

Recurrent Intermetatarsal Neuroma

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ABSTRACT

The recurrent intermetatarsal neuroma or plantar neuroma is an infrequent complication following surgical excision of an intermetatarsal neuroma. The rate of recurrence following excision varies, depending on the source, but may be from 7% to 20%. There are few reports in the literature with regard to the treatment of the recurrent neuroma by either conservative or surgical means. The few reports on the effectiveness of reoperation in relieving symptoms range from 20 to 86 percent. In the majority of the cases, the sample size was small and the techniques varied.

This paper deals with a retrospective study performed by the author in a community based practice. The study involved thirteen patients and thirteen feet. In all but two instances, a plantar approach was utilized (11/13). The overall success of surgical treatment of the recurrent neuroma was 12/13 cases (92%) with regard to resolution of primary complaints. The effectiveness of the plantar approach was 10/11 (90%). There was one failure in the study, which presented as a repeat recurrence, which was also complicated by the development of Reflex Sympathetic Dystrophy.

The primary technique employed in this retrospective study to eradicate the recurrent neuroma consisted of a plantar approach (11/13), with either simple neuroma resection with retraction of the proximal stump (2/11), or neuroma resection combined with epineuriplasty of the proper metatarsal nerve and relocation to the intrinsic musculature (9/11). The plantar approach (curvilinear to modified "Z") did not result in the formation of a painful scar, although one patient did develop persistent hyperkeratotic build up associated with the scar, which already possessed a painful scar from previous surgery.

REVIEW OF LITERATURE

There are few reports in the literature with regards to the recurrent intermetatarsal neuroma. Johnson et al. in 1988, reported their experiences with 39 recurrent neuromas in a total of 34 patients. They reported a 67% (22/34) success rate in which patients received complete relief or maximal improvement with only minor reservations. Additionally, they reported on another 9% (3/34) with improvement overall, while 24% (8/34) reported there was no improvement or that they were worse. One of the most significant aspects of their paper was the use of a plantar linear incision in 33 patients with only one reported symptomatic scar.

Their surgical technique involved identifying the involved plantar metatarsal nerve associated with the recurrent neuroma, resection of the neuroma, followed by transection of the nerve far enough proximally to facilitate its retraction into the non-weight bearing part of the foot, to avoid future irritation by the inevitable amputation-stump neuroma that will result. In addition, they examined the correlation of pathologic findings with the clinical diagnosis, as well as the relationship of the surgical approach to the patient's level of satisfaction. Of those patients that were dissatisfied with the result (33%), all had been reoperated via the plantar approach and it appears that their result was not influenced by the approach itself. It was the author's opinion that the initial recurrence was most likely due to the incomplete or partial excision of the original lesion. When they examined the site of recurrence, the third intermetatarsal space was the most prevalent (74.4%), followed by the second (23%) and finally the fourth intermetatarsal space (2.6%).

Regarding their eight failures, four had no change from the preoperative symptoms, two were worse and complained of a radiating-type pain into

the arch and posteriorly into their leg. The additional two failures developed reflex symptomatic dystrophy-like syndromes. They did not speculate as to why the failures occurred.

Beskin and Baxter in 1988 reported on a retrospective study of 39 recurrent neuromas in 30 patients. They utilized two surgical techniques, a dorsal approach as well as a plantar approach. Their overall success rate was 86%, where the patients were at least 50% better regardless of the technique. Their dorsal technique was similar to what other authors have described, with dissection through the previous site and excision of the neuroma and transection of the nerve stump proximally in the interdigital space. Their plantar approach utilized a transverse incision proximal to the weight bearing surface of the forefoot, over the involved intermetatarsal space. Once the involved nerve trunk was identified, a portion of the proper metatarsal nerve was resected and the proximal portion of the nerve trunk was allowed to retract proximally into the arch of the foot. In addition, they did not excise the recurrent neuroma. Seventy-three percent of the patients who underwent treatment of a recurrent neuroma via the plantar approach were 75 to 100% better (17/24), while there were 2 patients (8%) who were worse or only 25% improved. They had an additional 20% (5/24) who were only 50% better. They did not report any problems related to the plantar incision with regard to scarring, and felt that overall it was a sound approach and procedure. Their results were similar between the plantar and dorsal approaches, but the overall technique was easier through the plantar incision. They did comment on the failures, and felt that it was unnecessary to excise the recurrent neuroma.

Mann and Reynolds (1983) reported on a retrospective study of 76 intermetatarsal neuromas. Their review included a total of 11 recurrent intermetatarsal neuromas in a total of seven patients. They employed a dorsal surgical approach exclusively, because in their opinion the plantar approach posed too much of a risk of a painful plantar scar. Their technique involved resection of the neuroma in combination with resection of the nerve trunk as far proximally as possible in the intermetatarsal space, to avoid a recurrence. They reported an 81% (9/11) success rate with regards to resolution of symptoms. In their findings, the traumatic neuroma was adhered to the under surface

of the metatarsal head. They did not speculate as to why the recurrence took place. When reviewing the two failures, they did not re-explore the sites or discuss the reason for failure.

Bradley et al. in 1976 reported on a series of intermetatarsal neuromas that were excised. Their findings with regard to surgical excision of the recurrent neuroma indicated that it was only successful in about 20% of the cases.

MATERIALS AND METHODS

A total of 13 patients were seen in follow-up for a period of 7 to 26 months postoperatively. The patients were operated on between 10/90 and 5/93 by the author. This review group consisted of 12 females and one male. The average age of the patients was 46. The duration of symptoms prior to reoperation averaged 23 months and ranged from 2 to 108 months. If one patient is excluded (108 months) from the review, the average duration of symptoms changes to 16 months. Of the 13 patients that were operated on for a recurrent neuroma, five were initially operated on by the author. Of those five, one patient (MB) represented a failed decompression neuroplasty with translocation of the nerve, a second (JW) was symptom free for almost 4 months prior to onset of symptoms. The second surgery consisted of re-exploration of the intermetatarsal space without resection of a recurrent neuroma, but is included because of the symptomatology and the approach. This left three definitive recurrences from a pool of 32 patients who had either a neuroma resection (25) or a decompression neuroplasty with translocation (7).

Twelve of the intermetatarsal spaces had only undergone one previous attempt at excision, while one patient (one intermetatarsal space) had two prior surgeries. All prior surgeries had been performed through a dorsal approach.

The patient's symptoms varied but usually consisted of persistent pain that developed after surgery for a previous neuroma. The site was readily identified on physical examination by tenderness to palpation, as well as paresthesia with compression of the metatarsal heads. The pain most often radiated distally into the adjacent toes and occasionally proximally into the arch area. The sensation was described as "electrical" by the majority of the patients. Others had the sensation of a lump or a wrinkle in their sock in the affected

intermetatarsal space. It was not uncommon for the patient to have areas of hypesthesia in the adjacent interdigital spaces, as well as the area directly beneath the intermetatarsal space from the area of the previously excised neuroma. Most patients developed their symptoms 3 weeks to 6 months after surgery.

The majority of the patients were treated in a conservative manner prior to undergoing additional surgery. This treatment consisted of strapping, orthosis, injections, and physical therapy.

SURGICAL TECHNIQUE

Plantar Approach

The patient was usually positioned prone on the operating table. Anesthesia was achieved via a local block with or without sedation. General or spinal anesthesia was not employed in this series, but may be necessary depending on the patient. Tourniquet hemostasis for the initial dissection and neuroma resection is recommended, but not necessary. The use of loupe or microscopic magnification is quite important, especially when the surgeon is to perform an epineuriplasty as part of the procedure.

A curvilinear plantar incision was employed in eleven of the thirteen cases. The incision was placed over the indicated intermetatarsal space, usually beginning just proximal to the digital sulcus. It was then directed proximally across the plantar metatarsophalangeal joints between the metatarsal heads, with an attempt made to direct the incision within the plantar skin lines. Once the arch was encountered, the incision was curved or "Z'd" slightly. It was usually necessary to carry the incision into the distal arch region to facilitate exposure. This feature became most important with the addition of the epineuriplasty to the procedure. The dissection was carried sharply through the skin and subcutaneous tissue. Once the distal fibers of the plantar fascia were encountered, they were either separated or incised in a linear fashion from distal to proximal, into the arch of the foot. Directly beneath the fascia, the intrinsic musculature is encountered as well as the proximal portion of the proper metatarsal nerve. Identification of the affected nerve branch at this level is quite easy, due to the significant amount of scar tissue that awaits the surgeon in the distal aspect of the intermetatarsal space. This also facilitates identification of the distal recurrent neuroma.

The recurrent neuroma, or stump neuroma, generally is slightly bulbous in shape and very often has a cauliflower-like appearance. It usually is adhered to every structure in the intermetatarsal space in the area just proximal to the metatarsal necks. It is not uncommon to have prolongations of the nerve fibers extending dorsally into the intermetatarsal space as well. The lesion is then sharply dissected free from all adjacent tissues. Occasionally, the neuroma will have reattached itself to the distal digital branches, or a second, less obvious proper metatarsal nerve will be encountered and attached to the fibrous knot of tissue.

A small vessel loupe placed about the metatarsal nerve will facilitate the dissection process, as will a set of microsurgical instruments. Once the neuroma is dissected free, attention is directed proximally to the metatarsal nerve branch. At this level, the intrinsic musculature should be easily identifiable with light retraction. The proximal portion of the nerve is then stabilized. The surgeon may elect to incise the epineurium and dissect it away from the underlying endoneurium and facile bundles. The nerve is sharply transected at this level. The previously dissected epineurium is then sutured with 6-0 or 8-0 Prolene to create an epineural barrier. Once this is done, the sutured end of the metatarsal nerve can be sutured into the underlying intrinsic musculature, away from the weight bearing surroundings in an attempt to avoid recurrence of a symptomatic neuroma.

The tourniquet is deflated and hemostasis is achieved. Closure is performed in a routine fashion with repair of the subcutaneous tissue and skin. Occasionally, it is necessary to utilize a TLS-type drain, if there has been significant dissection of scar tissue as well as the neuroma.

Dorsal Approach

The historically described dorsal approach was utilized in only two cases. These two cases essentially represented a recurrence of the problem. The first patient (JW) began to experience significant pain and discomfort as well as parathesias at the site of a previously resected neuroma 4 months after surgery. Prior to this time, she had an uneventful recovery.

The second patient (MB) had undergone a decompression neuroplasty with nerve translocation one year prior to her second surgery. In this case, the entire nerve trunk was identified and was

markedly hypertrophied in the interdigital space. Its position was unchanged from its suspension one year earlier. She underwent a successful resection of the hypertrophied nerve trunk with an epineuriplasty and suturing of the nerve end into the dorsal interossei muscle. She went on to an uneventful recovery as well.

Nerve Resection

In the initial two plantar cases, the amputation neuroma was identified and the nerve trunk was traced as far proximal as possible. At that point, it was sharply resected and the proximal nerve trunk was allowed to retract into the arch. Each of these cases went on to an uneventful recovery without subsequent symptoms of a recurrent neuroma. In the remaining eleven cases that were performed via the plantar approach, the use of an epineuriplasty was incorporated as described above. Once the stump was sutured closed, it was then tagged into the intrinsic musculature.

POSTOPERATIVE MANAGEMENT

The postoperative management of those patients that had a plantar incision consisted of three weeks of non-weight bearing on the operative foot. If it was necessary, a small closed suction type drain (TLS) was employed, and was usually discontinued on the third postoperative day. A compression-type dressing was used for the first three to five days, followed by a standard dressing for the next seven to ten days. Bandages were usually discontinued ten to fourteen days after surgery. Selective suture removal was performed if non-absorbable type sutures were employed. The patient was encouraged to soak the foot and perform range of motion of the foot and ankle complex with the initiation of soaking the foot. At the three week mark, the patient began a period of progressive weight bearing with a compression stocking. In some cases, the patient was treated with an adjunctive orthotic device made of aliplast and plastizote, which was molded to their foot prior to starting weight bearing. This was usually fashioned into a neutral shell. Full activity was generally reached by the sixth to eighth week postoperatively.

The postoperative course for those patients undergoing the dorsal surgical approach was immediate weight-bearing to partial weight-bearing

as tolerated in a flexible postoperative shoe with a compression bandage. The dressing was changed initially on the third to fifth postoperative day. It was common for these patients to be out of bandages in seven to ten days, and return to normal soft shoes ten to fourteen days after surgery.

RESULTS

Plantar Incision

Resection of the recurrent neuroma combined with proximal transection of the nerve trunk under slight distal traction, to allow it to retract proximally into the intrinsic muscle complex, yielded total resolution of the plantar neuroma symptoms (2/2). One patient (NB) did continue to suffer from metatarsalgia that was present prior to surgery. This problem resolved with a program of custom orthotics, as well as further surgery to correct hammer toe deformities.

In the remaining patients that underwent the plantar approach, there was total resolution of neuroma symptoms in 8/9 cases. All of these remaining cases employed an epineuriplasty at the level of the nerve trunk transection, in combination with resection of the recurrent neuroma. There was one failure, and it resulted in not only a recurrence but also a full-blown Reflex Sympathetic Dystrophy-like syndrome. It occurred at 5 weeks postoperatively. The RSD syndrome was treated aggressively and eventually resolved, but the recurrent "neuroma" pain persisted and was only somewhat controlled with orthotics.

Overall the plantar approach using the epineural barrier resulted in total relief of previous neuroma pain in 8/9 patients or a success rate of 89%. In combining the two nerve resection techniques through the plantar approach, there was total resolution of symptoms in 10/11 patients for a success rate of 91%.

Plantar Scar

There were two patients who developed problems associated with the plantar scar. The first patient (LA) previously had a severe hypertrophic scar with a recurrent plantar keratosis at the level of metatarsal heads two and three, from repeated verruca excision some years earlier. The incisional approach was oriented to revise the scar through the use of a modified "Z" plasty. However, it was

only successful in the first six months postoperatively, as the patient developed symptoms related to hyperkeratotic tissue buildup. The patient also developed small punctate lesions along the incision line, but no true hypertrophic scar or keloid. The small lesions are painless, but the previous hypertrophic scar requires periodic debridement despite multiple attempts at biomechanical and accommodative control. A second patient (AG) developed similar small punctate lesions along the incision line as well, but does not require periodic attention nor is it painful.

Dorsal Incision

Of the two patients that underwent surgery for their recurrent neuroma via a dorsal incision, each received total resolution of symptoms immediately after surgery. Neither patient had any problems with the dorsal scar. One patient (JW) had a neurolysis with transection of the neuroma, while the second patient (MB) had a resection with epineuriplasty after a failed decompression/relocation. As of this writing, the patient is free of symptoms, and has had no problems with the scar.

Discussion and Conclusions

The incidence of persistent pain following resection of an intermetatarsal neuroma has been reported to occur from 7 to 20% of the time. The development of a recurrent neuroma presents a challenge to the surgeon. Research has shown that any time that there is axonal disruption, a traumatic or stump neuroma is produced. Recently, studies have focused on preventing the formation of a painful stump neuroma through a variety of techniques, including the creation of an epineural barrier as well as sealing the axonal tubules with histoacryl glue. Martini and Fromm reported in 1989 on a series of experiments using the sciatic nerve of rats and various types of closure. In the cases in which the nerve was transected alone, it resulted in a large neuroma. In cases of epineural closure, neuroma formation occurred 56% of the time. In the cases when tissue glue was carefully introduced into the epineural tube, the rate of neuroma formation was only 12.5%.

Resection of a recurrent neuroma has shown to be effective most of the time in providing relief of symptoms related to persistent neuroma pain (improvement of 50% or greater). The dorsal approach advocated by Mann and Reynolds was effective 82% of the time, but their procedure involved transection of the nerve along. Beskin and Baxter reported on both the dorsal and plantar approach. Their findings indicated that the plantar approach resulted in 92% of improvement by at least 50%, while the dorsal approach was 78% effective in relieving at least 50% of the symptoms. In each case, they too only transected the nerve and in the case of the plantar approach they did not resect the recurrent neuroma. They reported no problems with the plantar scar. Johnson et al. report that 67% of those undergoing plantar resection for the recurrent intermetatarsal neuroma were at least 50% better. In addition they reported only one instance of a problematic plantar scar out of 33 cases.

In the author's small yet controlled study group of 13 recurrent neuromas (persistent pain after neuroma excision), the results indicate that the plantar curvilinear approach (11/13), combined with the formation of an epineural barrier (8/9), is more predictable in achieving a greater percentage of patient satisfaction and relief of symptoms. The plantar approach is a relatively simple technique and provides wide exposure to the lesion. The creation of an epineural barrier does require a more advanced technique and skill level of the surgeon. In addition, by creating an epineural barrier, the surgeon is able to bury the nerve stump into a healthy vascular bed, usually away from the weight bearing surface of the forefoot and midfoot. The future for this problem may involve the use of histoacryl glue, although this product has yet to gain FDA approval. Should it become available, it may help eliminate or markedly reduce the occurrence of recurrent neuromas following excision of the intermetatarsal nerve, as well as following recurrent neuroma resection.

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