



An Alternative Bundle-to-Bundle Suturing Technique for Repairing Fresh Achilles Tendon Rupture



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ABSTRACT

The main concern about conventional Achilles tendon repair surgical techniques is how to maintain the initial strength of the ruptured Achilles tendon through complicated suturing methods. The primary surgical problem lies in the properties of the soft tissue; the deterioration of the Achilles tendon, especially in its elasticity; and the surface lubricity of the local tissues. In the present study, we describe an innovative bundle-to-bundle suturing method that addresses these potential problems.

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The increase in sports participation has led to an increase in the frequency of ruptured Achilles tendons, the incidence of which is now 18 per 100,000 people (1). This injury typically occurs in males aged 30 to 50 years. More than 60 surgical techniques have been described for repairing a ruptured Achilles tendon (2). The techniques established by Kessler, Bunnell, Lange, and Kirchmeyer are common and often performed (3,4). However, no consensus has been reached regarding the best performing technique or suture material with respect to different postoperative outcomes (5). The primary problem with the surgical repair of Achilles tendon rupture lies in the properties of the soft tissue of the injury (5–7). Disrupting the thin, soft tissue envelope and hypovascularity of the injury site can lead to problems with healing (8). Large-diameter sutures placed to hold the anastomosed ends together can add a bulk that can also lead to healing problems (4,9). We used a technique for anatomically reconstructing the tendon and still protecting the soft tissue envelop, preserving its hypovascularity. We describe this innovative approach to the repair of the Achilles tendon in the present study.

Surgical Technique

The principle behind surgical repair of the Achilles tendon is to restore the integrity of the tendon bundles by way of side-to-side

suture of the disrupted tendon fascicles (Fig. 1). Preoperative magnetic resonance imaging is used to determine the tendon structure, distance between the avulsed ends, and distance from the rupture site to the insertion on the calcaneus and any associated pathologic features (Fig. 2). The specific pattern of rupture at the ruptured ends of Achilles tendon could be considered a contraindication to the procedure. If the fascicular bundles are not substantially disrupted, bulk end-to-end reapproximation, with or without augmentation, might be more suitable than side-to-side fascicular reapproximation.

With the patient under general or spinal anesthesia, the patient is placed in the prone position. Once hemostasis has been achieved with an ipsilateral, pneumatic thigh tourniquet, a longitudinal 6- to 8-cm skin incision is placed over the rupture 1 cm medial to the Achilles tendon. Dissection is then carried directly down through the deep fascia to the Achilles paratenon, and a full-thickness flap is created by dissecting between the Achilles tendon and the paratenon. Once the fascia is opened, the rupture of the tendon and synovial tendon sheath (vagina synovialis tendinis) can be identified. Both ends of the avulsed tendon are then exposed, and the tendon bundles are carefully uncurled and rearranged (Fig. 3). The ankle is then positioned in equinus, after which simple interrupted sutures with 4-0 nonabsorbable material are placed at the proximal and distal portions of the adjacent avulsed, fascicular bundles of the tendon (Fig. 3). From the ventral to the dorsal layer, the ruptured tendon bundles are sutured in sequential order from 1 side to the other (Fig. 3). To further reinforce the repair and ensure the reliability of the reapproximation and only if the avulsed bundle of the tendon is long (>3 to 4 cm), an additional suture can be placed in the middle of the bundle. We confirm the desired tension of the repair by flexing both the patient's knees and comparing the resting tension of

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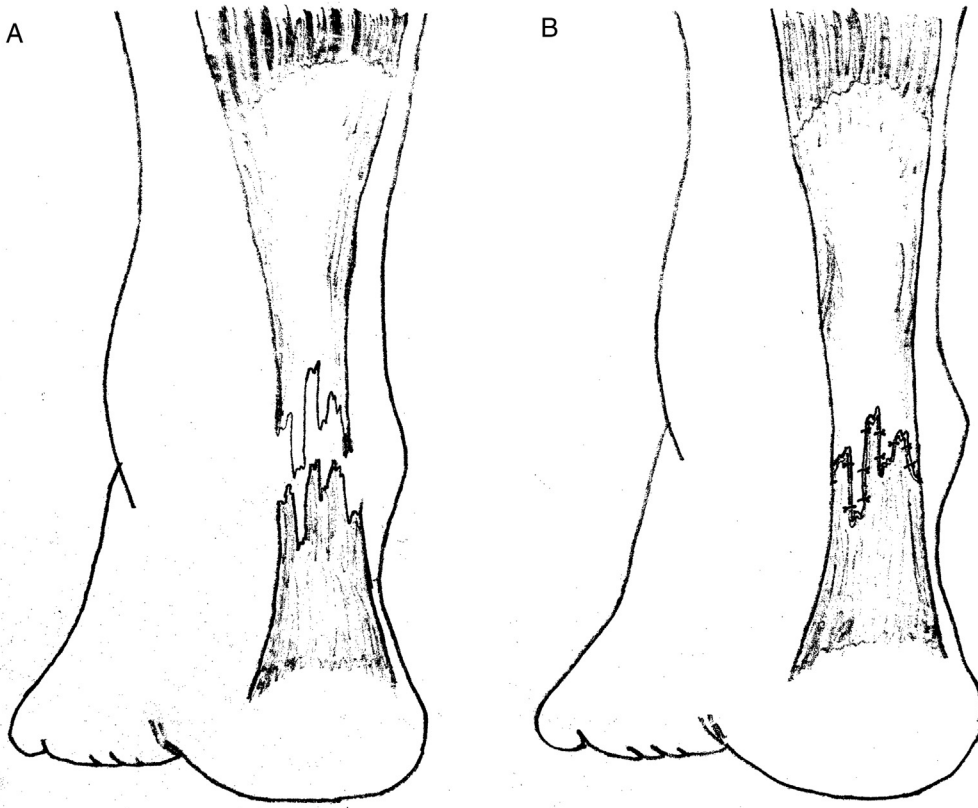


Fig. 1. (A) Schematic diagrams showing ruptured Achilles tendons. (B) The ruptured tendons were lined up and sutured using the bundle-to-bundle technique.

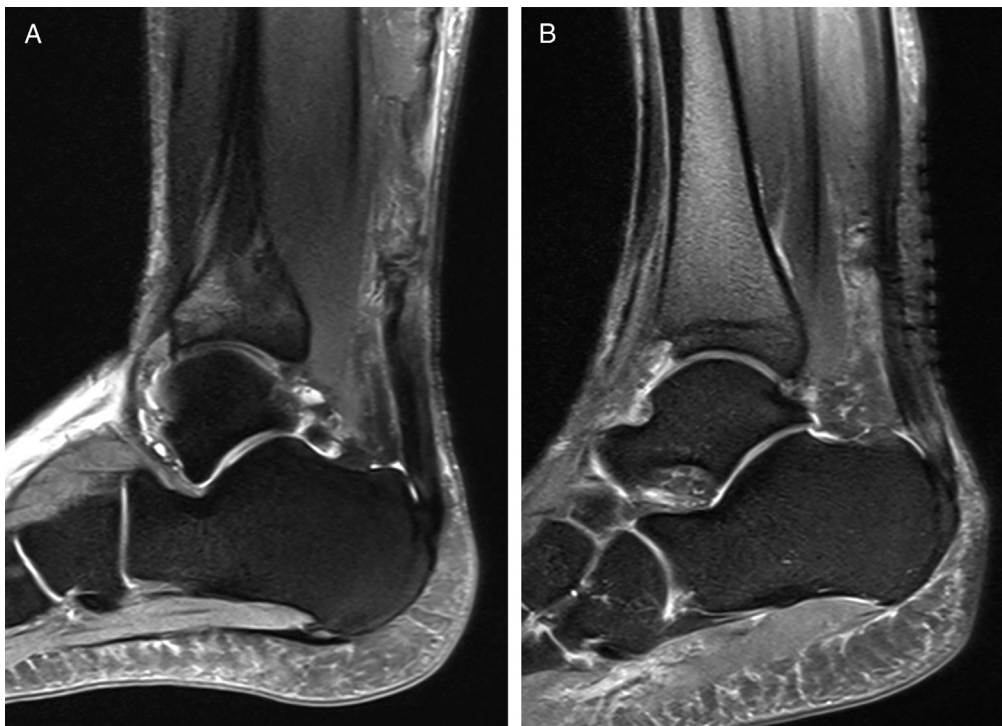


Fig. 2. The left ankle of a 31-year-old male with a ruptured Achilles tendon sustained while playing badminton. (A) Preoperatively, the tendon fibers were curled into round masses at both ruptured ends. (B) Postoperatively, the tendon fibers were lined up and rearranged without bulk at the ruptured ends.

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