Minimally invasive release of plantar fascia. A clinical retrospective study

Introduction

Plantar fasciitis is a common condition causing heel pain. It affects men and women equally typically in their fourth and fifth decades. Patients usually complain of pain on the posteromedial aspect of the heel, with typical pattern of exacerbation when first getting out of bed in the morning. The pain worsens after prolonged standing at the end of the day and is relieved by ambulation. The physical exam of those patients usually reveals tenderness to palpation at the medial tuberosity of the calcaneus, exacerbated by dorsiflexion of the toes. Obesity, limited ankle dorsiflexion due to tight Achilles tendon, pes planus, pes cavus, gout have been reported as risk factors. In some cases tenderness is also located at the origin of the abductor hallucis tendon, sign of entrapment or irritation of the 1st branch of the lateral plantar nerve. In cases with bilateral symptoms one should consider in the differential diagnosis rheumatoid arthritis, more likely in women or ankylosing spondylitis and Reiter syndrome in men. Other rare differential diagnoses include diabetic atrophic lesions, radiculopathy and occult fracture.

The plantar fascia is a strong layer of white fibrous tissue attached to the medial calcaneal tubercle. As it progresses distally it divides into five sections, each one extending into a toe and merging with skin fold, flexor sheaths and transverse metatarsal ligaments. Repetitive microtrauma and chronic overuse lead to pathological changes at the plantar fascia. Although the term “plantar fasciitis” is indicative of inflammation in the plantar fascia, histological studies have demonstrated degenerative lesions such as fibrosis, collagen necrosis and matrix calcification rather than inflammatory changes. These changes are more consistent with degenerative process without inflammation.

The diagnosis of the plantar fasciitis is established mainly on the history and clinical examination. X-rays are the most commonly requested and may show a heel spur. A heel spur was previously thought to be cause of plantar fasciitis, but this has been disproven, as 16% of normal population have heel spurs. A bone scan may be helpful to rule out a stress fracture, or an electromyography to rule out a nerve entrapment.

A plethora of conservative treatment modalities are utilized in the clinical management of the plantar fasciitis such as lifestyle modification, non-steroid an-
ti-inflammatory drugs, steroid injections, orthotics, Achilles tendon and plantar fascia stretching exercises\(^8\), botulinum toxin injections\(^9\), platelet-rich plasma injection\(^10\) and extracorporeal shock wave therapy (ESWT)\(^11\)(Tab. I). As far as corticosteroid injections are concerned, many complications have been reported, including rupture of the plantar fascia and fat pad atrophy\(^12\). Operative treatment, release of the plantar fascia, is necessary in less than 10% of the patients and only for those with persistent pain after 6 months of failed conservative measures. With the evolution of minimally invasive surgical procedures, classical extended release of plantar fascia has been abandoned and minimally invasive or endoscopic approaches have been proposed\(^13\).

In this study the medium term clinical outcome of minimally invasive plantar fasciectomy is evaluated and analyzed.

**Materials and methods**

Between the years 2008 and 2011, 126 patients visited the Clinic of Orthopaedic Department, General Hospital of Edessa with complaints of plantar fasciitis and were managed conservatively. The diagnosis of plantar fasciitis was established mainly on clinical grounds. Plain X-ray investigation of ankle and hindfoot was performed in all patients. One of the patients had an MRI evaluation prior to surgery to confirm the diagnosis. Stretching programmes, physical therapy, pain control with non-steroid anti-inflammatory drugs and corticosteroid injections were used in the management. After 6 months of unsuccessful conservative management, 15 of them (16 feet), with an average age 58.4 (27-71) years, underwent surgery. Distribution of series data regarding side, 8 right feet and 7 left were involved. They were all operated by the same surgeon with minimal invasive technique. VAS-FA (visual analogue scale- foot ankle) score and AOFAS (American Orthopaedic Foot and Ankle Society) Ankle Hindfoot scale, evaluating three main parameters – pain, functional aspects and alignment – and totaling 100 points\(^14\) were used. Wilcoxon test was used for assessment of VAS-FA score and AOFAS score value differences. P-values lower than 0.05 were considered as statistically significant.

**Surgical technique**

All patients were operated under ankle or popliteal block (Fig. 1). With the patient supine and the leg externally rotated, a calf tourniquet was used. After identification of posterior rim of medial malleolus a vertical line of 2-3 cm was drawn distally, ending just above the superior edge of weight-bearing plantar skin (Fig. 2). Incision of the subcutaneous fascia and

Figure 1. A popliteal block as anesthesia for plantar fasciectomy.
Figure 2. A 2-3 cm straight incision on the medial heel just above the weight-bearing surface.

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the superficial and deep fascias of abductor hallucis followed. After identification and isolation by blunt dissection of the plantar fascia, one third to half of the medial fascia was sectioned. Removal of heel spur was not performed at all because in our opinion it does not play role in the pathogenesis of the disease and also, excision of the spur through a minimally invasive approach carries high risk of iatrogenic injury of quadrates plantae and other intrinsic muscles. Partial weight-bearing as tolerated and stretching exercises were allowed the day after surgery. Wound dressings were changed every week and stitches removed at 15-17 days.

Results

Heel spur was recorded in 98 patients who were managed on outpatient basis for plantar fasciitis (77.8%). In the study group, heel spur was noted in 12 patients (80%), a rate comparable to that of plantar fascia series. Follow-up was conducted at 3 months, 6 months and one year after operation. In addition, a last evaluation of clinical outcome was performed at a mean time of 4.9 years post-operatively. All except one patient were available for follow-up. No post-operative complications, such as infection, wound dehiscence or nerve injuries, were recorded. 85.7% (12/14) of patients were satisfied with the results of their surgery. The clinical result in one case was scored as fair and one patient was dissatisfied. The patient who was dissatisfied had severe comorbidities (obesity, osteoarthritis) and suffered from a persistent lymphedema of the ipsilateral foot. Regarding the case with bilateral involvement, the clinical outcome was excellent for both sides. Pain and functional ability improvement after surgery was measured using VAS score, with a mean value of 7.7 pre-operatively in comparison with 2.7 at 3 months follow-up (p<0.05). Pre-operatively mean AOFAS Ankle hindfoot score was 58.53 (51-69). At 3 months, 6 months, 1 year postoperatively as well as at the last follow-up evaluation scores were 83.66 (69-90), 84.8 (73-94), 87.67 (73-95) and 89.66 (73-99) respectively with no statistically significant differences between the evaluation time points. In addition, post-operative improvement of AOFAS Ankle hindfoot score at any follow-up was stay.

Discussion

According to clinical scores, 84% of the patients reported to be pain free after surgery and were satisfied with the outcome. Minimally invasive release of plantar fascia may avoid the potential complications of traditional plantar fascia resection, especially regarding wound issues. These results are consistent with the results of other published studies1,4,6,16-20. The results of these case series are compared to the results reported by Wheeler et al.1 who demonstrated an 84% satisfaction rate at a mean follow-up of 7 years. There was no significant reduction in the post-operative VAS and AOFAS values neither in our 4.9 years follow-up nor in Wheeler’s and at 10 years follow-up.

Less than 50% of plantar fascia was incised, as biomechanical studies show that any more than that risks collapse of the longitudinal arch of the foot, disruption of windlass mechanism and lateral-sided foot pain21. Release of the 1st branch of the lateral plantar nerve is considered only if neurological symptoms are present. However, incision of the deep fascia of abductor hallucis longus may decompress the nerve.

A heel spur excision was not performed. The heel spur, previously thought to be cause of plantar fasciitis, is proven that in half of the cases is identified superior to the plantar fascia22. A previous study shows that 46% of heel pain patients had no spur, 50% of patients with bilateral spurs had pain in only one heel23. Excision of the heel spur is not necessary and it may actually exacerbate pain by altering the mechanics of the foot. Endoscopic surgery for plantar fasciitis offers comparable results with open surgery according to relevant studies24. Caio Nery et al. suggest an improvement at the AOFAS score from 51 to 89 at a 9.6 years follow-up. However, endoscopic surgery requires specialized equipment and a bigger learning curve for the surgeon. Currently, there is a trend towards new conservative therapies such as autologous platelet-rich plasma injections and extracorporeal shock wave therapy (ESWT). Autologous platelet-rich plasma injections are thought to aid the healing process, due to high concentration of growth factors. Despite the increased use, there are much to be learnt regarding the time, the method used and whether PRP is most effective alone or in combination with white blood cells10. As far as extracorporeal shock wave therapy is concerned, pulses of high-pressure sound waves bombard damaged tissue to relieve pain associated with plantar fasciitis. There are different theories regarding the pathophysiology of ESWT. Some say that it stimulates blood flow and perhaps elicits a beneficial immune response, while others contend the shock waves in effect re-injure the tissue, thereby initiating a healing response. Yet other experts propose the pulses bombard the central nervous system, essentially shutting the neural pathways down to relieve the pain. Although studies are encouraging, there is insufficient data concerning the long-term adverse effects and effectiveness of this option25. Shortcomings of the present study should be discussed. That represents a retrospective study. The sample size is relatively small and therefore statistical power of the study is weak, there was no control group. Surely, that study would prompt prospective cohort studies which can offer more valid data about the studies surgical technique.
Conclusion

Plantar fasciitis is usually self-limited disease and a small percent of patients should be managed operatively. In those cases with recalcitrant plantar fasciitis despite the plethora of conservative treatment modalities the minimally invasive open release of plantar fascia is a reliable and safe option which offers good to excellent clinical results.

Conflict of interest

No potential conflict of interest exists.

Ethics

The Authors declare that this research was conducted following basic ethical aspects and international standards as required by the journal and recently update in29.

References