of the fibrous tissue bridging the ruptured end is done (Fig.1). Prominent posterosuperior calcaneal tuberosity is excised. Dissection of FHL tendon protecting the neurovascular bundle. The FHL tendon is pulled up with plantar flexion of the ankle and great toe and cut at the level of the calcaneum. FHL tendon is divided into 2 slips and krackow sutures were taken in both the slips of the FHL tendon separately (Fig.2). 2 bony tunnels were drilled in the calcaneum starting at the superior calcaneal tuberosity directing anteroinferior and exciting at the plantar aspect of the heel. Each slip of the FHL tendon is pulled through each of the tunnels and fixed securely with the interference screw of the same size as the tunnel diameter. During this process,2 ethibond5-0 sutures were passed folded in each of the tunnels with both ends lying outside which later acts as sutures of an anchor (here interference screw acts as an anchor). Then the large gap present at the ruptured site was dealt withthrough horizontal release of the gastrocsoleus aponeurosis. Post-release of aponeurosis the gap was reduced and the repair of the Achilles tendon was done with the ends of the ethibond5-0 sutures fixed at one end with an interference screw (Fig.3). The Achilles tendon repair was done with krackow suturing and it was made sure that the repair was not in excessive tension. Paratenon was meticulously closed over the repair followed by the closure of the skin was done. A sterile dressing is then applied and a below-knee slab in $15^0$of plantarflexion is given (Fig.4).

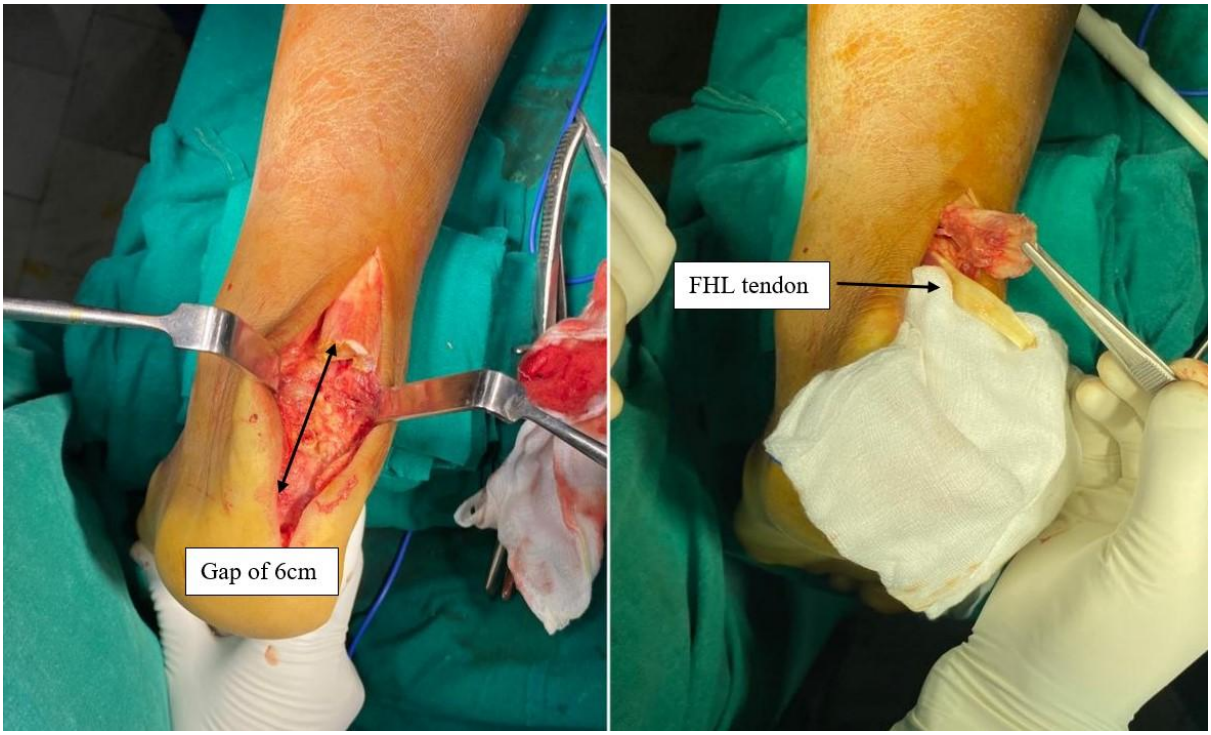

Figure 1: Intra-operative image showing Achilles tendon rupture with a large defect of 6cms and FHL tendon cut at the level of the calcaneum

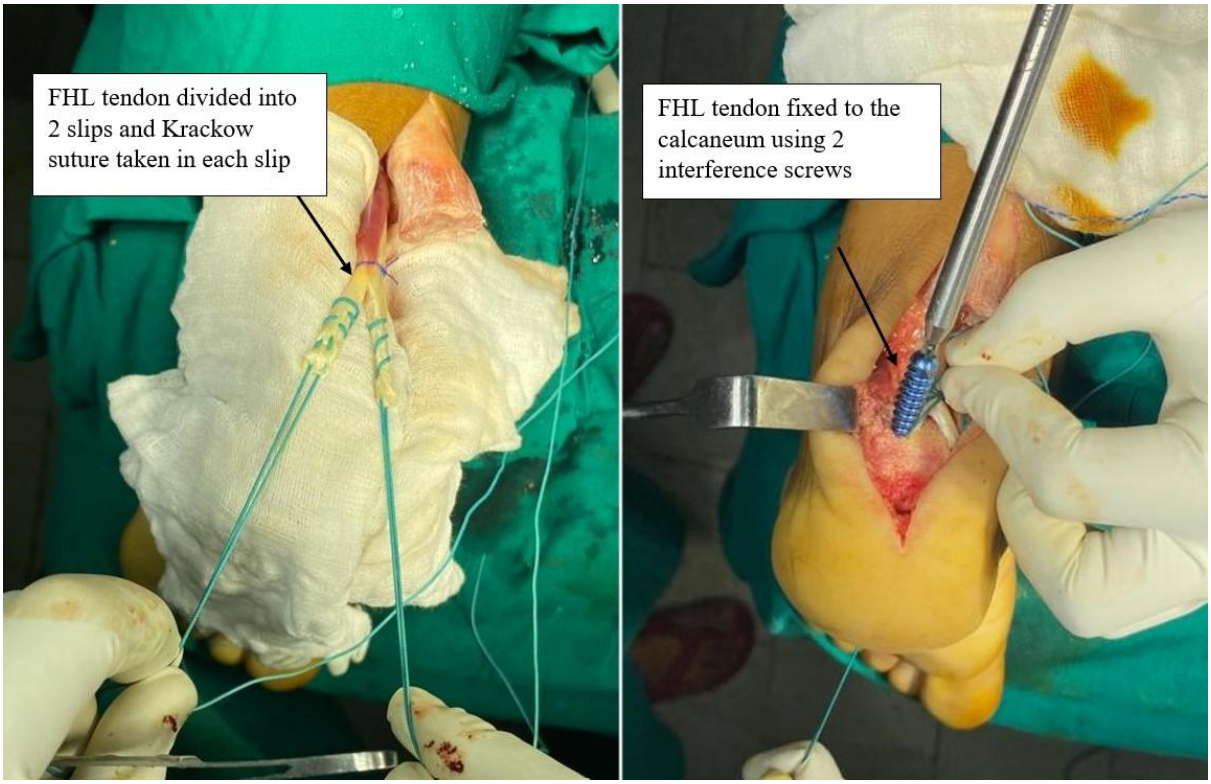

Figure 2: FHL tendon divided into 2 slips and Krakow suture taken in each slip(left) and fixation of tendon to calcaneum using interference screw(right).

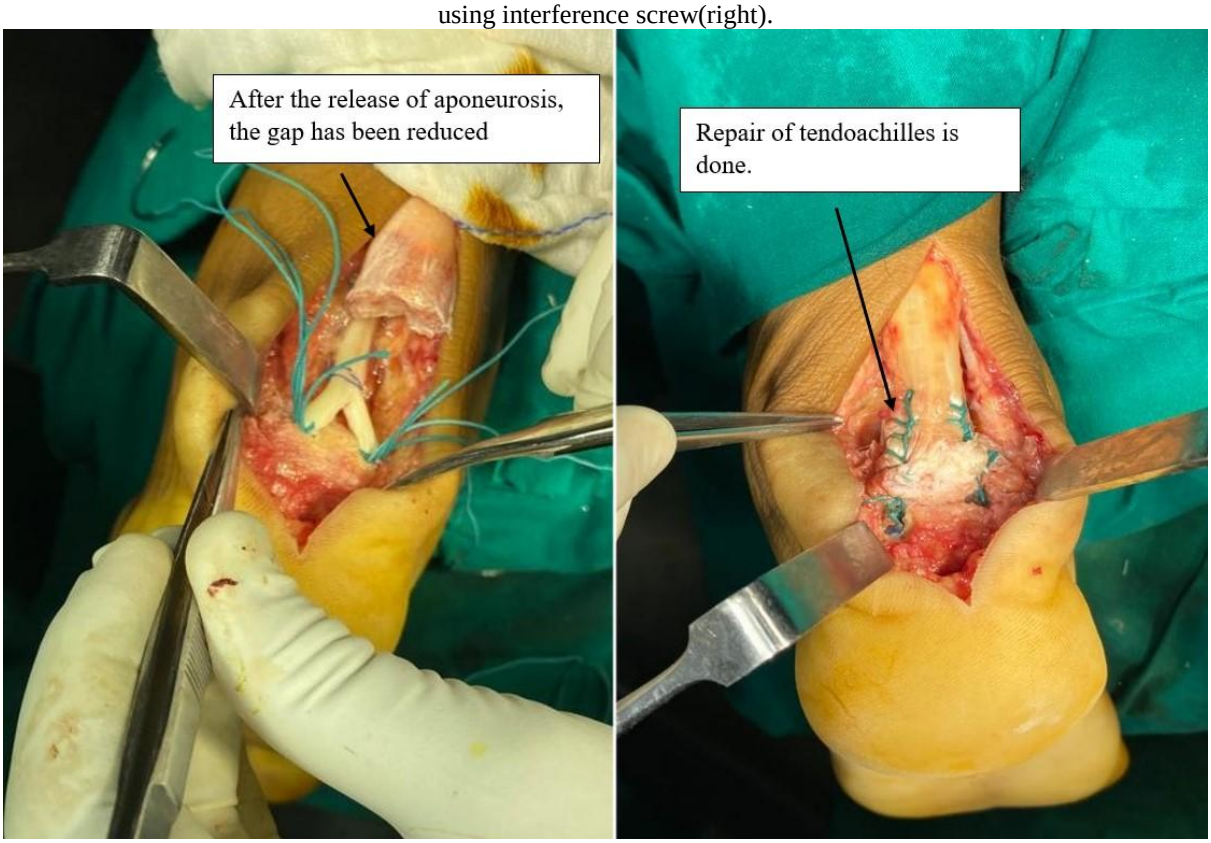

Figure 3: Reduced gap after Horizontal release of gastroc-soleus aponeurosis(left) and repair of tendoachilles with ethibond 5-0 sutures attached to interference screw(right)

The sutures were removed on the 12th post-operative dayand patients were placed in a non-weight bearing below knee cast in 10^0-15^0 plantar flexion for 3 weeks and in a neutral position for 3 more weeks. 6 weeks postoperatively a rehabilitation program for partial weight bearing and range of motion began. Strengthening exercises were started after 12 weeks. Patients were followed up for a maximum period of 12 months. The functional outcome and strength of plantar flexion were assessed using the AOFAS-AH score and Standing heel rise test respectively at 6 and 12 months.

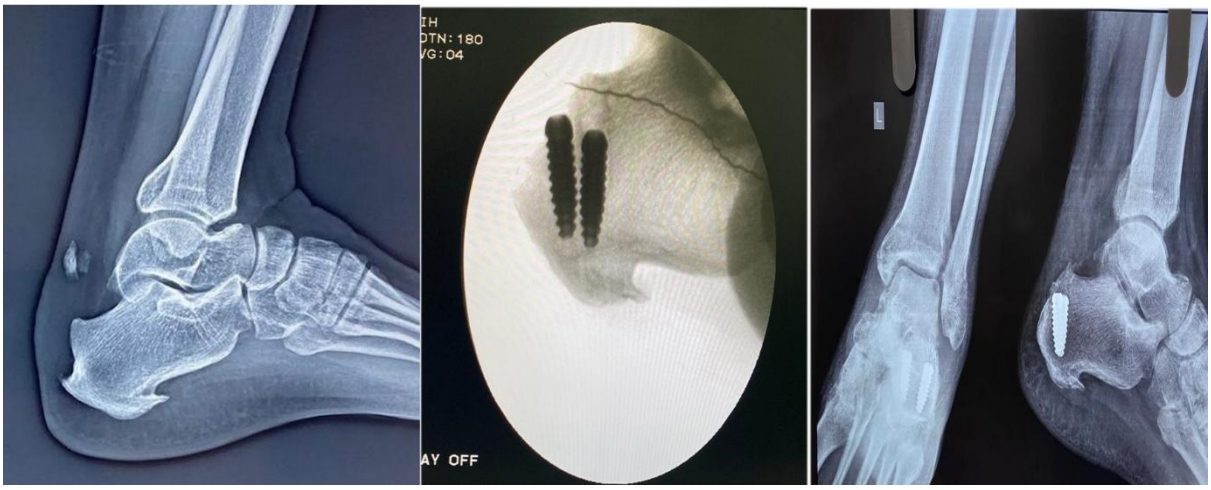

Figure 4: Image showing Pre-operative X-ray(left), Intra-operative C-ARM image(middle), and Post-operative X-ray(right) of the patient.

4. Results

The following results were obtained from the study conducted on 14 patients with ages of the patients ranging from 35yrs to 68yrs. The mean age group was 52.28±12.18 yrs. Among 14 patients 13 were male and 1 female. The cause of rupture included steroid injection 7(50%), tendinosis 5(36%), and re-rupture 2(14%). The occupational data found to be manual labour 8(57%), corporate jobs 5(36%), and housewives 1(7%). There was no case of a bilateral rupture in our study. The average time interval from trauma to the surgery was of 7.2±2 weeks depicting the chronicity of the ruptures. No patients were lost to follow-up. At the last follow-up, the strength of the plantar flexion was more than 50% compared to the normal limb was achieved (Fig.5). In the pre-operative period, the mean AOFAS-AH score was 42.9±11.7 out of 100 points showing substantial disability due to tear. The mean AOFAS-AH at 6 months was 74.7±12.7 and at 12 months it was 92.07±5.2 showing significant improvement in the functional outcome (Fig.6). The statistical analysis was done using paired t-test and statistical significance, $p<0.001$ was established.

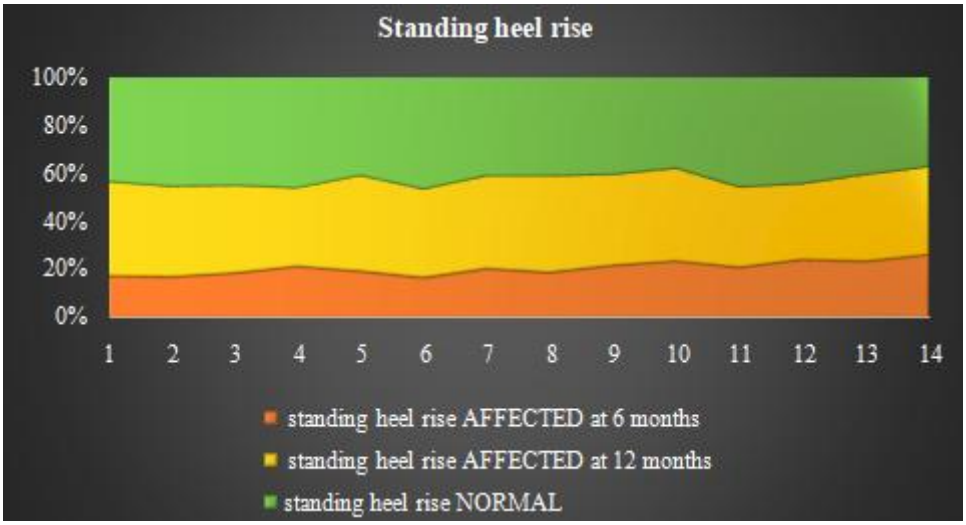

Figure 5: Graphical representation of standing heel-rise test in fourteen patients at 6 and 12 months in comparison to the normal side

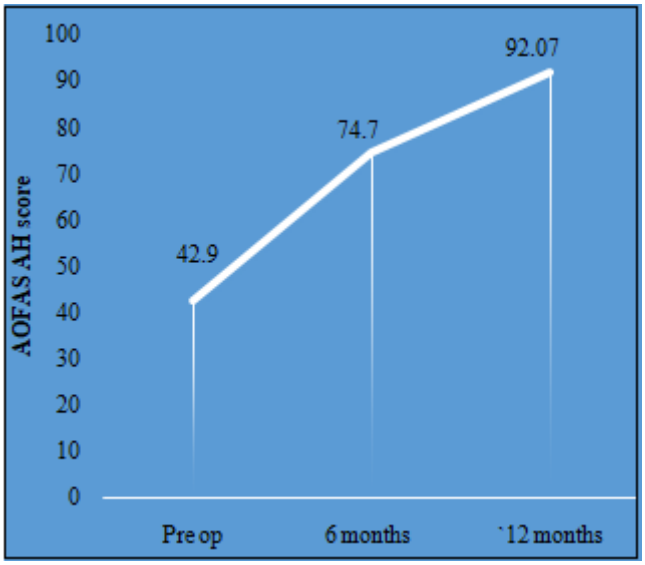

Figure 6: Graphical representation of Average AOFAS AH Score pre-operatively, at 6 months, and 12 months postoperatively.

Among all 14 patients, none of them complained about functional weakness and loss of power of propulsionin their routine activities. There were no major complications. Wound dehiscence was reported in a single case which resolved with regular dressing with normal saline and the local application of mupirocin ointment.

5. Discussion

An autologous tendon transfer is widely used as an augmentation procedure in chronic Achilles tendon rupture with the transfer of the FHL tendon to reconstruct the Achilles tendon having several advantages. The FHL tendon is the second strongest muscle in the rear part of the lower leg having similar properties to that of the Achilles tendon. Since our study includes insertional rupture, it involves direct repair of the Achilles tendon to the calcaneum but this involves bone-to-tendon healing which is a slow process and unpredictable[6]. Augmenting the repair with FHL transfer into the end of the Achilles tendon can facilitate its vascular reformation by allowing micro vessels to enter chronic ruptured tissues. Furthermore, FHL transfer also works as a reserve strategy in case of failure of Achilles tendon repair.

Wapner et al. found in their study that augmentation of the reconstruction provided no additional benefit and in fact increased the amount of scar tissue formed which only compromised functional outcome[7]. But our study has demonstrated an excellent functional outcome with an AOFAS-AH score of 92.07±5.2 at the end of 12 months signifying Achilles tendon repair along with augmentation using FHL tendon transfer provides excellent results. Some authors found FHL transfer alone was insufficient for the reconstruction of defects greater than 5 cm and a V-Y myotendinous advancement or fascial turn-down flap was required[8,9,10,11]. In our study, we managed a gap of 5-10cm with the horizontal release of gastric soleus aponeurosis thereby getting adequate length for direct repair and decreasing excessive tension in the Achilles tendon. Mulier et al. have shown poorer results and higher infection rates with gastrocnemius turn-down flaps as compared to tendon transfer techniques[12]. But in our study, we found no such complications except a single case had wound dehiscence which was managed with regular dressings and the local application of mupirocin ointment.

Attention to some surgical details like generous debridement of the ends of the Achilles tendon, preserving the anterior paratenon, good interlacing, and centralization of the tendon, careful closure of the paratenon, and minimizing the post-operative ankle equinus are the chief factors that played a major role in achieving an excellent outcome in our study[13]. Using interference screws for securing the fixation along with early mobilization and strengthing exercises came to the aid of achieving more than 50% of plantar flexion strength with respect to the contralateral side at the end of 12 months.

The use of interference screw fixation needs a short length of FHL tendon thereby circumventing the need for a second incision near the medial aspect 1st metatarsal. The morbidity of FHL transfer is mainly the loss of active plantar flexion of the great toe. But according to our study FHL transfer morbidity is clinically insignificant even in daily routine activities.

The main limitation of our study is the small number of patients and the follow-up duration was limited to 12 months.

6. Conclusion

Chronic insertional Achilles tendon ruptures with a gap of 5-10 cm treated by surgical repair using interference screw and augmentation with FHL tendon transfer achieved excellent functional outcomes at our latest follow-up with no major complications.

Funding: no funding sources

Conflict of interest: none

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