TENDO ACHILLES RUPTURES: AN OVERVIEW

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Although Ambrose Pare first described the Achilles tendon rupture in 1575, there is still lively debate concerning this injury and particularly its management. Podiatric and orthopedic literature describe contain many reports detailing the efficacy of all modalities from imaging of the suspected rupture, to surgical techniques of repair and rehabilitation. Our intent is to provide a brief overview and summary of the current concepts and techniques in the management of Achilles tendon ruptures.

The typical patient is the 30 - 50 year old male weekend athlete suffering the injury after abnormally strenuous exercise. Rupture is most commonly believed to be in response to chronic collagenous microtrauma and degeneration coupled with questionable blood supply in a critical region of the tendon. Excessive mechanical stress such as sudden rapid dorsiflexion of the ankle or abrupt dorsiflexion of the plantarflexed foot is usually the inciting event. Direct insult or acute laceration may occur but are less frequent. Corticosteroid therapy, either as a local injection for chronic tendonitis or systemically for treatment of connective tissue disorders like systemic lupus erythematosus are contributing factors as well.[1] The most common site of rupture is 2 - 6 centimeters proximal to the calcaneal insertion where a purported zone of diminished vascularity exists. Microangiographic studies and radiosodium clearance rates have documented nutritional loss and a decrease in blood supply to this area of the tendon, particularly after the third decade of life.[2,3] Rupture may occur more proximally at the myotendinous junction in younger patients or more distally at the calcaneal insertion in later life.[4,5]

Diagnosis of the Achilles tendon rupture is usually made by a complete history and physical with description of the injury. There may have been a premonitory period of aches and pains in the region of the heel. An inability to raise the heel from the ground, a palpable defect posteriorly, or a positive Thompson and Doherty "squeeze" test aid in making the diagnosis.[6] Active plantarflexion by the long flexors and peroneals and organized hematoma at the rupture site may be misleading and present a more difficult diagnostic challenge, especially in the delayed injury or partial tear.

Imaging modalities used as adjunctive procedures range from plain films, CT and ultrasound to magnetic resonance. Plain lateral radiographs may be helpful when the fatty filled posterior triangle bounded by the margins of the Achilles tendon, the calcaneus and the deep flexors as described by Kager loses its uniformity indicating a rupture.[7] Real time ultrasonography may be useful but is limited in field of view, does not image the entire ankle and is operator dependent.[8] CT imaging is restricted to the axial plane and gives inferior anatomic information to MRI. Magnetic resonance supplements the physical exam in precisely diagnosing tendo Achilles injuries. Pain, swelling and hematoma may impede deep palpation and MRI can offer detailed anatomic insight as to the size of the gap that is present and orientation of fibers, thereby aiding preoperative planning. MRI is generally not needed to establish the diagnosis of Achilles tendon ruptures but certainly has a role in the

evaluation of clinically equivocal tears and as a research and documentation tool.

Various authors have attempted to classify the injury pattern of the Achilles tendon in an effort to create guidelines for repair. Kuwada presents a thoughtful approach categorizing ruptures by the width of defect. Type I is a partial tear while type II is a complete tear with a defect of less than 3 centimeters. Type III injuries measure 3 - 6 centimeters and in type IV the defect is greater than 6 centimeters.[9] Repair options are further classified into end to end anastomosis and operative use of autogenous tendon or fascial grafting. Synthetic materials for interpositional grafting and gastrocnemius recessions may be needed to increase length of available tendon to close some defects.[10,11] Kuwada further recommends that type I injuries be treated conservatively if less than 50% of the tendon is involved. Type II ruptures will normally do well with end to end repair. Type III may require end to end anastomosis in combination with synthetic or autogenous grafting and type IV injuries necessitate gastrocnemius recessions coupled with grafting and end to end suturing. Autogenous grafting makes use most commonly of the plantaris and peroneus brevis tendon.[12] Synthetic grafts in use include carbon fiber composites, Dacron vascular materials and Marlex mesh offering the combination of strength and scaffolding for soft tissue ingrowth.[4]

The most controversial area concerning tendo Achilles ruptures remains. What is the optimal treatment; closed nonsurgical versus open versus percutaneous repairs? Nonsurgical advocates site the incidence of surgical complications such as sural nerve entrapment, wound infection and skin slough as drawbacks to open repair. Conversely, a significant complication of closed treatments is a re-rupture rate variably reported between 1% and 30%, elongation of the tendon and plantarflexion weakness as quantified on a Cybex dynanometer[13,14,15] Carlstedt et al. however found no consistent difference in biomechanical parameters (strength, stiffness, and energy uptake) or in tendon elongation between those surgically treated compared to immobilization alone during in vivo studies on rabbits.[16] Percutaneous repair was proposed to avoid the potential wound complications of open surgery while diminishing the re-rupture rate of conservative treatment. Biomechanical in vitro tests have shown percutaneous techniques to result in repairs 50% weaker than end to end procedures and still carry a substantial risk of sural neuropathy due to the technique being relatively blind.[17,18]

Technique, perioperative management of the patient and understanding of potential complications have improved since the early literature comparisons warning of the risks of surgical treatment. Recently, even authors that propose conservative treatment acknowledge the majority of surgical complications tend to be minor and not affect the final outcome.[19] Cost considerations between surgical and nonsurgical treatment must include not only the hospital expenses of the procedure but also the cost of re-rupture treatment should that occur when the injury is managed by immobilization alone. The optimal treatment for Achilles tendon ruptures is most likely patient specific. It is based on interplay between the severity of he injury, the functional requirements and expectations of the patient and the abilities and experience of the practitioner.

CLINICALLY ILLUSTRATED

SURGICAL REPAIR OF ACHILLES RUPTURE

Fig. 1. Palpable defect of the main body of the Achilles Tendon.

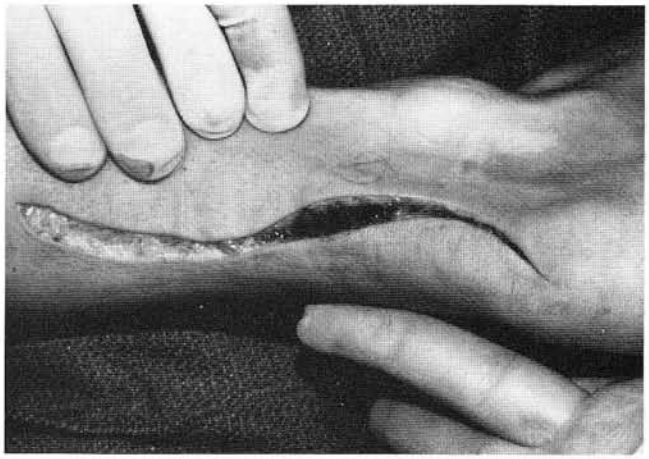

Fig. 2. Curvo-linear longitudinal incision placed over the extent of the Achilles Tendon.

Fig. 3. Sub-cutaneous dissection demonstrating the Sural Nerve and Lesser Saphenous Vein.

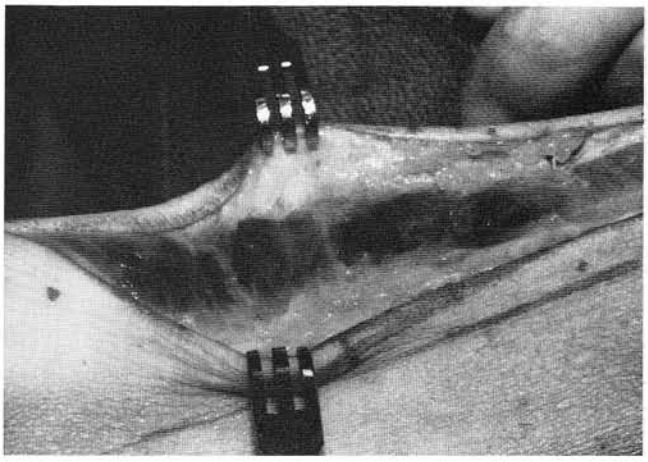

Fig. 4. Exposure of the deep fascia with tendon rupture visualized beneath the intact paratendinous layer.

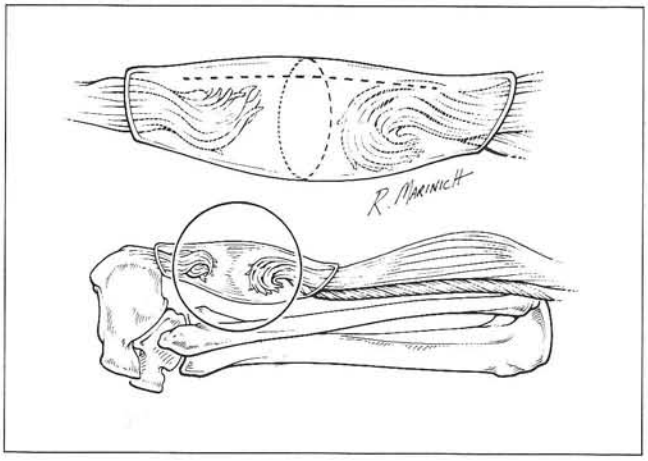

Fig. 5. (Top) Ruptured tendon contained within the intact peritendinous layer. (Bottom) "Mop-end" configuration of tendon ends with planned incision of the peritendinous layer.

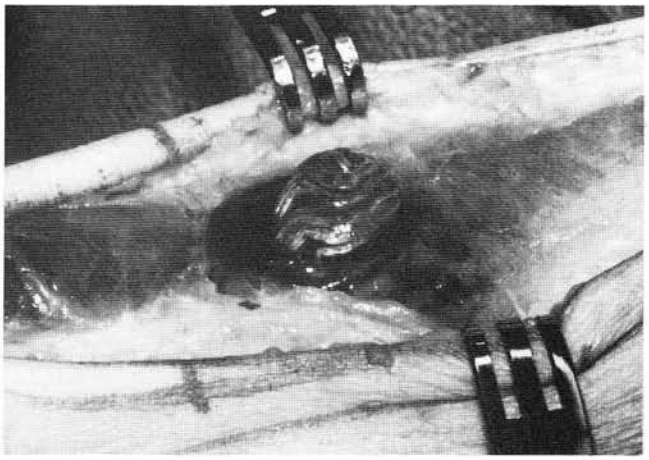

Fig. 6. Initial penetration of deep fascia and paratenon with extrusion of tendon rupture.

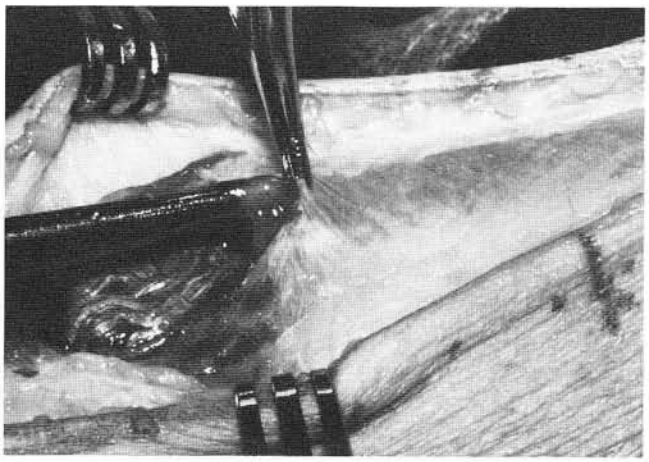

Fig. 7. Separation of deep fascia and paratenon.

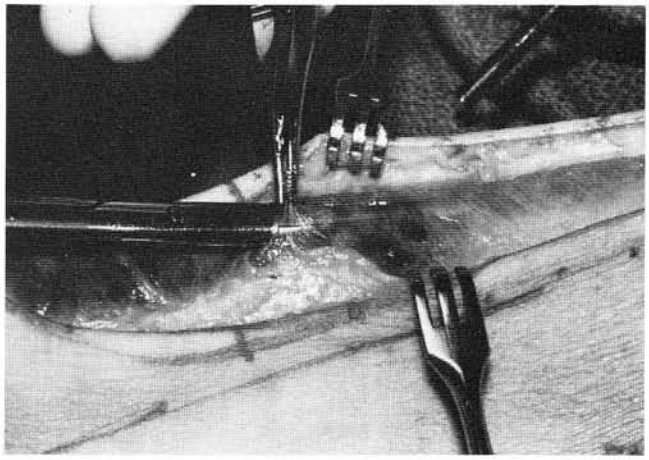

Fig. 8. Isolation of the deep fascial layer.

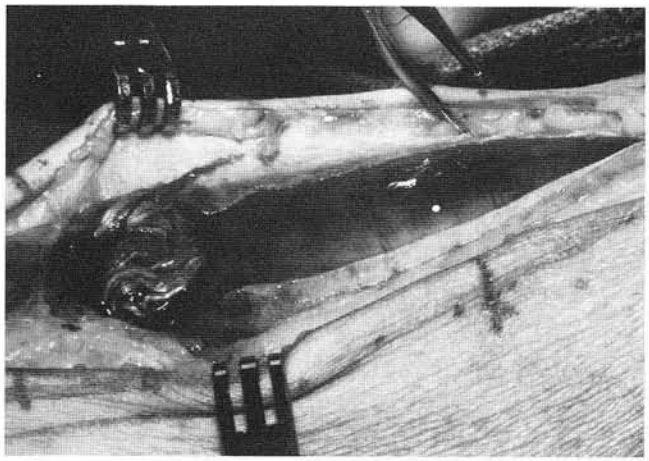

Fig. 9. Full incision of the proximal section of the deep fascia with exposure of the hemorrhagic and engorged paratenon.

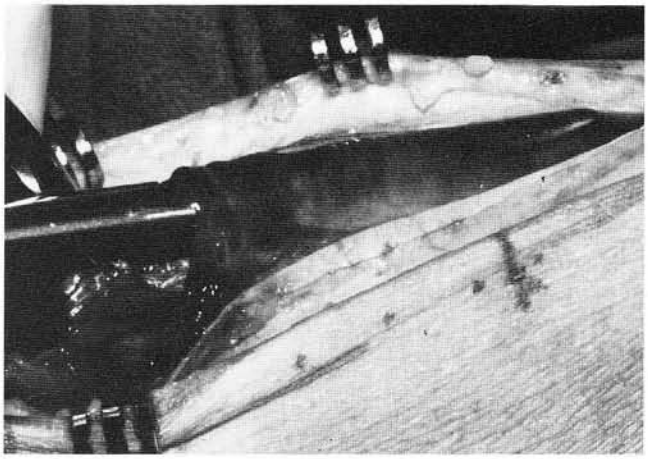

Fig. 10. Separation of the paratenon.

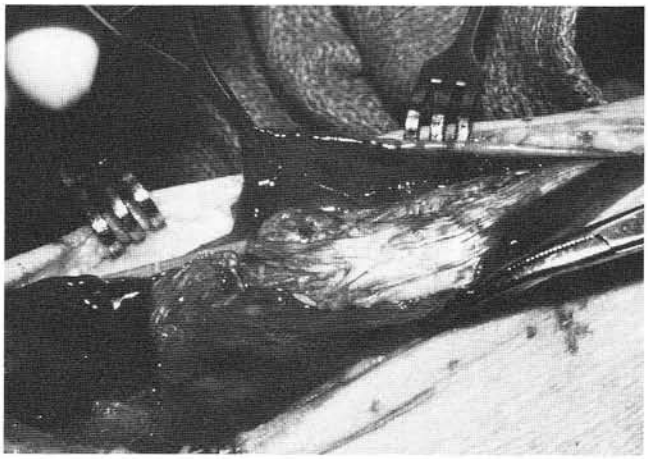

Fig. 11. Incision and reflection of the paratenon from the proximal segment of the tendon rupture.

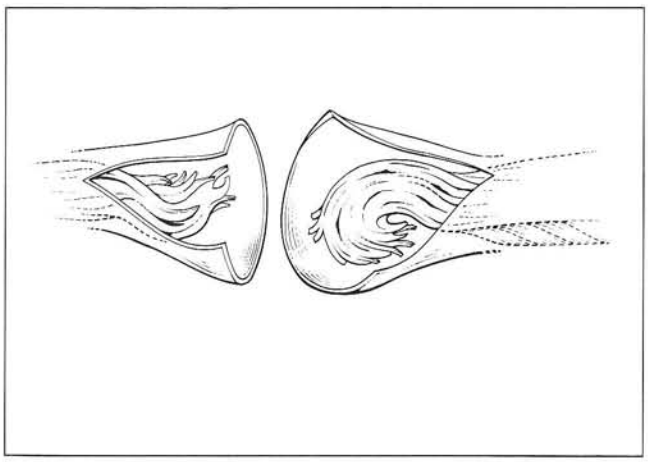

Fig. 12. Reflection of the paratenon and exposure of the "mop-end" segments of the tendon rupture.

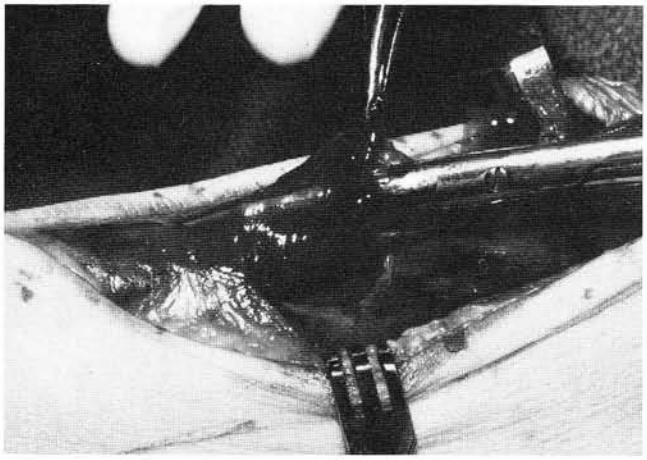

Fig. 13. Incision of the paratenon over the distal portion of the Achilles tendon.

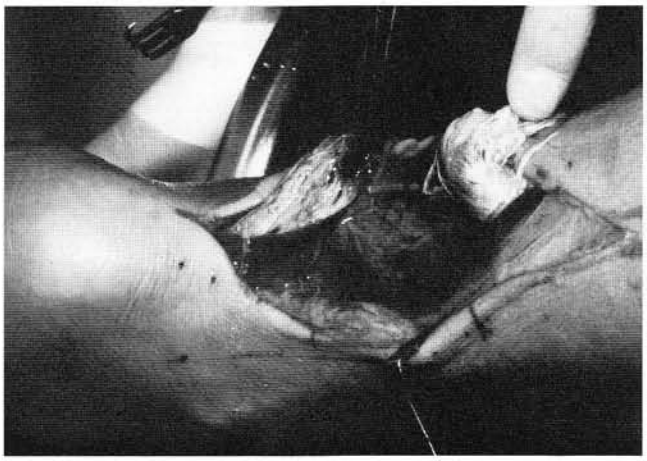

Fig. 14. Exposure of the terminal ends of the tendon rupture.

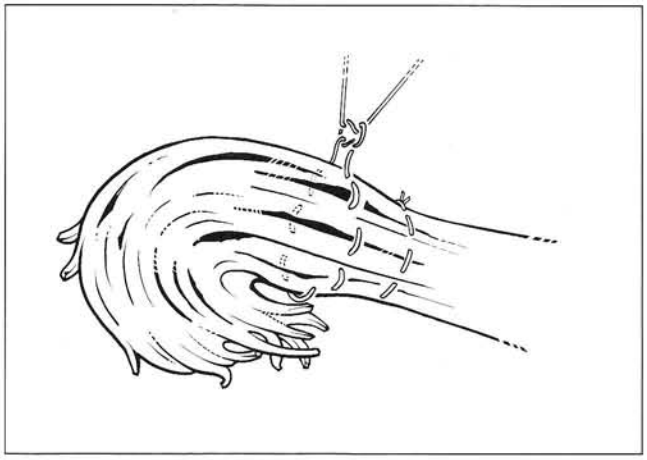

Fig. 15. "Purse string" suture technique to coalesce frayed terminal fibers of the tendon rupture.

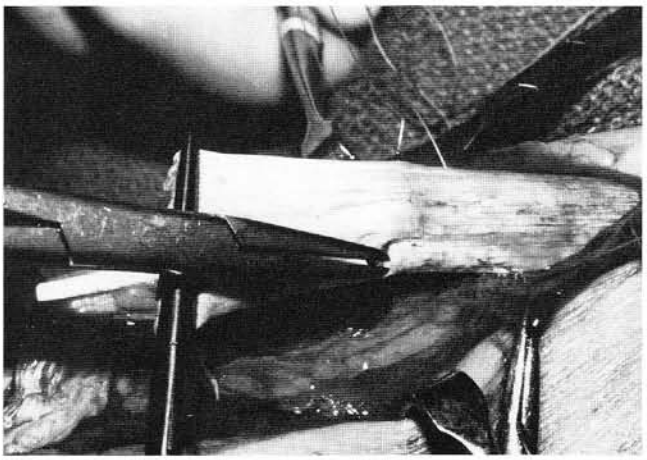

Fig. 16. Clinical gathering of the frayed end of the proximal segment of the tendon rupture.

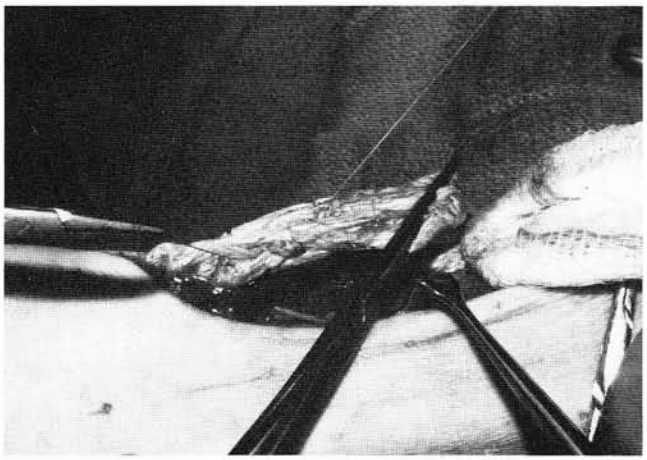

Fig. 17. "Purse string" repair of the distal segment of the ruptured Achilles Tendon.

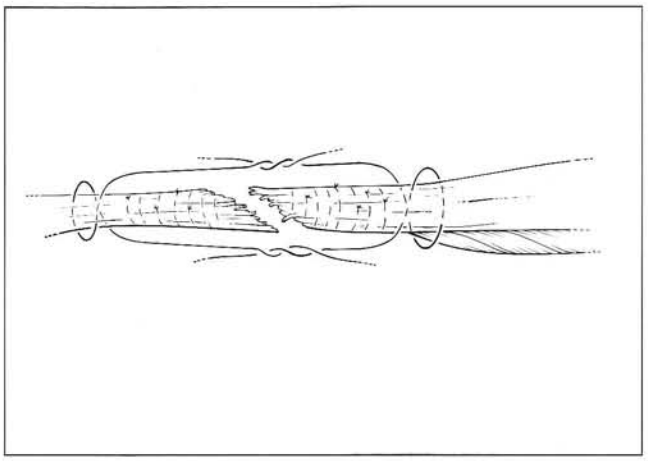

Fig. 18. Retention suture technique.

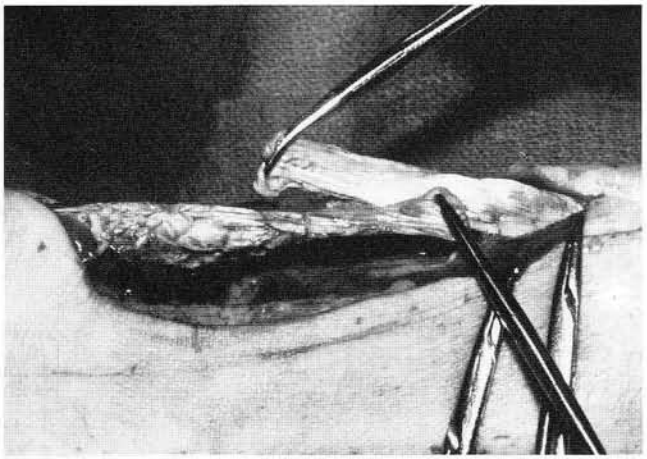

Fig. 19. Apposition of tendon ends under "physiologic tension".

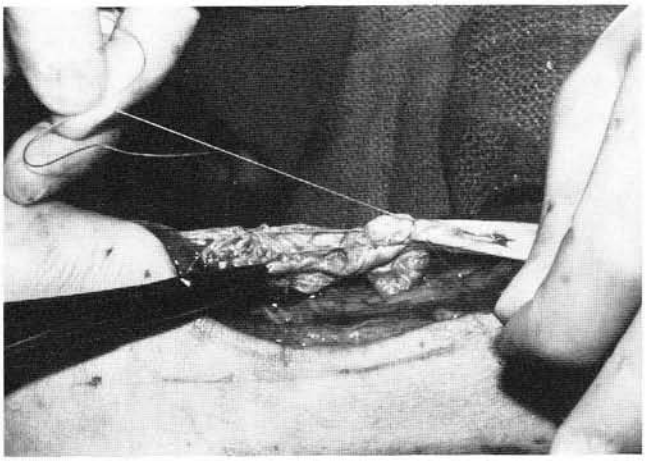

Fig. 20. Suture reinforcement of tendon repair.

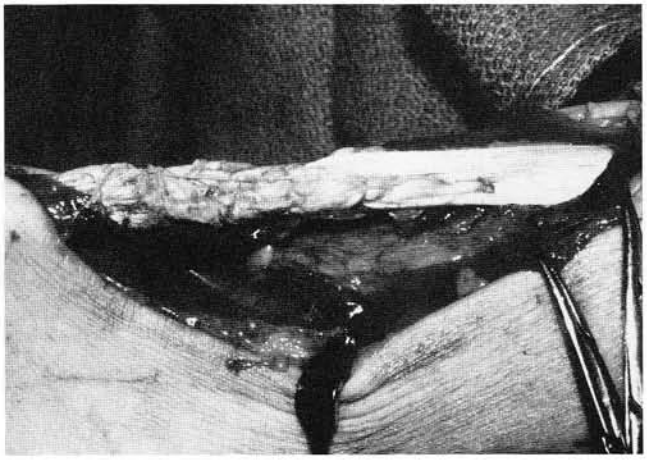

Fig. 21. Completed repair of tendon rupture.

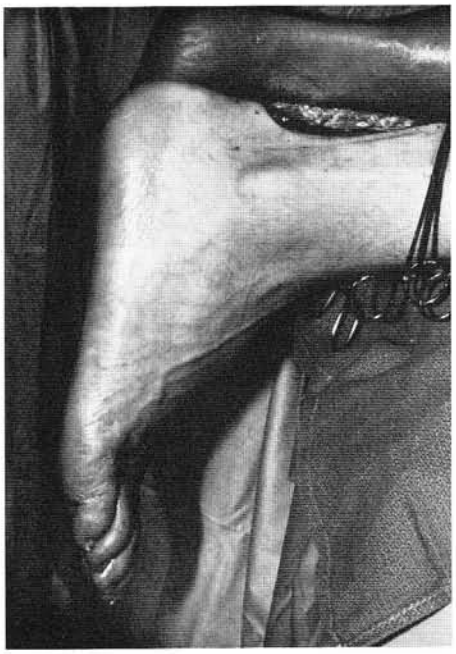

Fig. 22. Tendon repair completed with "physiologic tension" confirmed by comparison to the contra-lateral extremity.

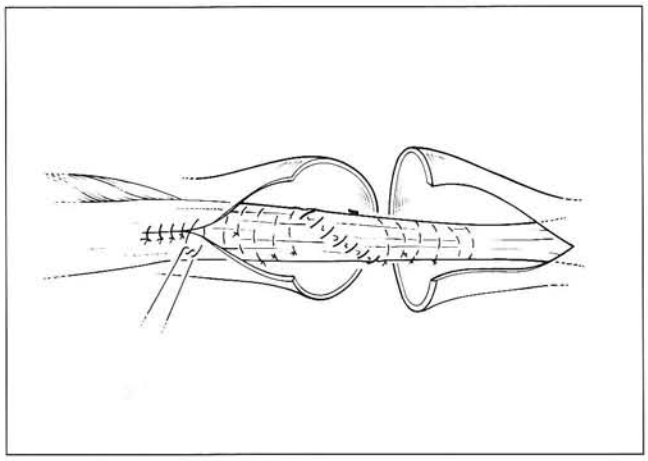

Fig. 23. Side-to-Side repair of the Achilles Tendon with initial closure of the paratenon "sleeve".

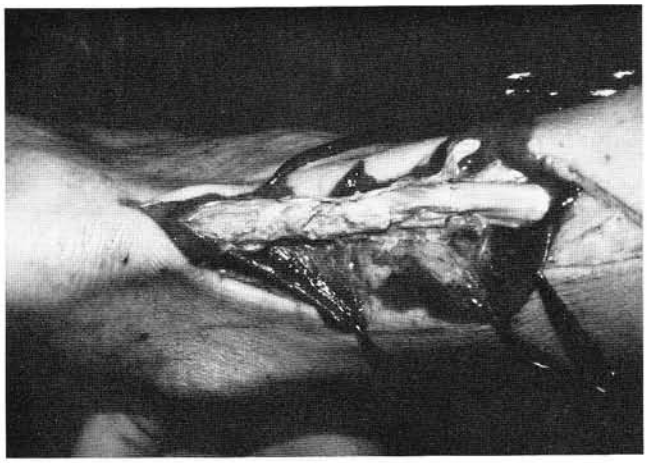

Fig. 24. Identification of paratenon layer for closure.

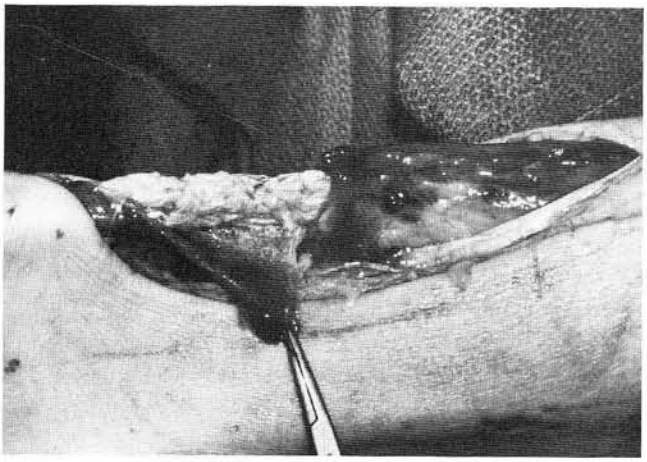

Fig. 25. Closure of proximal portion of the paratenon sleeve.

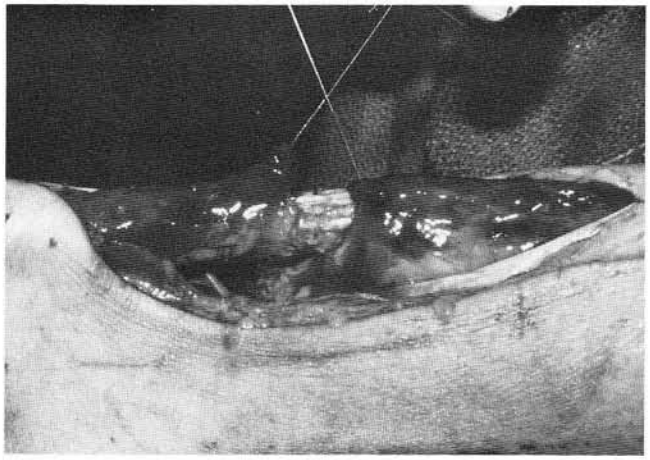

Fig. 26. Closure and apposition of distal portion of the paratenon tube.

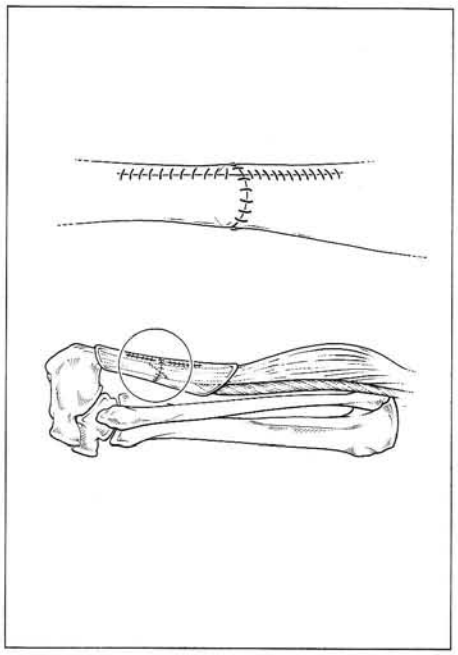

Fig. 27. Anastomosis of proximal and distal segments of the paratenon sleeve.

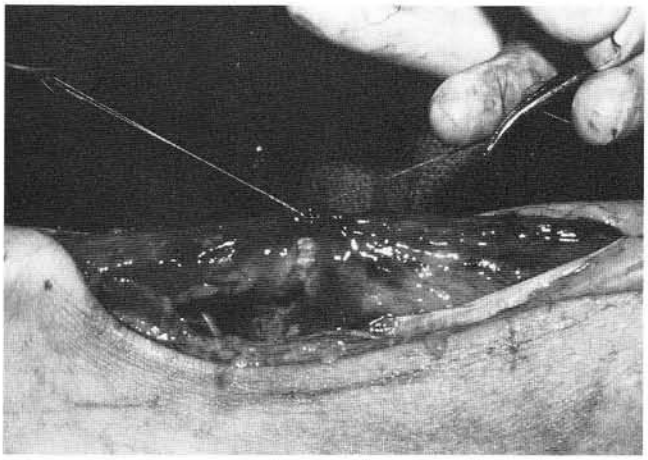

Fig. 28. Apposition of proximal and distal ends of the peritendinous layer.

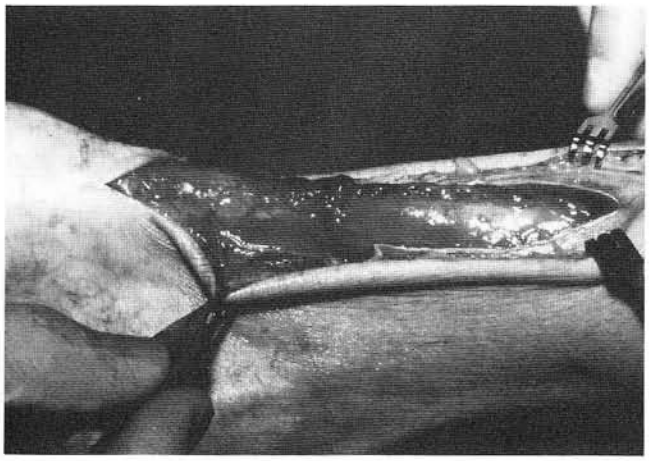

Fig. 29. Completed closure of the peritendinous layer over the repaired rupture of the Achilles Tendon.

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