

Surgical Reconstruction of the Chronic Rupture of the Calcaneal Tendon by V-Y Plasty of Abraham: About Eight Cases

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Abstract: The rupture of the calcaneal tendon is a frequent lesion requiring surgical management. For chronic disruption in particular, restorative surgery is desirable and several methods have been described. We report a retrospective study of eight cases of chronic rupture of the calcaneal tendon treated surgically by myotendinousplasty in V-Y according to Abraham, collected in the Traumatology and Orthopedics II department of the Mohammed V Military Teaching Hospital in Rabat Morocco between 2010 and 2015. The majority of patients were male. The cause of chronic rupture of the calcaneal tendon was a diagnostic error in 25% of the cases, a lack of knowledge of the pathology in 62.5% of the cases and negligence in 12.5% of the cases. The results were evaluated according to the Kitaoka score after an average follow-up of three years. They were very satisfied with a score of 89%. The aim of this study is to highlight the difficulty of making the diagnosis in certain circumstances, which is the cause of chronic rupture and to underline the interest of the surgical treatment, by the myotendinousplasty "V-Y" in this case.

Keywords: Abraham's V-Y plasty, Calcaneal tendon, Chronic, Rupture, Surgery.

INTRODUCTION

Breaks of the calcaneal tendon are particularly frequent in men aged 40 to 50 who practice a sustained or occasional sport activity. In some cases, the diagnosis is late on an unnoticed trauma.

The rupture of the calcaneal tendon is called chronic, when the patient presents himself with a delay of at least four to six weeks [1]. It is a difficult lesion to treat. There is usually a considerable gap between the tendon ends, healing and retraction of the calf muscles.

The treatment is mainly surgical by the reconstruction of the calcaneal tendon to avoid a considerable functional morbidity. Several techniques have been described in the literature. The superiority of one technique over another has not been demonstrated and the optimal surgical management of calcaneal tendon rupture remains controversial.

In this connection, we describe eight cases of chronic rupture reconstruction of the calcaneal tendon using Abraham's V-Y plasty with favorable outcome.

MATERIALS AND METHODS

We report a retrospective study of eight cases presenting a chronic rupture of the calcaneal tendon (Table-1), treated surgically by myotendinousplasty in VY according to Abraham's technique, collected at the Department of Traumatological and Orthopedic Surgery II of the Military Hospital Instruction Mohammed V in Rabat Morocco between January 2010 and March 2015.

The overall average age of our patients was 41 years old with extremes ranging from 22 to 55 years

old. Our study had a clear male predominance. It consisted of seven male patients (87.5%) and one female patient (12.5%). The mechanism of the injury was secondary to a sports accident in five patients and a home accident (stairlift) in the other three patients. Four of our patients (50%) had no particular pathological history, while in two cases (25%), type II diabetes was identified, and in two cases (25%), amateur athletic patients had tendinitis of the calcaneal tendon.

The delay between diagnosis and treatment ranged from four weeks to four months. The causes of the delayed diagnosis were:

- A diagnosis error in two cases or 25% in two athletes whose break was taken for the tendinitis diagnosed before.
- A lack of knowledge of the diagnosis in five patients, in 62.5% of cases.
- Neglect of the only patient in our study for four months, or 12.5%.

Clinically, all patients (100%) presented with lameness associated to a walking fatigability and a difficulty climbing stairs. On clinical examination, at the inspection, a posterior ax blow or hiatus showing the location of the rupture was found (Fig-1), with a loss of the physiological equinus of the affected foot (100%). Thompson's maneuver was positive for all our patients. Monopodal support was impossible for all patients. All our patients benefited from a conventional radiological assessment including two frontal and lateral ankle images to eliminate differential diagnoses such as calcaneal avulsions or other bone lesions. Ultrasound was requested for all patients to confirm the diagnosis (Fig-2). However, no patient received an MRI.

Therapeutically, all our patients were operated on spinal anesthesia on the ventral decubitus with placement of a pneumatic tourniquet at the root of the limb and a block under the affected leg. A posteromedial approach of about ten centimeters was made (Fig-3), with careful hemostasis and opening of the sheath of the calcaneal tendon or mesotendon in the longitudinal direction. The rupture zone was identified with evidence of scar tissue (Fig-4), which was resected in order to find a healthy tendon area (Fig-5), and then measure the loss of the substance in maximal equinus. A myotendinousplasty in V-Y according to Abraham was decided. The myotendinous junction was localized, followed by preparation and making an inverted V incision in the proximal portion of the tendon (Fig-6). It was repaired in Y form by a Vicryl wire N°2 with equinus feet (Fig-7). The postoperative course is completed by an immobilization by a resin boot in an equine light of approximately 30 ° for 3 weeks and then an additional 3 weeks with feet in a 90 ° position. We respected a lack of support until the fifth postoperative week. The last week, the patient was allowed to resume support on the resinboot with a making of a walking heel. The sutures were removed during the change of the plaster at the third week. At the end of this period, the re-education was started such as a recovery of the joint's mobilities, strengthening of the muscles including the triceps muscle sural, potential region of the tugging. Finally, proprioceptive work was also undertaken in order to find all previous skills.

RESULTS

After an average follow-up of 36 months (12 months and 60 months). The criteria used to judge our results are exclusively clinical:

- The possibility of unipodal support;
- The absence of pain;
- The plantar flexion of the foot against resistance scoring according to the MRC scale (Medical Research Council of Great Britain) to assess the competence of the triceps sural muscle;
- The mobility arc and search for the negative Thompson sign;
- The return to pre-injury activities;
- The evaluation according to Kitaoka's score.

The prevalence of preoperative pain, stiffness and edema is summarized in (Table-2). We observed for the majority of the patients that the symptoms are weak or absent. The patients for whom one of the three entities namely pain, edema and stiffness are present are those who were treated at a date close to the trauma, at one month in this case and this in four cases (50 %).

The resumption of full support was done at the fifth postoperative week, after the removal of the plaster. The recovery of usual and total activities was occurred on average after the ninth week. The patients returned to their sporting activities (normal walk to sustained walking) after an average of 22 weeks +/- 6 weeks. At last follow-up all our patients (100%) were able to stand on tiptoes.

All patients had plantar and dorsal flexion of the foot comparable to the contralateral side in seven patients (87.5%) slightly decreased in one case (12.5%). The study of the force of contraction of the triceps sural on the MRC scale found a normal force of the triceps sural muscle rated at 05 in seven patients (62.5%) and at 04 in one patient (37.5%).

In our study, the average KITAOKA score was 89%. No patient presented any postoperative complications including no lesions of the sural nerve, no skin necrosis, and no superinfection of the surgical approach. At the last follow-up, no case of iterative rupture was observed.

Table-1: recapitulative results of our study

CASE	SEX/AGE (years)	MECHANISM BREAK	LENGTH DEFECT TENDON(in cm)	DURATION SYMPTOMS (month)	DURATION OF FOLLOW UP (week)	RESULTS
1	M/35	SPORT	5	1	16	EXCELLENT
2	F/43	SPORT	N/C	2	28	EXCELLENT
3	M/22	SPORT	5	1	16	EXCELLENT
4	M/55	FALL STAIRS	6	4	22	SATISFIED
5	M/50	FALL STAIRS	N/C	1	30	SATISFID
6	M/25	SPORT	5	2	22	EXCELLENT
7	M/38	SPORT	3,5	1	16	EXCELLENT
8	M/47	FALL STAIRS	5	1	28	EXCELLENT

Table-2: Pain – Edema – Preoperative stiffness

	PAIN	EDEMA	STIFFNESS
NONE	3	3	7
LOW	3	5	1
MODERATE	2	0	0
SEVERE	0	0	0



Fig-1: Image showing the posterior hatchetor hiatus



Fig-2: Ultrasound showing a discontinuity of the achillis tendon at the myotendinous junction with individualization of a fibrous nodule



Fig-3: schema of the medial posterior approach on a right ankle



Fig-3: Image showing the tissue fibrous scar tissue



Fig-4: Image showing the loss of substance after resection of the fibrous scar tissue



Fig-5: Image showing the myotendinous plasty in V-Y: section in « V »



Fig-6: Image showing the transformation of « V » to « Y » of the plasty

DISCUSSION

Chronic rupture of the calcaneal tendon does not appear to be decreasing despite the reliability of the clinical diagnosis and the contribution of imaging. It can occur in 10% to 25% of patients with acute rupture [2]. It is due either to the error of the initial diagnosis or to the negligence of the patients. Ultrasonography and magnetic resonance imaging (MRI) have a great interest in the diagnosis and treatment of these lesions. They make it possible to locate the lesion, to show the state of the tendinous extremities, and to quantify the defect [3].

The management of the chronic breaks of the calcaneal tendon is difficult because of retraction of the tendon ends and the atrophy of the sural muscle. Their treatment is mainly surgical. Several techniques of surgical reconstructions have been proposed. Their goal is to achieve the integrity of the tendon and especially its function. In the literature, there is no consensus for the surgical management of these lesions. Several classifications have been described, but the results of the implementation of these recommendations have not been evaluated [4]. Among them, that of Myerson, who classified the chronic fractures of the calcaneal tendon

into three types according to the length of the tendon defect:

- Type 1: between 1 to 2 cm in length. It is treated by termino-terminal repair.
- Type 2: between 2 and 5 cm. It is treated with V-Y lengthening, with or without tendon transfer.
- Type 3: > 5 cm. It is treated by the use of a tendon transfer, alone or in combination with V-Y advancement.

The need for ablation of the fibrous tissue and the difficulty of dissection of the tendinous extremities make percutaneous repair difficult. Various authors have suggested that techniques combining excision of scar tissue, termino-terminal anastomosis, and strengthening of the anastomosis are the most beneficial in repairing the calcaneal tendon [5]. The most used techniques are:

- Technical Proximal Turnover (Bosworth).
- Technique of the transfer of the flexor muscle of the big toe (Wapner).
- Technique of the transfer with fibular short muscle tendon (Perez Teuffer).
- V-Y flap technique (from Abraham).

This last one was described by Abraham and Pankovich in 1975, for the treatment of chronic ruptures of the calcaneal tendon [6]. They adopted this technique as a result of poor experiences using flap flaps and fascia lata transfers. They found that these procedures led to skin adhesions at the repair site and weakness of the calf muscles, which was noticed by the decrease in force during the push. They reported results from four patients with chronic rupture of the calcaneal tendon with a tendon spacing of five to six centimeters. Three out of four patients regained full strength. The length of the gap was measured with the knee at 30 ° flexion and the ankle at 20 ° of plantar flexion.

The authors, in the Thomas study, speculated that dissection may render the flap free of blood supply, but it becomes revascularized from either the neighborhood or the paratendon [7]. Others had good results using this technique on three patients who had a loss of substance of 8 to 10 cm [8]. The us team used the same technique on six patients. All of their patients were able to walk on their toes and return to previous activities [9]. They deduced that the V-Y flap allows intrinsic healing leading to a tendon with improved elasticity, strength and mobility and in addition it avoids the sacrifice of other lower limb tendons.

This technique has been adopted by all practitioners of the service, without being a school affair, because of its simple realization, does not sacrifice another tendon of the lower limbs it has been reported by different authors, nevertheless it sees its

limit in large inter-fragmentary gaps exceeding 8 to 10 cm.

In our series, the average Kitaoka score was 89%. This result seems very satisfactory and reaches the score obtained by most authors [10-12]. It does not seem to be any relationship between the decrease of the perimeter of the calf and a loss of the plantar flexion strength. According to the authors, the results on the plantar flexion force after rupture of the operated calcaneal tendon vary with a deficit, compared to the unoperated side ranging from 0 to 35% [13]. In our series a deficiency of 15° of the plantar flexion as well as amyotrophy of the triceps were objectified in one case which represent 12.5%.

The epidemiological profile of our study does not match that found in some series [14], which report older age groups of patients, which we believe may be related to a non-sporting older population. The return to socio-professional and even "amateur" sports activities is earlier in our study than that reported in the literature [14]. Saxena and Cheung [15] describe a series of five patients treated with Bosworth flap flap with or without reinforcement where they report an average return to activity at 34 weeks. In a series of eleven patients treated by resection of scar tissue and end-to-end anastomosis, Porter and al [16] report an average time to return to sport activity of 5-8 months (2.5-9 months). An interesting fact in the series described by Lee [14], the time to return to activity ranged from 15.2 to 17weeks. The rapid return to activity has been attributed to the use of a human dermal cell matrix to accelerate healing. In our study, the return to sports activity was not taken into consideration. With regard to "secondary ruptures" of the calcaneal tendon after reconstruction surgery, the rates vary from 1.4% to 3% for the lowest [16] to higher levels over 17% [17]. In our study, no new cases of rupture were observed with a mean follow-up of two years. This absence would attest to the resistance provided by our repair using Abraham's V-Y flap.

As with most retrospective series, there are a number of methodological issues that may affect the validity of the conclusions.

For example, in our study, although it represents a non-significant sample compared to the literature, the patients are relatively young and include only amateur athletes. This may explain better results compared to older and less active patients in the other studies. The numbers are small and the results are subjective without statistics.

In addition, we did not compare or evaluate with other risk factors that may influence functional outcomes such as body mass index or other comorbidities.

CONCLUSION

Chronic fractures of the calcaneal tendon are rare but potentially debilitating. The choice of care is partly guided by the type of tendon injury. Most lesions require surgical management. Many techniques can be used to repair or rebuild a tendon with chronic rupture. It is difficult to compare different techniques. Most of the studies were retrospective and small and focused on the results of a single technique.

Tissue engineering is promising, but additional research and clinical trials are needed to evaluate its efficacy on humans.

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