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Evaluation of the effectiveness of V-Y plasty of frozen Achilles tendon rupture, with immediate follow-up weight-bearing and rehabilitation. Case analysis

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Abstract

The Achilles tendon is a strong tendon in the human body but is prone to rupture, especially during recreational activities. Misdiagnosis of ruptures can lead to chronic issues, affecting the quality of life. Surgical V-Y plasty is a technique used to treat chronic Achilles tendon ruptures by lengthening the tendon and restoring its continuity.

Two cases of Achilles tendon ruptures were presented, where V-Y plasty was performed along with immediate weight-bearing and rehabilitation. The patients showed significant improvement post-surgery, with no symptoms or restrictions on physical activity after about 6 months. The rehabilitation protocol included functional training, regenerative treatments, and follow-up visits to monitor progress.

Studies have shown that surgical treatment is more effective in preventing re-tears compared to conservative treatment for Achilles tendon ruptures. V-Y plasty has been proven to be an effective technique for treating chronic ruptures with large defects in tendon continuity. Immediate weight-bearing and rehabilitation post-surgery have shown positive outcomes in patient recovery.

Further research is needed to establish a standardized rehabilitation protocol for Achilles tendon ruptures. The unique management regimen used in the cases presented yielded successful results, emphasizing the importance of immediate rehabilitation post-surgery for

improved patient outcomes. V-Y plasty with immediate weight-bearing and rehabilitation is a promising method for treating chronic Achilles tendon ruptures.

Key words: Achilles tendon, human body, ankle joint, knee joint, Chronic Achilles tendon rupture.

1. Introduction

The Achilles tendon is the most durable, mechanically strongest tendon of the human body. It is formed by the tendon of the gastrocnemius and sheath muscles, its attachment is on the calcaneal tuberosity. The Achilles is flat and wide, covering the lower part of the shin. It is poorly supplied with blood, the amount of blood required to nourish the tendon comes from the posterior tibial artery and the fibular artery.[1]

From a biomechanical point of view, the Achilles tendon is the main flexor of the ankle joint (the gastrocnemius muscle is a two-joint muscle in addition to sole flexion of the foot, it additionally assists in flexing the knee joint, while the patellar muscle only acts on the ankle joint).[2] Despite its resilience, the Achilles tendon is the most commonly subject to rupture, the weakest point being located between 2 - 6 cm above the calcaneal tuberosity.[3] The majority of ruptures (approximately 75%) occur during recreational activities, more often in men between 30-40 years of age, particularly while playing soccer, tennis, basketball due to overloading. However, 25% of ruptures can occur in patients with a sedentary lifestyle.[4] Although injuries to the Achilles tendon are common and generally not too difficult for an experienced clinician to diagnose, up to about 20% of acute ruptures are misdiagnosed, leading to stagnant ruptures. [5]

Chronic Achilles tendon rupture is the term used for ruptures that last for 4-6 weeks after the injury, due to misdiagnosis or ineffective treatment. [6] Symptoms of chronic rupture include chronic pain, chroma, and weakness of the calf muscles and inability to raise the foot, making it impossible to climb on the toes. These definitely worsen the quality of life of patients. Overlooked rupture of the Achilles tendon (for example, in ankle sprain injuries or ankle fractures of the lower leg) leads to shrinkage of the muscle belly and distancing of the

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[1] Bochenek A, Reicher M. (2012). Anatomy of man, Volume 1, Wydawnictwo Lekarskie PZWZ, Warsaw.
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[6] Maffulli N, Via A, & Oliva F. (2017). Suppl 4, M6: chronic Achilles tendon rupture. The Open Orthopaedics Journal, 11, 660. https://doi.org/10.2174/1874325001711010660

tendon stumps from each other.[7] To obtain the appropriate length of the tendon, the surgeon performs its lengthening with the "V-Y" technique performed above its rupture. To do this, he incises the tendon in a "V" shape, then moves the ends away from each other and sutures the tendon so that the edges of the wound take on a "Y" shape.

In our work, we would like to present two cases of treating frozen ruptures of the Achilles tendon, using the surgical V-Y technique and the implementation of immediate rehabilitation and weight-bearing.

2. Case descriptions

1. The patient, 44 years old, reported to the Ortho Med Sport Clinic on 03/09/2019 due to severe pain in the Achilles tendon. From the interview, it turned out that the patient in 04.2019 at another center underwent surgery to remove the Haglund's growth, after which a plaster splint was placed. In June 2019, the patient felt severe pain, after which she went for a follow-up visit to the doctor performing the procedure. After an ultrasound was performed, it was found that the Achilles tendon had completely ruptured. Conservative treatment was ordered, including, among other things, a series of corticosteroid injections. Surgical treatment was refused. The applied treatment for 3 months brought no improvement. The pain worsened, the patient was unable to put weight on this limb, to walk without crutches, nevertheless the patient was assured that this was a normal condition. In September, during a visit to Ortho Med Sport, the patient was examined physically and by ultrasound, finding: inability to stand on tiptoe, positive Thompson's sign, palpable defect in the course of the tendon, abolition of sole flexion of the foot. The patient was diagnosed with a complete rupture of the Achilles tendon. The patient was qualified to undergo surgical V-Y plication of the Achilles tendon. After making an incision from the medial side, a complete rupture of the tendon was found. The presence of numerous deposits was noted, the occurrence of which is associated with frequent GKS injections. The deposits were scraped off, and the tissues were mobilized. V-Y plication was performed. The continuity of the tendon was restored. The tendon sheath was sutured. A dressing was applied, immobilization in a Walker type shoe in a horse stance with heels and compression underwear. From the first hour after surgery, the wound area was cooled using a Game Ready device.

[7] Lin Y, Duan X & Yang L. (2019). V-Y tendon plasty for reconstruction of chronic Achilles tendon rupture: a medium-term and long-term follow-up. Orthopaedic Surgery, 11(1), 109-116. https://doi.org/10.1111/os.12429

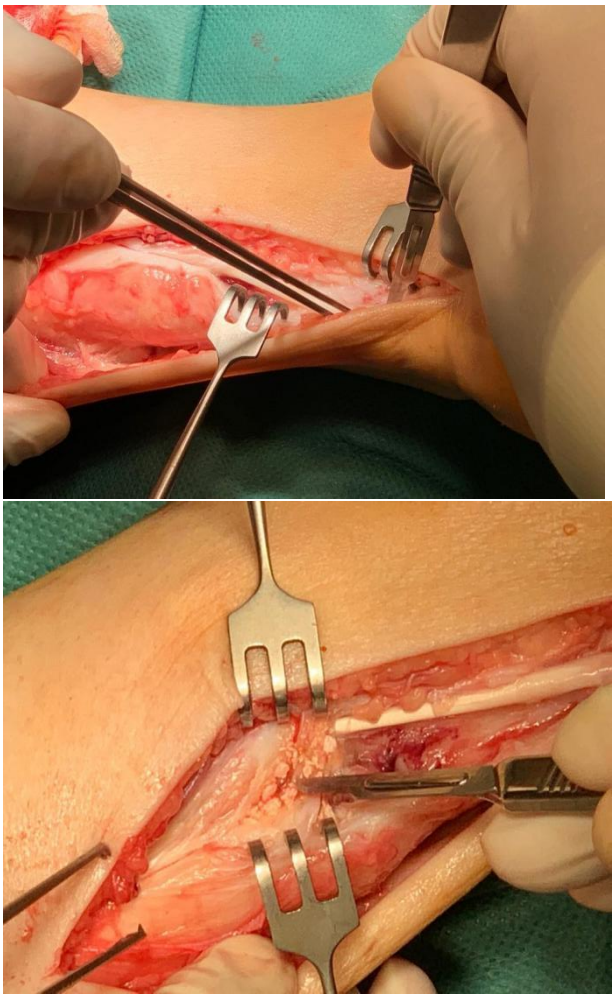

Fig. 1. 1- Making a medial incision, 2- visible steroid deposits.

Fig. 2. Removed steroid deposit.

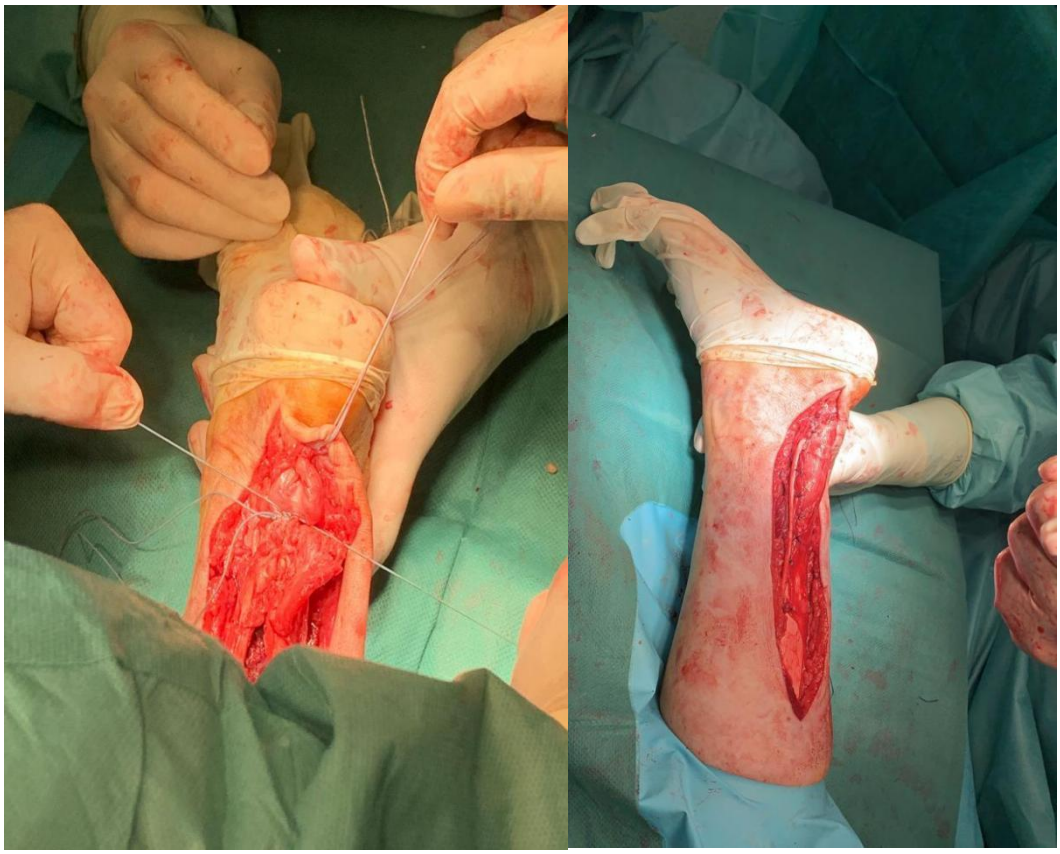

Fig. 3. Subsequent stages of the procedure, restoration of tendon continuity.

2. The patient, 43 years old, reported to Ortho Med Sport on 29/06/2018 due to failure of surgical treatment of Achilles rupture at another center. The patient was provided with a plaster bandage at the time of admission. Physical examination revealed inability to stand on tiptoe, positive Thompson's sign, palpable swelling and hematoma in the tendon area, and weakness of sole flexion of the foot. The patient reported severe pain occurring both during exercise and at rest. A revision surgery was recommended, also using the V-Y technique. The surgery took place on 02.07.2018. The incision was made on the medial side of the tendon. The tendon suture scar was reached, there a bundle of bridging threads was encountered, which were improperly attached, not bringing the stumps of the tendon together. The Achilles tendon was found to be completely ruptured/unhealed, with a 12 cm gap between the stumps. The tissues were cleaned and mobilized. The stumps of the tendon were scarred. Surgical sutures left over from the primary plication were removed. The wound was flushed out. V-Y plasty was performed. In addition, modeling bridging sutures were placed at the site of the tear, and the continuity of the tendon was restored. The tendon sheath was then sutured. A sterile, compressive dressing was then applied. Immobilization in a Walker-type

shoe in a horse stance with heel pads and compression underwear was applied. From the first hour after surgery, the wound area was cooled using a Game Ready device.

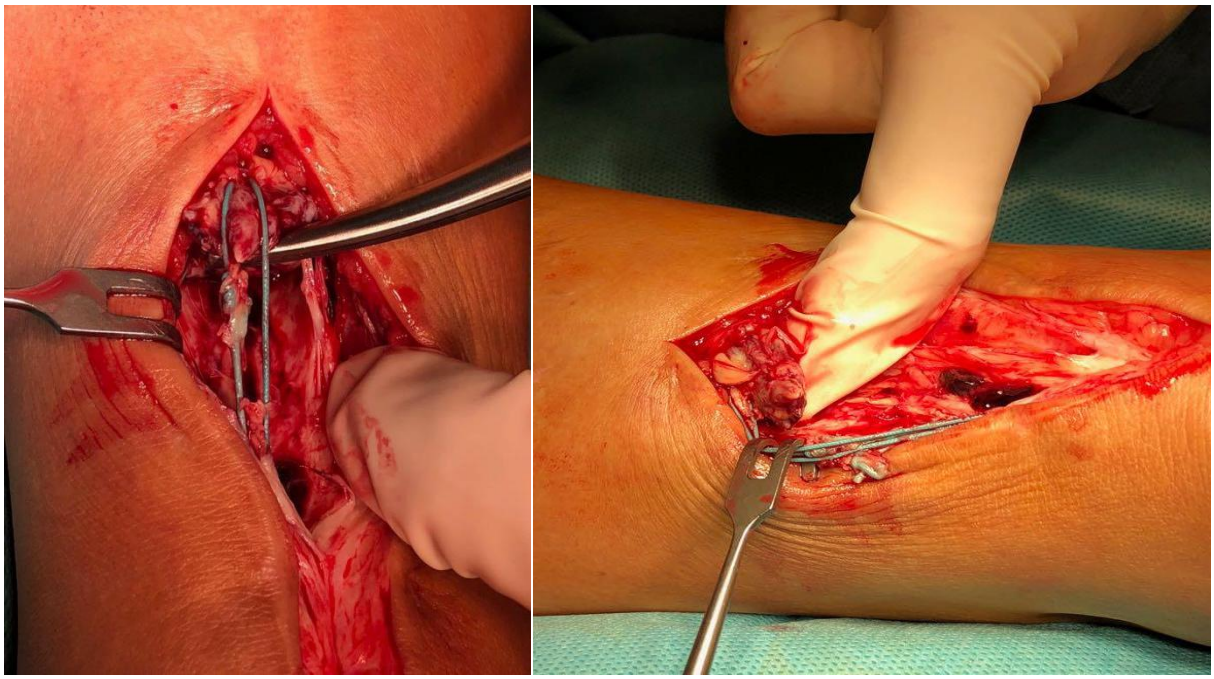

Fig. 4. 1,2 Visualization of misplaced attachment threads, not fulfilling their function, loose tendon stumps hanging in space.

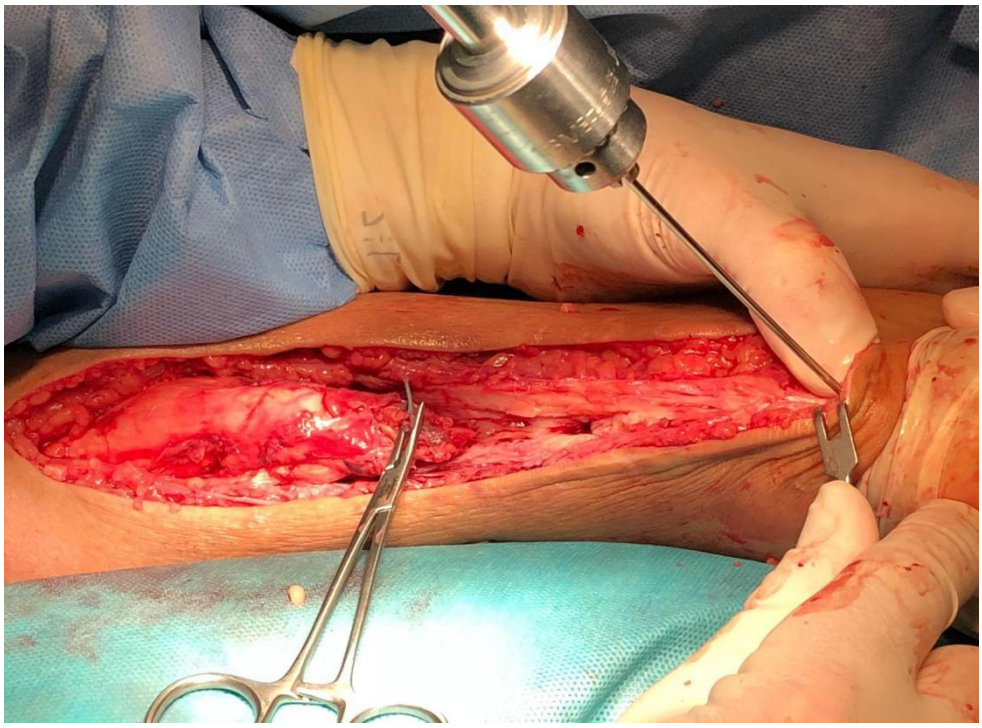

Fig. 5. Visible 12cm defect in the continuity of the tendon.

Fig. 6. 1- Photo after plastic surgery, tendon continuity restored. 2- wound sutured.

Course of rehabilitation

From the first day after surgery, both patients were allowed to put full weight on the limb in a shoe. Crutches were weaned as soon as possible. Rehabilitation was started immediately the next day, during which efforts were made to keep the use of the shoe to a minimum, and to achieve full range of motion of the foot as soon as possible. In both patients, full range of motion was achieved around 2 weeks after the surgery was performed. The duration of Walker shoe use was 4-6 weeks. Every 2 weeks, more heels were removed, bringing the foot alignment closer to the neutral position. Patients had no restrictions on activities of daily living from the first days after surgery.

Fig. 7. First week after surgery, full weight-bearing rehabilitation.

Functional training, from the first day after surgery, was done in our rehabilitation room under the close supervision of physiotherapists and a doctor. Patients performed resistance, eccentric-concentric exercises, using their own body weight. Under supervision, patients learned to perform correct movement patterns. Great emphasis was placed on performing propiorception exercises, using an unstable surface. All the exercises were complemented by the physiotherapist's manual work: scar mobilization, muscle band alignment and fascial work. Stretching and rolling the muscles and fascia after exercise is also of great importance.

Fig. 8. First week after surgery, full weight-bearing rehabilitation.

All rehabilitation was complemented by regenerative treatments, i.e. Game Ready, flossing, dry needling, lymphatic drainage, electrostimulation, hyperbaric chamber.

Fig. 9. Two weeks after Achilles revision, full weight-bearing rehabilitation

The patients had follow-up visits in a pattern - one week after surgery, 2 weeks after surgery, one month, 2 months, 4 msc, 6 months. The treatment of the first patient was completed on March 31, 2020, and the second patient on February 05, 2019 i.e. about 6 months after the operation. To date, they report no symptoms and have no restrictions on physical activity. The comfort of their lives has improved dramatically.

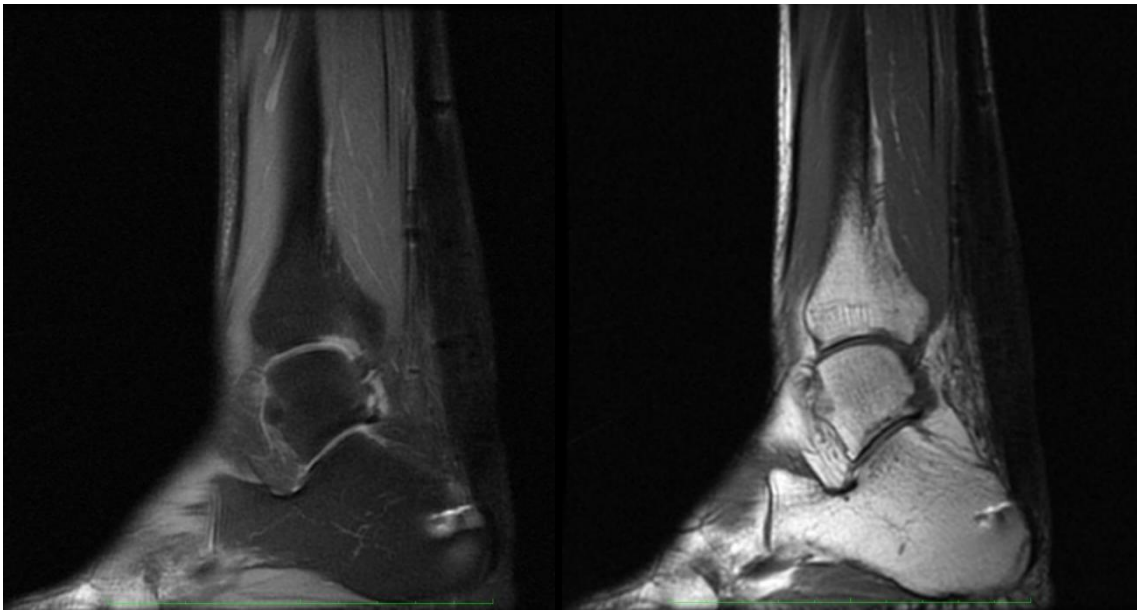

Fig. 10. MRI Evaluation of treatment results six months after plasty in patient #1.

3. Discussion

Despite the fact that Achilles tendon rupture is one of the most common lower extremity injuries, as the above cases show, doctors still make mistakes in diagnosis and treatment. There is still much controversy over surgical vs conservative treatment.[8]

A meta-analysis by Dengi et al. analyzed eight randomized trials that included 762 patients. [6] Overall, tendon re-tear occurred in 14 out of 381 patients treated surgically and in 37 patients treated conservatively. Statistical analysis showed that re-tears were statistically significantly less frequent in the surgically treated group than in the conservatively treated group. There were no significant statistical differences among the incidence of venous thrombosis, the percentage of patients who returned to sports, the range of motion in the ankle joint or physical activity among the two groups. It is for this reason that the authors concluded that surgical treatment appears to be the better long-term choice for patients with this problem.

As for the choice of V-Y plasty itself for treatment in the cases of the patients we presented, i.e., already stagnant ligament ruptures, our choice, in addition to the good results in them, is also supported by the work of Lin Yang-jing et al. who undertook an evaluation of the results of treatment of stagnant Achilles tendon rupture in 20 patients operated on by this

[8] Guclu B, Basat H, Yildirim T, Bozduman O, & Us A. (2016). Long-term results of chronic Achilles tendon ruptures repaired with VY tendon plasty and fascia turndown. Foot & ankle international, 37(7), 737-742. https://doi.org/10.1177/1071100716642753

method in their clinic. Their postoperative management, however, differed markedly from ours. Patients were placed in a below-knee cast for four weeks. During this time, patients were only allowed to perform unweighted exercises with crutches. After 4 weeks, partial weight bearing on the leg was implemented, and it was not until 10-12 weeks after surgery that patients returned to their usual activities and complete weight bearing on the operated leg. The average follow-up time was 32.8 months, and none of the patients ruptured their Achilles again or developed serious postoperative complications.[5]

The long-term postoperative effects of V-Y plasty of stasis were also presented in their study by Guclu et al.[9] They performed this operation in 21 patients, in whom the average time from injury to surgery was 7 months. The average tendon loss measured intraoperatively was 6cm. They supported their work with up to an average of 16 years of follow-up. None of the patients ruptured the tendon again; two patients developed a superficial wound infection, which withdrew after oral antibiotic therapy. Patients were placed in a cast postoperatively, in 5 degrees of plantar flexion, which was maintained for 6 weeks. After this time, gradual weight bearing on the operated leg was allowed and rehabilitation was started, after 2-3 weeks patients were allowed to put full weight on the leg and gradually return to normal activities in about a month.

These papers and our experience indicate that V-Y plication is an effective technique for treating chronic Achilles ruptures along with large defects in tendon continuity. In none of the works cited that used this method were there any reports of recurrent ruptures. This technique has a lot of advantages - it does not require taking a graft from another area and thus additional mutilation, and it does not require the use of synthetic materials.

However, we believe that the adopted time in which the weight bearing of the operated leg was delayed is too long. As well as unnecessary immobilization of the leg in a plaster dressing. Walker's shoe perfectly fulfills the protective properties, increases the comfort of the patient's life, allows full loading of the operated leg without side effects from the first day after surgery. Undertaking rehabilitation right away also did not result in any negative effects in the cases we presented. It allowed the patient to quickly resume normal life activities, which also resulted in improved well-being.

[9] Guclu B, Basat H, Yildirim T, Bozduman O, & Us A. (2016). Long-term results of chronic Achilles tendon ruptures repaired with VY tendon plasty and fascia turndown. Foot & ankle international, 37(7), 737-742. https://doi.org/10.1177/1071100716642753

The 2017 paper by Frankewycz et al. analyzed protocols, rehabilitation regimens from as many as 213 centers.[10] One hundred and seventeen of them characterized postoperative management. There is no common consensus, no gold standard of researchers on the postoperative rehabilitation management regimen for Achilles ruptures. [11,12] Several studies have focused on the effect of loading on the percentage of re-tears and the functional status of the joint. [13,14] They have not shown that immediate loading of the joint has any negative effect on the healing process of the tendon, its elongation. Nor does it predispose to re-tears.

Further studies are needed, conducted on a larger number of randomized patients, to establish, first of all, a uniform rehabilitation management protocol that is most beneficial to the patient, and that would allow the patient to return to activities of daily living quickly. As we have shown in our work, our unique management regimen produced the results expected by the patients and freed them from long-term pain and limitations.

Applications

V-Y plasty of an aged Achilles tendon rupture, with immediate follow-up weight-bearing and rehabilitation, yields sensational results. The method is effective in the treatment of chronic ruptures of the Achilles tendon. Implementation of rehabilitation immediately after the procedure allows the patient to quickly return to physical fitness without pain and movement restrictions.

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[10] Frankewycz B, Krutsch W, Webe J, Ernstberger A, Nerlich M & Pfeifer C. (2017). Rehabilitation of Achilles tendon ruptures: is early functional rehabilitation daily routine?. Archives of orthopaedic and trauma surgery, 137, 333-340. https://doi.org/10.1007/s00402-017-2627-9

[11] Carter T, Fowle, P & Blokker C. (1992). Functional postoperative treatment of Achilles tendon repair. The American journal of sports medicine, 20(4), 459-462. https://doi.org/10.1177/036354659202000417

[12] Yang X, Meng H, Quan Q, Peng J, Lu S, & Wang A. (2018). Management of acute Achilles tendon ruptures: A review. Bone & joint research, 7(10), 561-569. https://doi.org/10.1302/2046-3758.710.BJR-2018-0004.R2

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[14] Young S, Patel A, Zhu M, van Dijck S, McNair P, Bevan W. & Tomlinson M. (2014). Weight-bearing in the nonoperative treatment of acute Achilles tendon ruptures: a randomized controlled trial. The Journal of Bone and Joint Surgery - American, 96(13), 1073-1079. https://doi.org/10.2106/JBJS.M.00248

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