

Repair of Achilles tendon tear by unique hybrid technique

by RCS Khandelwal¹, Jagdish Dhake², Abhinav Jogani^{3*}, Kishore Kumar⁴

The Foot and Ankle Online Journal 13 (2): 3

Achilles tendon rupture is a debilitating injury with a protracted and sometimes incomplete recovery. The surgical method of Achilles tendon repair, like open repair with or without augmentation, has a higher complication rate like delayed tendon healing (since paratenon integrity is destroyed in open repair technique which delays or hampers the tendon healing). Wound healing problems like suture granuloma, deep infection, skin edge necrosis, superficial dehiscence, pressure ulcer, and blisters may occur. Here we developed a newer hybrid technique (open exposures of the tendon and percutaneous tenodesis through calcaneum) for Achilles tendon repair to minimize the complications and enhance the tendon healing. Excellent results were observed with this hybrid technique.

Keywords: Achilles tendon tear, Achilles rupture, watershed, tendon augmentation.

This is an Open Access article distributed under the terms of the Creative Commons Attribution License. It permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. ©The Foot and Ankle Online Journal (www.faoj.org), 2020. All rights reserved.

The Achilles tendon is the most frequently ruptured tendon in the human body [1]. The mean age of presentation is 35 years with a male:female ratio of 20:1 [2,3].

The commonest site of rupture is in a region 3 to 6 cm above the calcaneus which corresponds to a watershed region of poor vascularisation[4]. Perfusion in this region is further compromised during stretching and contraction [5,6]. With increasing age there is decreased collagen-cross linking and weakening of the tensile strength of the tendon. Maffulli, et al., [7] and Järvinen, et al., [8] histologically observed significant collagen degeneration in patients with Achilles tendon rupture. Ruptured Achilles tendons have histologically demonstrated collagen degeneration with a greater content of collagen III and less collagen I [8].

Both oral and intratendinous injection of steroids have been implicated in spontaneous tendon rupture [9]. Other risk factors for rupture of the Achilles tendon include steroid therapy, hypercholesterolemia, gout, rheumatoid arthritis, long-term dialysis, and renal transplantation [10-14].

Surgical treatment, like the open repair technique, is associated with an increased incidence of postoperative complications, such as skin-tendon adhesions, infection, delayed healing of the surgical wound, sural nerve lesion, and suture granulomas [15].

Percutaneous repair, first described by Ma and Griffith [16], seems to bridge the gap by combining the advantages of both methods [17,18]. It is associated with a lower complication rate compared to open operative repair [15] but it may be associated

1 - Professor & Head of Unit, Department of Orthopaedics, Seth GS Medical College and KEM Hospital, Mumbai, India

2 - Senior Registrar, Department of Orthopaedics, Seth GS Medical College and KEM Hospital

3 - Assistant Professor, Department of Orthopaedics, Seth GS Medical College and KEM Hospital

4 - Senior Registrar, Department of Orthopedics, Seth GS Medical College and KEM Hospital

* - Corresponding author: drabhinavdjogani@gmail.com

with a higher risk of re-rupture and sural nerve injury [19]. However, several researchers have reported the absence of re-ruptures and nerve lesions [20].

Material and methods

A consecutive series of Achilles tendon rupture in 12 patients, occurring between 2 to 4 cm proximal to the calcaneus tuberosity, were treated by a hybrid technique (open exposures of the tendon and percutaneous tenodesis through the calcaneus). In all cases, the diagnosis was based mainly on history and clinical examination (functional impairments, palpation of the gap, and the Thompson test) and confirmed by ultrasound examination and MRI. All patients were evaluated on follow-up.

Presentation

The patient typically presents with pain, inability to bear weight and a history of a clear popping sensation or sound after an episode of activity during which they sustain a forced dorsiflexion of the ankle. The injury can also be sustained during eccentric contraction. The patient frequently describes the sensation of being kicked, shot or even bitten on the back of the heel. Acute Achilles tendon rupture can readily be detected on physical examination. Plantar flexion of the foot is understandably weak [16]. The Achilles tendon is best examined with the patient kneeling and the feet hanging over the edge of the chair. In this position, soft tissues hang off the Achilles tendon like a tent ridge pole and defects can be readily visualized (Figure 1). There is frequently a visible defect in the Achilles tendon. This is accompanied by swelling due to peritendinous hematoma.

Operative technique

The patient was placed in a prone position under general, spinal or peripheral nerve block anesthesia with the knees slightly flexed and a pneumatic tourniquet placed around the proximal part of the thigh. Before starting the procedure, the rupture and the diastasis (gap) were localized. The procedure is illustrated and described in detail in Figures 2-18.



Figure 1 (patient in prone position) The left TA is ruptured. The right Achilles tendon is well defined and soft tissues hang off it like a tent. The suspension of the soft tissues off the Achilles tendon is not visible on the left side as the tendon is ruptured.

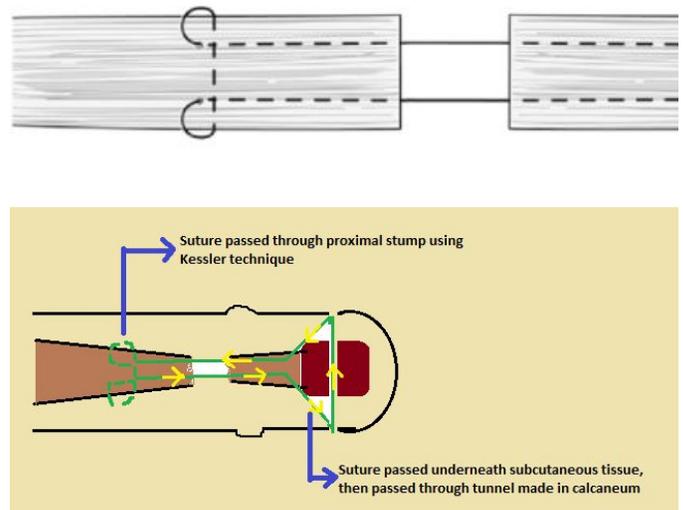


Figure 2 Schematic diagram showing Kessler suture used in our Hybrid Technique.

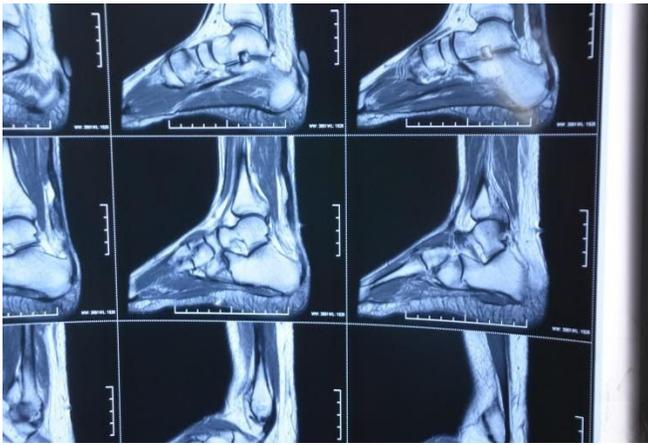


Figure 3 Preoperative MRI showing Achilles tendon tear.



Figure 4 Patient placed in prone position on table.

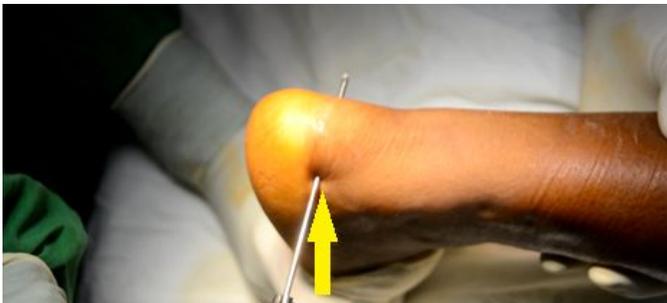


Figure 5 Tunnel made by insertion of K-wire through the calcaneum for passage of ethibond suture.



Figure 6 Preoperative incision markings along Achilles tendon with level of Achilles tendon rupture.

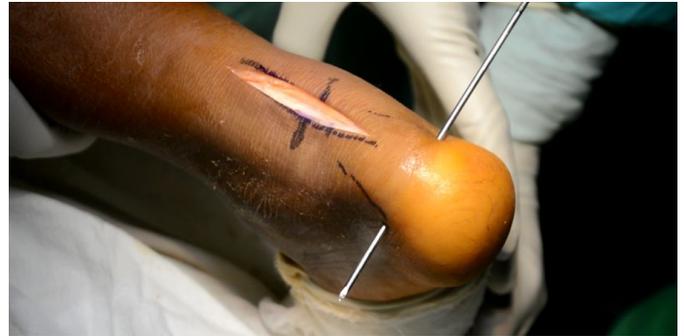


Figure 7 Skin incision over Achilles tendon in midline.

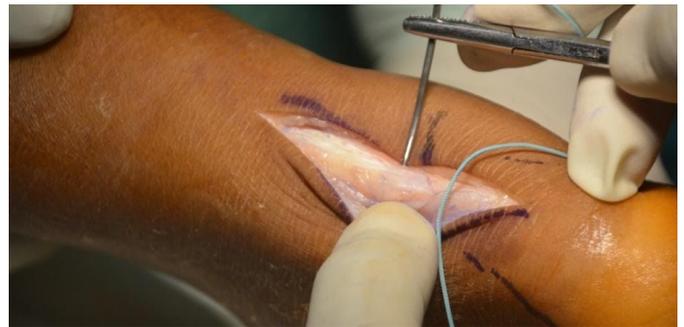


Figure 8 Ethibond suture passed through proximal tendon stump.



Figure 9 Ethibond passed vertically along the length of tendon from proximal to distal stump.

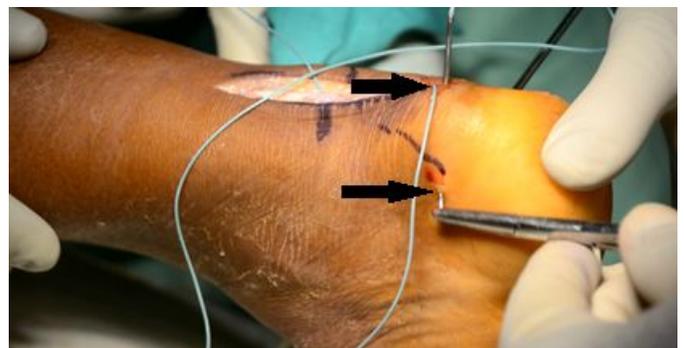


Figure 10 The Ethibond is then passed in a subcutaneous plane, taken out through the exit point of the tunnel.

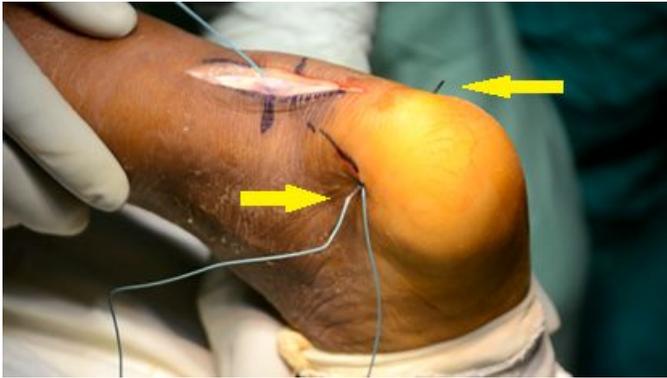


Figure 11 The Ethibond is passed through a tunnel made by K-wire in calcaneus.

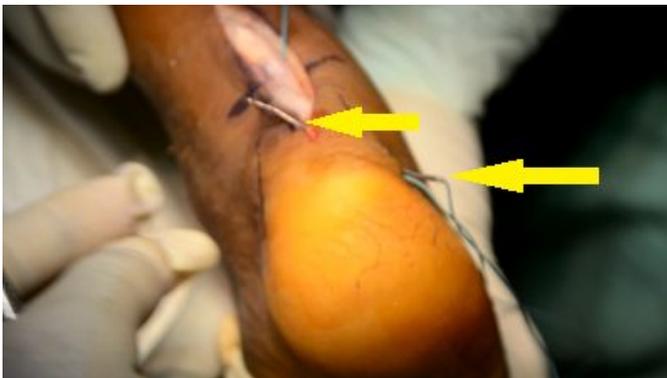


Figure 12 The Ethibond is passed in a subcutaneous plane, back into the incision site.

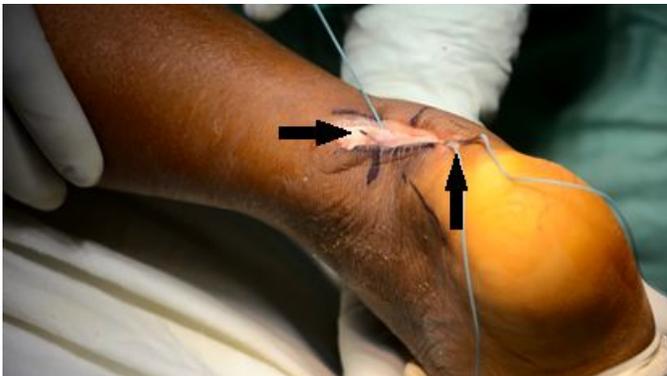


Figure 13 Ethibond passed along the length of the tendon from distal to proximal stump.



Figure 14 Final tightening of both ends of the Ethibond with foot in plantar flexion before making a knot.

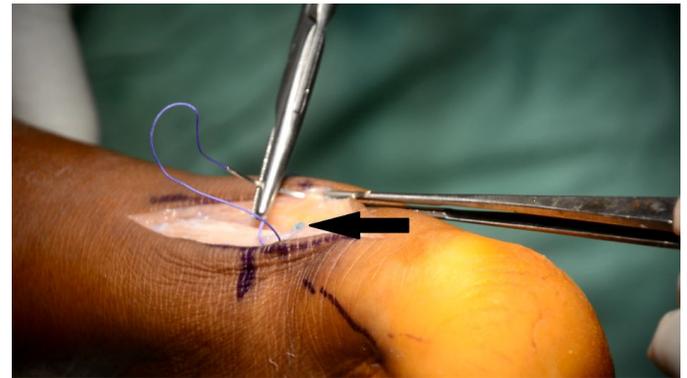


Figure 15 Arrow pointed over a knot made and buried subcutaneously with vicryl.



Figure 16 Staple wound closure.

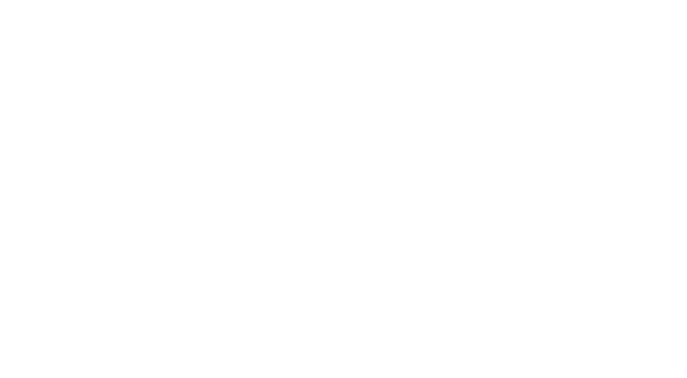




Figure 17 Postoperative follow-up after staple removal.

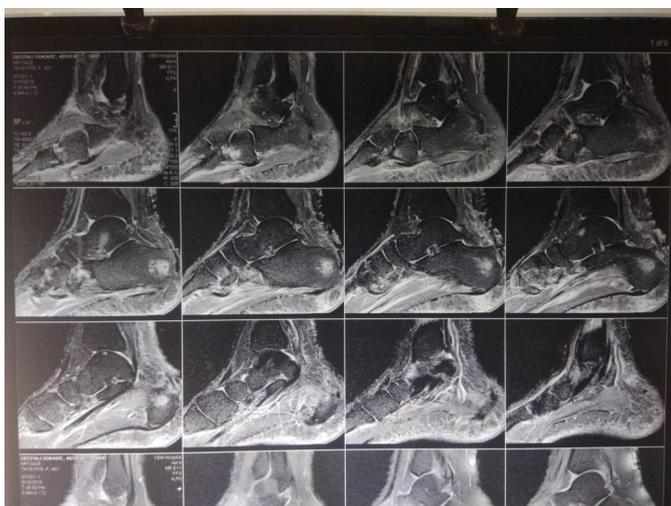


Figure 18 Postoperative MRI after two weeks.

Discussion

The choice of suture material has important implications in tendon repair. Here we demonstrated excellent tendon healing results. Adverse surgical outcomes can be avoided by selection of the suitable suture materials for appropriate indication. Risks of Achilles tendon repair with open technique with or without augmentation include:

- Excess bleeding
- Nerve damage
- Deep Infection
- Blood clot
- Wound healing problems like suture granuloma, skin edge necrosis, superficial dehiscence, pressure ulcer, blister.
- Calf weakness

Conclusion

Hybrid technique (open exposures of the tendon and percutaneous tenodesis through calcaneus) of Achilles tendon repair with single ethibond suture has obtained better results in terms of tendon width, muscle mass and strength recovery of plantar flexion and patient satisfaction. As single Ethibond suture is used for tendon repair it decreases chances of postoperative infection. significantly good results were found in terms of clinical outcomes. Better outcomes found with Achilles Tendon Rupture Score.

References

1. Maffulli N, Waterston SW, Squair J, Reaper J, Douglas AS. Changing incidence of Achilles tendon rupture in Scotland: a 15-year study. *Clin J Sport Med.* 1999;9:157–160.
2. Möller A, Astron M, Westlin N. Increasing incidence of Achilles tendon rupture. *Acta Orthop Scand.* 1996;67:479–481.
3. Leppilahti J, Puranen J, Orava S. Incidence of Achilles tendon rupture. *Acta Orthop Scand.* 1996;67:277–279.
4. Beddy P, Dunne R, de Blacam C. Achilles wiiitis. *AJR Am J Roentgenol.* 2009;192:W79.
5. Carr AJ, Norris SH. The blood supply of the calcaneal tendon. *J Bone Joint Surg Br.* 1989;71:100–101.
6. Komi PV, Fukashiro S, Järvinen M. Biomechanical loading of Achilles tendon during normal locomotion. *Clin Sports Med.* 1992;11:521–531.
7. Maffulli N, Ewen SW, Waterston SW, Reaper J, Barrass V. Tenocytes from ruptured and tendinopathic achilles tendons produce greater quantities of type III collagen than tenocytes from normal achilles tendons. An in vitro model of human tendon healing. *Am J Sports Med.* 2000;28:499–505.
8. Järvinen M, Józsa L, Kannus P, Järvinen TL, Kvist M, Leadbetter W. Histopathological findings in chronic tendon disorders. *Scand J Med Sci Sports.* 1997;7:86–95.
9. Newnham DM, Douglas JG, Legge JS, Friend JA. Achilles tendon rupture: an underrated complication of corticosteroid treatment. *Thorax.* 1991;46:853–854.
10. Lee WT, Collins JF. Ciprofloxacin associated bilateral achilles tendon rupture. *Aust N Z J Med.* 1992;22:500.
11. Poon CC, Sundaram NA. Spontaneous bilateral Achilles tendon rupture associated with ciprofloxacin. *Med J Aust.* 1997;166:665.
12. McGarvey WC, Singh D, Trevino SG. Partial Achilles tendon ruptures associated with fluoroquinolone antibiotics: a case report and literature review. *Foot Ankle Int.* 1996;17:496–498.
13. Donck JB, Segaert MF, Vanrenterghem YF. Fluoroquinolones and Achilles tendinopathy in renal transplant recipients. *Transplantation.* 1994;58:736–737.
14. West MB, Gow P. Ciprofloxacin, bilateral Achilles tendonitis and unilateral tendon rupture--a case report. *N Z Med J.* 1998;111:18–19.

15. Chiodo CP, Wilson MG. Current concepts review: acute ruptures of the achilles tendon. *Foot ankle Int* [Internet] 2016 Sep 27;27(4):305–313.
16. Ma GW, Griffith TG. Percutaneous repair of acute closed ruptured achilles tendon: a new technique. *Clin Orthop Relat Res* [Internet] 2016. Sep 27, pp. 247–255.
17. Maffulli N, Longo UG, Oliva F, Ronga M, Denaro V. Minimally Invasive Surgery of the Achilles Tendon. *Orthop Clin North Am* [Internet] 2017 Jul 15;40(4):491–498. 2009.
18. McClelland D, Maffulli N. Percutaneous repair of ruptured Achilles tendon. *J R Coll Surg Edinb* [Internet] 2017 Jul 15;47(4):613–618.
19. Wong J, Barrass V, Maffulli N. Quantitative review of operative and nonoperative management of achilles tendon ruptures. *Am J Sports Med* [Internet] 2016 Sep 27;30(4):565–575.
20. Hockenbury RT, Johns JC. A biomechanical in vitro comparison of open versus percutaneous repair of tendon Achilles. *Foot Ankle* [Internet] 2016 Sep 27;11(2):67–72.