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Case Series

V-Y tendon advancement in patients with chronic retracted tendo-Achilles rupture: functional and clinical outcomes

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ABSTRACT

Chronic Achilles tendon rupture is a relatively uncommon disabling condition, often due to delayed diagnosis or missed treatment. Primary repair is often complicated by retraction of the tendon, scar tissue formation and shortening of the gastrocnemius-soleus complex. The V-Y tendon advancement is a useful reconstructive technique that allows reconstruction of tendon continuity without the need for tendon grafts or tendon transfers. In our study we aimed to evaluate the clinical and functional outcome of V-Y tendon advancement in patients with chronic retracted tendo Achilles rupture. We conducted a retrospective observational study of 15 patients treated with V-Y tendon advancement for chronic Achilles tendon rupture from January 2020 to December 2025. Functional results were evaluated by American Orthopaedic Foot and Ankle Society (AOFAS) ankle-hindfoot score and Achilles Tendon Total Rupture Score (ATRS). Heel-rise ability, ankle range of motion, return to daily activities and postoperative complications were recorded as clinical outcomes. The patients' mean age was 48.7 years and the mean duration of follow-up was 16.7 months. Average tendon defect after debridement was 5.2 cm. The average AOFAS score improved from 44.3 preoperatively to 88.9 at final follow-up. The average ATRS score was 83.9. Eleven patients (73.3%) were able to repeat a single heel-rise test. The most common complication was mild ankle stiffness. There was no re-rupture of the tendons. Thus, we concluded that, V-Y tendon advancement is a reliable and effective technique for reconstruction of chronic retracted Achilles tendon rupture the procedure leads to satisfactory functional outcome, restoration of gait and low complication rate.

Keywords: Chronic Achilles tendon rupture, V-Y plasty, Achilles tendon reconstruction, neglected tendo Achilles rupture, tendon advancement

INTRODUCTION

The Achilles tendon is the largest and strongest tendon in the human body. It transmits the force generated by the gastrocnemius-soleus complex to the calcaneus and is essential for walking, running and jumping. Despite its strength, Achilles tendon rupture is one of the most common tendon injuries seen in orthopedic practice, especially in middle-aged individuals participating in recreational sports activities. In recent decades, there has been a steady increase in the incidence of Achilles tendon rupture, due to increase in participation in athletic activities and improved awareness of sports-related injuries.[1]

Rupture of the Achilles tendon is generally regarded as chronic rupture when the rupture is diagnosed or managed more than four to six weeks after the initial injury.[2] The injury may be confused with an ankle sprain or the symptoms may initially be mild, and patients delay seeking medical attention, leading to delayed diagnosis. Scar tissue forms in the tendon gap as the tendon ends are

pulled back by the force of the gastrocnemius-soleus muscle complex over time. This causes the musculotendinous unit to shorten, calf muscles to atrophy, and loss of plantarflexion strength to develop gradually.[1-3]

Patients with chronic rupture of the Achilles tendon frequently complain of difficulty in walking, weakness in push-off, inability to perform a single heel-rise test, difficulty in climbing stairs, and decreased participation in recreational and occupational activities.[1] Clinical examination often reveals a palpable tendon defect, calf muscle wasting, reduced power of plantarflexion and a positive Thompson test. Magnetic resonance imaging (MRI) is still the most reliable imaging modality to assess the integrity of the tendon, tendon retraction and defect size, and thus helps in surgical planning.[4]

The management of chronic Achilles tendon rupture is controversial because there is no single reconstructive technique that is suitable for all patients. Various surgical options have been described including direct end-to-end repair, gastrocnemius recession, fascial turndown flaps, tendon transfers, free tendon grafting and allograft reconstruction.[2,5] The preferred procedure is primarily dictated by the length of the injury, size of the tendon defect, quality of the tendon and functional requirements of the patient.

The V-Y tendon advancement is still a good reconstructive choice for patients with moderate-sized tendon defects among the available procedures. The technique involves the advancement of the proximal gastrocnemius aponeurosis to bridge the gap in the tendon while preserving the integrity of the native Achilles tendon. Unlike tendon transfer procedures, V-Y advancement does not use a functional tendon and therefore does not cause morbidity at the donor site. Furthermore, the procedure is technically simple, biologically advantageous and inexpensive.[6]

Several studies have reported encouraging results following V-Y advancement of the tendon. Satisfactory functional recovery in neglected Achilles tendon ruptures treated with V-Y tendinous advancement was first reported by Abraham and Pankovich.[7] More recently, Lin et al reported significant improvements in the functional outcome scores and restoration of heel rise ability in patients who underwent V-Y tendon plasty for chronic Achilles tendon rupture.[6] Nonetheless, although these results are promising, the literature is limited by a relatively small sample size and a lack of comparative studies.

The present case series describes the clinical and functional outcomes of 15 patients with chronic retracted Achilles tendon ruptures treated with V-Y tendon advancement at our institution. The aim was to evaluate tendon healing, restoration of function, heel-rise ability, return to activities, and complications following reconstruction.

CASE SERIES

This retrospective observational study was done in department of orthopaedics, ESIC Medical college and Hospital, Sanathnagar, Hyderabad, after obtaining approval from the Institutional Ethics Committee. Hospital records of patients who underwent surgery for chronic Achilles tendon rupture between January 2020 and December 2025 were reviewed. 15 consecutive patients fulfilling inclusion criteria for V-Y tendon advancement for chronic retracted Achilles tendon rupture included. Patients older than 18 years old, had a chronic Achilles tendon rupture presenting more than 4 weeks after injury, underwent V-Y tendon advancement for tendon defects >4 cm, and had minimum follow-up of 12 months.

All patients underwent clinical examination and magnetic resonance imaging to assess tendon retraction and defect size. Surgical reconstruction was performed using V-Y tendon advancement through posterior approach. Postoperatively, patients were immobilized in plantar flexion and underwent standardized rehabilitation protocol.

All procedures were performed under spinal or general anesthesia in the prone position. A pneumatic tourniquet was placed on the thigh. The ruptured Achilles tendon was exposed through a posterior longitudinal incision and all fibrotic tissue was removed down to healthy tendon ends. The tendon defect was quantified with the ankle in neutral flexion (Figure 1). The gastrocnemius aponeurosis was incised proximally in a V-shaped manner (Figure 2). The length of each limb of the V was twice the size of the defect. When the gap was large and the arms of the V extended beyond the musculotendinous junction, we went to tendon transfer procedure. The proximal tendon flap was then advanced distally to bridge the defect and repaired with nonabsorbable sutures. In cases of complete avulsion and in cases where the distal stump was unsuitable for end-to-end repair, we planned for a suture anchor fixation with two suture anchors in the calcaneum. The limbs of the V incision were then closed in a Y manner, thus lengthening tendon and restoring continuity (Figure 3). Tension on the tendon was measured after repair and the wound was closed in layers. A plaster cast was applied to immobilize limb in equinus. The operated limb was immobilized in plantar flexion for 2 weeks. At two weeks, sutures were removed and serial casting or controlled ankle motion boot achieved gradual correction to neutral ankle position. Partial weight bearing was started at 6 weeks and full weight bearing was achieved at 8-10 weeks. Subsequently, physiotherapy was started, which included ankle mobilization exercises, strengthening of calf muscles, proprioceptive training and gait rehabilitation. Patients were followed at 2 weeks, 6 weeks, 3 months, 6 months and final follow up after 1 year. Outcome measures included the ankle-hindfoot AOFAS score, total score of Achilles tendon rupture score, single heel-rise test, range of motion of ankle, resumption of daily activities, and monitoring of post-operative complications.

Table 1: The summary of the results obtained in the study.

Parameters	Findings (%)
Age (in years), mean±SD	48.7±7.9
Sex	
Male	12 (80.0)
Female	3 (20.0)
Side involved	
Right	8 (53.3)
Left	7 (46.7)
Mechanism of injury	
Sports injury	5 (33.3)
Slip and fall	3 (20.0)
Missed rupture	3 (20.0)
Domestic fall	2 (13.3)
Road traffic accident	2 (13.3)
Duration before surgery (weeks), mean±SD	8.5±2.9
Tendon gap (cm), mean±SD	5.2±1.3
Follow-up duration (months), mean±SD	16.7±3.8
Preoperative AOFAS score, mean±SD	44.3±6.2
Final AOFAS score, mean±SD	88.9±4.7
Final ATRS score, mean±SD	83.9±6.2
Heel-rise ability	
Present	10 (66.7)
Partial	5 (33.3)
Return to daily activities	
Yes	12 (80.0)
Delayed	3 (20.0)
Complications	
Nil	7 (46.7)
Mild stiffness	3 (20.0)
Calf wasting	2 (13.3)
Superficial infection	1 (6.7)
Wound edge necrosis	1 (6.7)
Calf weakness	1 (6.7)
Overall complication rate	8 (53.3)
Re-rupture rate	0 (0)

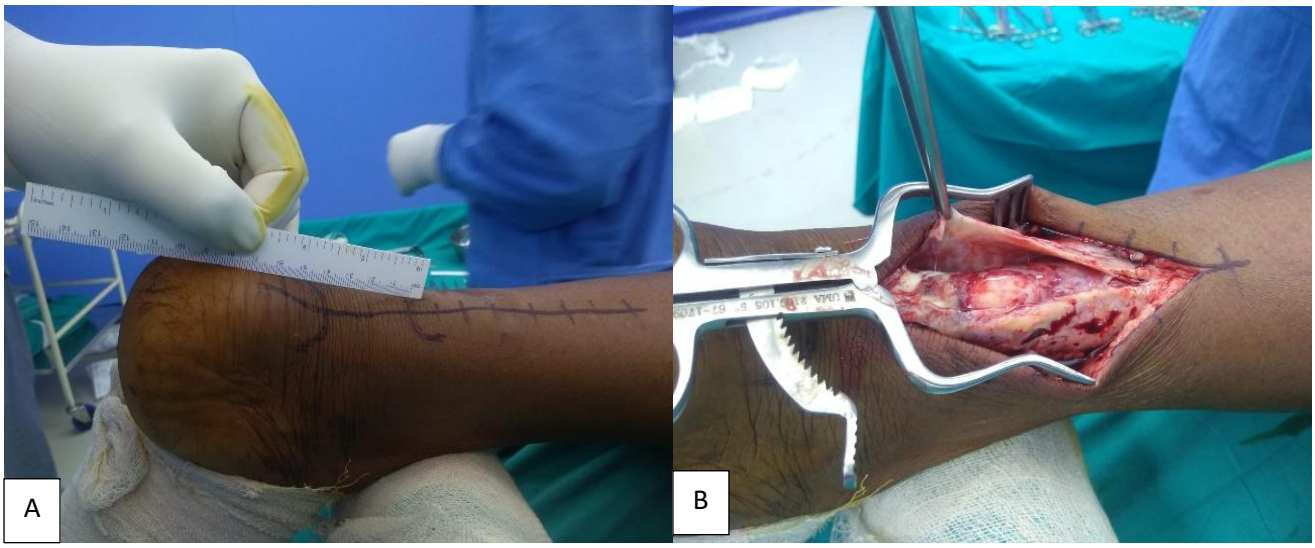

Figure 1 (A and B): Clinical picture of the defect between the retracted tendon and calcaneum. The paratenon is opened to expose the fibrous scar between the retracted ends.

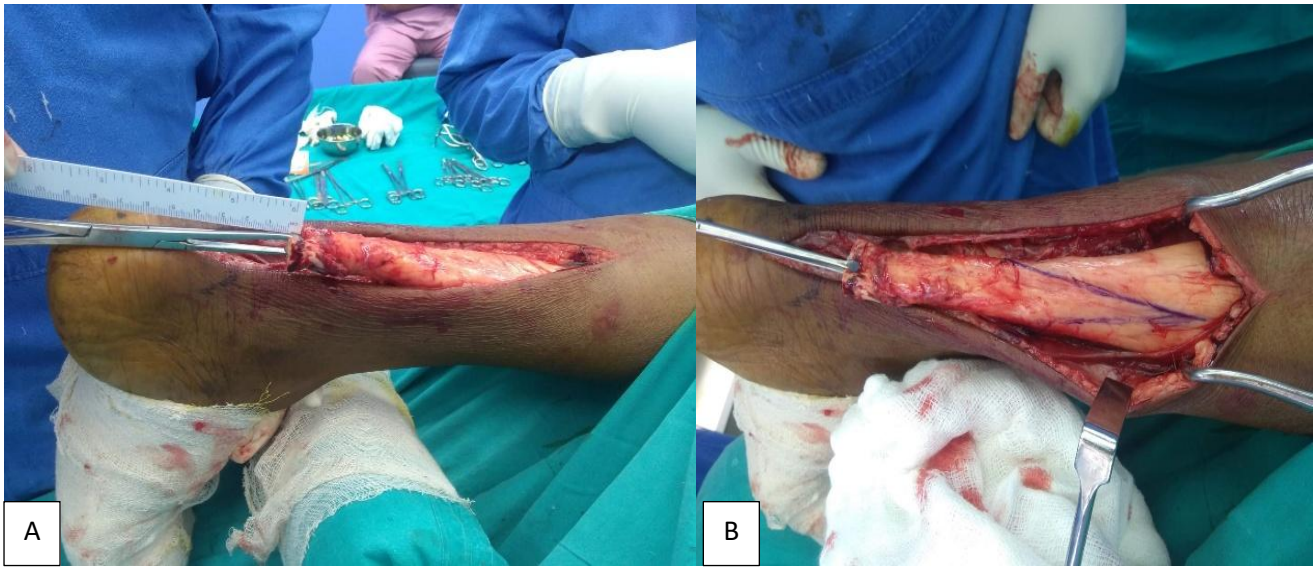

Figure 2 (A and B): The gap between the health tendon end and calcaneum is evaluated. It was found to be 5 cm. Accordingly the length of the limbs of the V in V-Y plasty were planned.

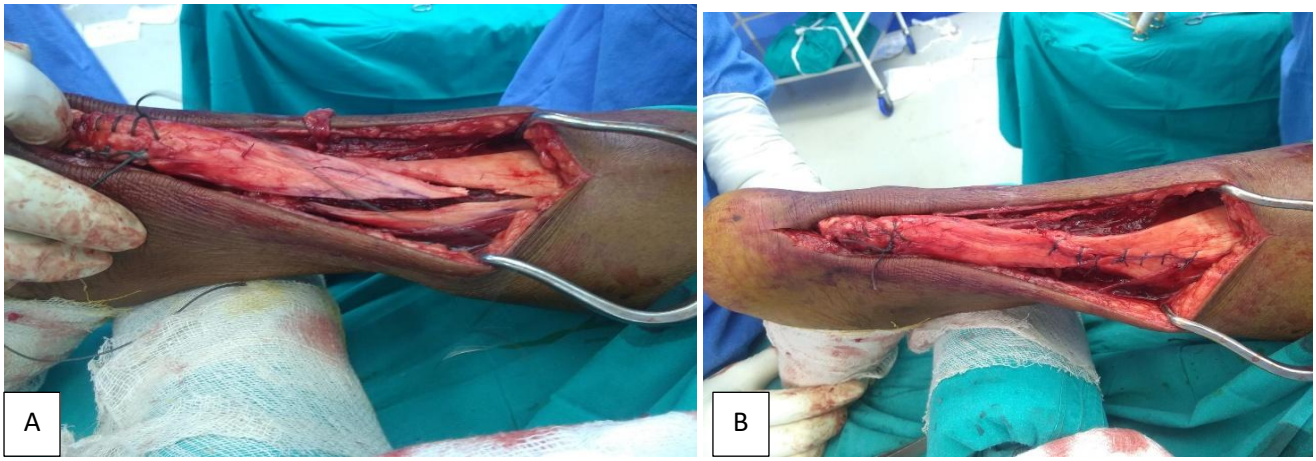

Figure 3 (A and B): The V-Y plasty is completed. The distal end of the stump is repaired using a suture anchor and krackow stiches are applied. The limbs of V and Y are closed.

Figure 4: Heel raise test showing good recovery in the post operative period.

DISCUSSION

The chronic rupture of the Achilles tendon is a challenging problem because of the combination of late presentation with retraction, scarring, poor quality of the tendon and shortening of the gastrocnemius-soleus complex. These pathologic changes often preclude direct tendon repair and require reconstructive procedures to restore tendon continuity and plantarflexion strength.[1,2]

The present study showed good clinical and functional results after V-Y tendon advancement. Mean AOFAS score improved from 44.3 preoperatively to 88.9 at final follow-up. Mean ATRS score was 83.9. These results demonstrate significant improvement in pain, function and patient satisfaction post reconstruction. Similar findings were reported by Lin et al in patients with chronic Achilles tendon rupture and tendon defect between 4-9cm, with significant improvement in both AOFAS and ATRS scores after V-Y tendonplasty.[6]

The mean tendon defect in our series was 5.2 cm. The size of the tendon defect is one of the most important factors influencing the choice of reconstruction, according to previous authors. Direct repair is possible for defects less than 2 cm, but larger gaps usually need tendon advancement or augmentation techniques, said Myerson.[4] Maffulli et al. further suggested tendon transfer or grafting procedures for larger defects (>6 cm).[2] However, our results imply that V-Y advancement alone may give satisfactory results in selected patients with moderate sized tendon defects.

The main advantage of V-Y tendon advancement is that it preserves the native Achilles tendon. V-Y advancement maintains the physiological continuity of the gastrocnemius-soleus-Achilles tendon complex and prevents donor-site morbidity compared with flexor hallucis longus (FHL) transfer or peroneus brevis transfer or free tendon grafting.[5,8] The FHL transfer has become popular due to its similar line of pull and strong plantarflexion power but can lead to loss of hallux flexion strength and changes in the biomechanics of the forefoot.[8] In contrast, V-Y advancement facilitates reconstruction with local tissue with preservation of normal muscle function.

Another advantage is the technical simplicity and economic feasibility of the procedure. “No special implants or allografts or fancy fixation devices are required for the procedure. This is especially true in developing countries where late presentation is still common and resources for advanced reconstruction may be limited. Abraham and Pankovich showed that neglected Achilles tendon rupture could be treated effectively with V-Y advancement with good functional recovery.[7] Our results support the continued relevance of this technique in contemporary orthopedic practice.

The ability to rise on the toes again is regarded as an important indicator of functional recovery after reconstruction of the Achilles tendon. In the current study, 73.3% of patients regained the ability to perform a single heel-rise test. Similar findings were reported by Lin et al who noted that most patients regained heel-rise ability but some residual weakness persisted despite excellent subjective outcomes [6]. Failure to restore plantarflexion strength in all patients may be related to chronic muscle atrophy and chronic tendon dysfunction prior to surgery.

In our series, patients with larger defects and longer delays before treatment tended to have lower functional scores and residual weakness of the calf. The finding found are consistent with previous reports suggesting that a longer delay to reconstruction negatively affected muscle function and recovery overall.[1,2] Thus, early diagnosis and prompt surgical treatment continue to be essential for the best prognosis.

Complications encountered in the present study were few and manageable. The most common complication was mild ankle stiffness, which improved with physiotherapy. One patient developed a superficial wound infection and another patient developed wound edge necrosis. Importantly, there was no re-rupture of tendons or injury to sural nerve. Prior studies of V-Y tendon advancement have reported similar complication profiles.[6,7] In our series no re-rupture was observed thus confirming the durability and reliability of the reconstruction.

There are some limitations of the present study. First, the retrospective design allows for the possibility of selection bias. Second, the sample size was too small. Third, there was no control group treated by other reconstructive techniques such as FHL transfer or tendon grafting. Finally, the follow-up period may be too short to evaluate long-term functional outcomes and late complications.

Despite these limitations, the results of this study suggest that V-Y tendon advancement is a feasible treatment option for chronic Achilles tendon rupture. The procedure offers a reliable restoration of tendon continuity, satisfactory functional recovery and low incidence of complications. In our opinion V-Y advancement should continue to be a useful reconstructive option for chronic Achilles tendon defects of approximately 3 to 6 cm.

CONCLUSION

Chronic rupture of the Achilles tendon is a difficult problem with main challenge being tendon retraction and muscle shortening. This study showed that V-Y tendon advancement is an effective reconstructive option for such ruptures with moderate tendon defects. There was significant improvement in AOFAS and ATRS scores and patients regained the ability to heel rise and return to normal activities with low complication rate and no re-ruptures during the follow-up. It preserves the native tendon and avoids donor site complications seen in tendon

transfers. This technique is possible in resource poor settings. The study recommends the V-Y tendon advancement as the primary technique for 3-6 cm defects and calls for larger studies to validate these findings and compare against other options.

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