A seven-year retrospective outcome study of a medial extensile surgical tarsal tunnel release in the treatment of tarsal tunnel syndrome.

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Abstract

This study aims to analyze the clinical results of using a medial extensile surgical approach for decompression of the tibial nerve, including its distal medial and lateral branches, to treat tarsal tunnel syndrome. These structures are the complete flexor retinaculum and the deep fascia of the abductor halluces muscle, including individualized release of the medial and lateral plantar nerve tunnels. Method: This is a retrospective review of 90 surgical releases in 79 patients (19 men and 71 women) with an average age of 50 years compatible with idiopathic tarsal tunnel syndrome, which underwent an extensive medial decompression technique of the proximal and distal tarsal tunnel. Results: Of the 90 released 77 reported outcomes in the75thpercentile or better. There were 17 incidents of infection which resulted in 12 cases of wound dehiscence, which were all successfully managed. Conclusion: The extensile approach to tarsal tunnel release offers successful outcomes for the treatment of tarsal tunnel syndrome with low reoccurrence rates.

Keywords: Tarsal tunnel, Open approach, Electro diagnostic testing.

Introduction

Tarsal Tunnel syndrome is a relatively misunderstood pathology in the lower extremity. First described by Kopell and Thompson in 1960 and then by Keck and Lam in two separate studies in 1962, Tarsal tunnel syndrome is an entrapment syndrome of the entire tibial nerve behind the medial malleolus and under the flexor retinaculum or laciniate ligament [1-3].The clinical presentation is typically tenderness posteromedial over the nerve. In some patients there can be true neurogenic signs including both the sensation of numbness and actual hypoesthesia and clawing of the toes. Tinel sign as a diagnostic criterion has been met with some variability in the literature [4-6]. The underlying cause of Tarsal tunnel syndrome has been attributed to multiple pathologies including space occupying mass, anomalous muscle belly, tarsal coalition, trauma, venous malformation and limb lengthening procedures [7-19]. The literature reveals some of the best outcomes are associated with the removal of space-occupying lesions that are within the tarsal tunnel canal [20, 21]. In contrast, some of the poorest outcomes have been associated with re-operation of a failed tarsal tunnel [22-25]. Regardless of the cause a full work up to evaluate all intrinsic and extrinsic factors should be undertaken before any surgical intervention is performed. The diagnosis of tarsal tunnel is made with a thorough history and physical exam with the aid of ancillary studies. Patients usually present with medial ankle and plantar foot pain, worse with activity but also present at rest. Many times, the patient's only complaint is heel or sub-metatarsal pain and the physician can be misled into treating the wrong diagnosis [26-28]. Ancillary studies that have proved to be helpful in the confirmation of the tarsal tunnel syndrome diagnosis include MRI, ultrasound and electro diagnostic studies [29-35]. In a small study of 9 patients by Samarawickrama, et al all of the patients with a positive EMG study had confirmation of a tarsal tunnel syndrome with ultrasound, revealing overlapping studies may help to confirm the diagnosis and reassure the patient and the surgeon of the appropriate treatment.The treatment of tarsal tunnel syndrome includes a myriad of non-surgical treatments including bracing, orthotics, physical therapy, immobilization and nerve blocks [36-38]. Surgical treatment of tarsal tunnel syndrome can be performed either as an endoscopic or open approach. The endoscopic tarsal tunnel release has received more attention lately but is more technical and requires a particular skill set by the surgeon [39-42]. The open procedure can be further divided into a minimal incision and extensile incision approach. The literature is replete with studies that reveal incomplete release is a major cause of tarsal tunnel release failure [43]. In this study the authors present 90 cases of extensile tarsal tunnel release over a period of seven years followed to stabilization of symptoms. All the releases were performed by the lead author. A detailed

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surgical technique is described as well as post-operative outcomes and surgical complications are reported the authors aim to prove that an extensive release provides the ability to release all compartments while minimizing post-surgical complications and inadequate release.

Surgical Technique

The patient is transferred to the OR suite and placed on the table in the supine position. A general anaesthetic was instituted, and a thigh tourniquet is used for hemostasis. After a standard prep and drape, the incision is marked in the posterior medial aspect of the ankle. The incision is centered halfway between the high point of the medial malleolus and the anterior medial border of the Achilles tendon and extended three centimeters proximal to this marked line as well as distally just beyond the porta pedis (Figure 1). A controlled depth skin incision is performed, and care is taken in the initial incision to cauterize all perforators and skin bleeders (Figure 2). The retinaculum is identified and all constrictors in the retinaculum are noted. A small rent is created in the retinaculum with a scalpel, taking care to avoid an iatrogenic injury to the neurovascular structure deep in the ligament. A blunt scissor is then used to release the retinaculum both distal and proximally completely, with special attention to the distal aspect deep to the abductor halluces muscle belly (Figure 3). Care must be taken to ensure the deep fascia of the posterior leg as well as the deep investing fascia of the abductor muscle belly is released in its entirety. The nerve is identified proximally and gently released utilizing a technique that worked from the edge of the neural tissue into the tarsal tunnel (Figure 4). No instrumentation directly contacted the nerve through the dissection this dissection was carried completely proximal to distally making sure to release all branches of the nerve distally. The focus of the dissection is to identify any soft tissue masses in the tarsal canal, release of any vascular slings if present, and gently free the posterior nerve and its branches from the retinaculum posteriorly. Once the nerve has been completely released, the perineural space is instilled with 8mg of dexamethasone with a 30-gauge needle. The proximal incision is instilled with a long-acting anaesthetic for post- operative pain control. Prior to any closure, the thigh tourniquet is released, and a bloodless field is maintained with cautery. Finally, the wound is closed in layers without approximation of the retinaculum and a well-padded posterior splint is applied (Figure 5). The

Figure 1. *Planned incision demonstrating the midpoint between the high point of the medial malleolus and the anterior medial border of the Achilles tendon. It is extended 3cm proximally and ends distally just beyond the porta pedis.*

Figure 2. *Electrocautery used for dissection and hemostasis through the subcutaneous tissue.*

Figure 3. *Metzenbaum scissors are utilized to release the retinaculum.*

Figure 4. *The posterior tibial nerve with perineural fat.*

post-operative protocol allows weight bearing in the splint for two weeks to protect the incision site. At the two-week follow-up, the splint and sutures are removed, and the patient is encouraged to start full weight bearing in the shoe of their choice.

Methods

A retrospective review of tarsal tunnel release procedures performed from January 2010 to December 2017 was carried out by gathering data from the hospital EMR and the lead surgeon's clinical office. We obtained approval from our institution's review board at Henry Ford Health System, after an expedited review. All surgical procedures were performed by the lead author. The query resulted in 104 cases of tarsal tunnel release. Fourteen cases were Excluded from the study due lack of follow up. In total, 90 tarsal tunnel releases were performed on 79 patients. Reviewed information consisted of age, sex, side of surgery, presence of diabetes, subjective symptoms of peripheral neuropathy, whether a diagnostic posterior tibial nerve block was performed, and whether an EMG was performed. A successful diagnostic block is defined as any block that produces lasting symptom relief greater than 8 hours. All diagnostic blocks were performed by the primary surgeon and were comprised of a combination of Kenalog 40mg, Marcaine 0.5% and lidocaine 2%. Post- operative information consisted of wound dehiscence, post-operative infection, and subjective percentage of improvement based upon patient's subjective improvement rating.

Result

In total, 90 tarsal tunnel releases were performed on 79 patients. The average time of follow up was 529 days. The average age was 50 years. There were 49 procedures performed on the left foot and 41 on the right. There were 71 females compared to 19 males (Table 1). Subjective neurogenic symptoms were described in 83 (92%) of the cases. Of the 90 performed procedures, 77 (85.56%) exhibited ≥ 75% improvements at final follow up, which was determined by stabilization of symptoms. A diagnostic nerve block was performed on 57 (63.33%) limbs with 84.21% of those patients achieving a ≥ 75% improvement after surgical intervention (Figure 6). Preoperative electro diagnostic evaluated patients who had tarsal tunnel releases reported symptom improvement >74% in 89% (71/80). There were 17 incidences of post-operative infection and 12 surgical sites dehisced. All postoperative complications were successfully managed and despite these events 26/29(90%) patients who experienced complications reported >74% improvement postoperatively.

Figure 5. *Layered closure per surgeon's preference without re-approximation of the retinaculum.*

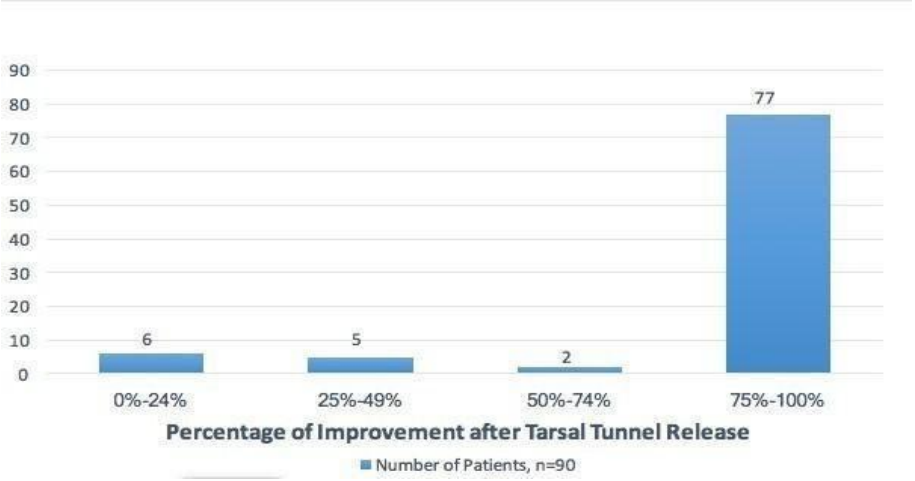

Figure 6. *Number of patients based off their percentage of improvement after tarsal tunnel release.*

Table 1. *Demographic information.*

Total Number of Tarsal Tunnel Releases	90
Number of Females	71
Number of Males	19
Average Age yrs.	50
Left Foot	49
Right Foot	41

Discussion

In our study we have shown that the diagnosis of tarsal tunnel syndrome is dependent on a cumulative amount of data including patient history, clinical findings, ancillary studies. Of the 77 patients examined, ≥ 75% reported improvement in their clinical symptoms. We were also able to find a correlation between the success of tarsal tunnel syndrome and the success of a diagnostic block, with 84% of patients reporting ≥ 75% improvementDifferent surgical approaches have been described in literature and each has their merits. Our surgical approach was based on the anatomical location of the posterior tibial nerve. We have found that keeping the incision directly over the neurovascular bundle reduces the dissection needed to inspect and release the nerve. This directly reduces scarring around the nerve, which we believe lowers our failure rate. Another important part of our surgical approach is the length of the surgical incision. The direct relationship between incomplete release and patient satisfaction in the literature has led our lead author to define the appropriate incision length to avoid incomplete release of the nerve and its branches. Finally, avoiding manipulation of the posterior tibial nerve and its branches has allowed reduced scarring around the nerve. This is aided with the absolute rule to release the tourniquet prior to closure of the incision to ensure a bloodless field. The authors stress the importance of protecting the incision for two weeks in a posterior splint to reduce the possibility of wound dehiscence and thus the overall surgical success. We acknowledge deficiencies in our research. First, this was a retrospective study. Furthermore, our end point was defined by a stabilization of the patient's symptoms and not a defined length of time. It is possible that higher overall patient satisfaction

rates may have been reported if patients had been followed for a longer time. In conclusion, our data has shown that a medial extensile release of the tarsal tunnel using our specific technique yields consistently good outcomes and high patient satisfaction. The diagnosis of tarsal tunnel should be gained from a thorough work-up that includes a patient's history, a thorough physical exam and ancillary studies to rule out any musculoskeletal causes of the symptoms. Further studies are needed to evaluate the tarsal tunnel release post-surgically with electro diagnostic evaluation to determine the true success of the procedure.

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