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Surgical Outcomes for Resection of the Dorsal Exostosis of the Metatarsocuneiform Joints

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ABSTRACT

A retrospective case series testing the efficacy of surgical resection of the dorsal exostosis deformity of the metatarsocuneiform joints was performed. Surgery was performed in 26 consecutive patients (28 feet), in whom previous conservative therapy had failed. All 26 patients had bursitis at the level of the dorsal exostosis deformity. The patients were separated into 2 groups: group 1, those with bursitis and neuritis before surgery (n = 13; 46.4%), and group 2, those with bursitis without neuritis (n = 15; 53.5%). Both groups were evaluated using an 11-point visual analog scale administered preoperatively and ≤1 year postoperatively. The mean pain rating in the patients with neuritis and bursitis before surgery (7.31 ± 2.8) and in those with bursitis without neuritis (6.67 ± 3.4) had both decreased to 0 at 6 months and 1 year after surgery. After surgery, 7 patients (25.2%) experienced neuritis. Of these 7 patients, 4 (57.1%) had continuation of neuritis that was present before surgery and 3 (42.9%) had an onset of neuropraxia that was secondary to the surgery itself. This might have resulted from retraction of the nerves during spur removal. Eventually, all the cases of neuritis resolved. One patient (3.6%) experienced regrowth of their dorsal exostosis deformity, 1 (3.6%) developed an abscess at the surgical site, and 1 (3.6%) developed pain elsewhere at the Lisfranc joint. All patients were subsequently treated at our institution and were pain free and had returned to full activity within 1 year. These results suggest that resection of the dorsal exostosis deformity of the metatarsocuneiform joints is an effective surgical procedure for patients with this deformity.

The dorsal exostosis of the metatarsocuneiform joint, also known as “tarsal boss,” “humped foot,” and “overbone,” is an osteoproliferative lesion that occurs frequently and can be a common source of foot pain (1,2). Published data are lacking concerning the surgical outcomes after resection of the dorsal exostosis deformity. The pain, which has often been described as dull or sharp in nature, is often exacerbated with shoe gear, which acts as an irritant to the deformity and surrounding soft tissue structures (Fig. 1). Few publications have addressed the etiologic factors that contribute to this deformity (1–10). The condition might occur by different mechanisms in either pronated or cavus foot types (3). In the cavus foot, the presence of a plantarflexed first ray can be visible. This can occur when the first ray is hyperdeclinated with respect to the lesser metatarsals. If the first ray is rigid, and the midtarsal and subtalar joints do not compensate for the deformity during gait, excessive weightbearing on the first metatarsal head will occur. As the first metatarsal head is pushed dorsally by the ground, dorsiflexion of the first metatarsal occurs at the metatarsocuneiform joint, leading to repetitive jamming and proliferation in the area (3,4). In the pronated foot, the mechanism is a result of hypermobility at the joint surface. When the subtalar joint pronates during gait, the midtarsal joint increases its pronation about the oblique axis, which subsequently decreases the efficiency of the pull of the peroneus longus tendon at the first metatarsal base. This instability of the first ray causes dorsiflexion and repetitive jamming at the metatarsocuneiform joint (3,4). The spurring at the level of the second and third metatarsocuneiform joint and across the entire tarsometatarsal complex can be attributed to an arthritic condition. Trauma and neuropathic joint disease have also been reported to cause destruction of the articular surface and subsequent spurring of the metatarsocuneiform joints (3).

Secondary findings commonly associated with this deformity include ganglion cysts, adventitious bursitis, and extensor tendonitis (5). Burning or other paresthetic complaints can be seen preoperatively in patients when wearing shoe gear, resulting from the close proximity of nerves that traverse dorsally at the metatarsocuneiform joints. The presence of preoperative neuropraxia is crucial, because it can be exacerbated or continue in the postoperative setting (5). When the deformity has been diagnosed, the patient should begin a

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Fig. 1. Clinical view showing the dorsal exostosis deformity of the first and second metatarsocuneiform joints.

regimen of various conservative treatment options, including padding, steroid injections, nonsteroidal anti-inflammatory drugs, compressive dressings, and shoe gear modifications. However, when conservative therapies fail, outpatient surgery is warranted. Outpatient surgery includes resection of the dorsal exostosis deformity at the metatarsocuneiform joints.

To the best of our knowledge, published data are lacking about surgical outcomes after resection of the dorsal exostosis deformity of the first, second, and third metatarsocuneiform joints. We performed a retrospective study of the efficacy of resection of the dorsal exostosis. We hypothesized that surgical resection of the spurs would provide pain relief to patients and, thus, would be an acceptable treatment option for patients with this deformity.

Patients and Methods

All 26 participants (n = 28 feet), aged 11 to 80 years from Beaumont Hospital Wayne who had undergone surgical resection of the dorsal exostosis of the metatarsocuneiform joints from July 2010 to February 2014 were included in the present study. The institution review board at the Beaumont Health Care system approved the retrospective study. All information was obtained using medical record review by the primary author (V.B.). Of the 26 subjects, 24 were females and 2 were males. The participants were evaluated regarding the level of pain, type of pain, and presence of bursitis with neuritis (group 1) or bursitis without neuritis (group 2). In addition, the nerves that produced the neuritis before and after surgery were also examined. Neuritis was diagnosed by a positive Tinel's sign on palpation of the specific nerve that was causing the patients' symptoms. Bursitis was defined as pain and swelling at the site of the exostosis. Most of the patients underwent a series of conservative treatment options, including padding, orthotics, steroid injections, nonsteroidal anti-inflammatory drugs, compressive dressings, and shoe gear modifications. The interval from the diagnosed onset of pain to surgery ranged from 6 days to 6 years. Several patients had been treated conservatively for the deformity by other physicians and, when presenting to our office, requested surgical correction without repeating conservative care. Conservative therapy had failed in all participants, who were considered outpatient surgical candidates. Additional findings before surgery and the surgical procedures performed in addition to resection of the dorsal exostosis were also recorded (Table). When evaluating the patients' level of pain after surgery, we found no relationship between the pain level and the procedures used. Pain at the exostosis site was not related to other sites of pathology. The exclusion criteria included patients with Charcot or gouty arthropathy, a history of traumatic injury at the level of the metatarsocuneiform joints, and peripheral sensory neuropathy. Pain was evaluated using an 11-point visual analog scale (0 to 10; 1 cm between each whole number), where 0 was no pain and 10 was the worst pain they had ever experienced. The pain level and type were evaluated preoperatively and at 1 week, 3 months, 6 months, and 1 year after surgery. The dorsal protrusion distance of the metatarsal and cuneiform was measured on weight-bearing lateral projection radiographs taken before surgery. A linear line was drawn overlying the midline of the shaft of the first metatarsal and was carried proximal to the level of the metatarsocuneiform joint. The dorsal protrusion distance, as defined as "spurring" at the level of the metatarsal and cuneiform was then measured and recorded (Fig. 2). When measuring the dorsal protrusion distance radiographically, the first author (V.B.) performed the measurements 3 times using picture archiving and communication system radiology software. The average of the values was taken to confirm the mean dorsal protrusion distance. The measurements were thereafter confirmed by our fellowship-trained surgeon (L.M.F.).

Table
Ancillary surgical procedures (N = 28 feet)

Procedure	No. of Feet (%)
Austin/Akin/tailor's bunionectomy/plantar fasciotomy	1 (3.57)
Closing base wedge osteotomy/Akin/tailor's bunionectomy/arthroplasty of second digit	1 (3.57)
Tenotomy and capsulotomy of second metatarsophalangeal joint	1 (3.57)
Tailor's bunionectomy	1 (3.57)
Excision granuloma extensor halluces longus tendon	1 (3.57)
Excision neuroma second intermetatarsal space	1 (3.57)
Synovectomy sinus tarsi	1 (3.57)
Excision neuroma third intermetatarsal space	1 (3.57)
Elevating osteotomy third metatarsal/excision neuroma third intermetatarsal space	1 (3.57)
Excision verrucae plantaris/total nail avulsion	1 (3.57)
Austin/Akin/excision ganglion cyst	1 (3.57)
Closing base wedge/Akin	1 (3.57)
Arthroplasty digits of 2 to 5	1 (3.57)
Silver bunionectomy	1 (3.57)
Total	14 (50)

The presence of Lisfranc joint arthritis, defined by a decrease in joint space and sclerosis, was also recorded. These radiographic parameters were also measured in a comparison group of 40 patients from Beaumont Healthcare System who did not have pain associated with a dorsal exostosis and did not undergo surgery for this particular deformity. The objective of this was to delineate at what point the dorsal protrusion distance of the metatarsal and cuneiform in our group of patients would result in symptoms. Additionally, the first and second intermetatarsal angle was measured. We found no correlation between patients developing spurs with an increased or decreased intermetatarsal angle; thus, it was excluded from the study.

All procedures were performed by the fellowship-trained surgeon (L.M.F.) and corresponding author (V.B.). Follow-up included assessment of pain, functional activity, complications, and treatment of complications up to 1 year after surgery.

Surgical Procedure

All procedures were performed at Beaumont Hospital Wayne with the patient under intravenous sedation. The patients were placed in the supine position on the operating table. A linear incision was made medial to the extensor halluces longus tendon overlying the dorsal exostosis deformity of the first metatarsal cuneiform joint. The deep fascia can include a portion of the extensor retinaculum and is incised to expose the deformity. A linear incision is then made overlying the periosteum and can be reflected to allow for adequate exposure of the exostosis. A power saw is then used to resect the spur at both the metatarsal and cuneiform joints and create a dell "saucerization" at both sides of the articular surface (Fig. 3). Tobin et al (2) in 1989 recommended, if possible, the creation of a dell (i.e., saucerization of the wound bed). They warned that failure to do so will result in recurrent hyperostosis. The foot should then be loaded to ensure that the bone surfaces on either side of the deformity are flush. In patients with dorsal exostosis at the second and third metatarsal joints or more laterally at the tarsometatarsal joints, an incision was made directly over the exostosis using fluoroscopy to allow for better exposure. Caution must be taken in making direct dorsal incisions because of the close proximity of the medial and intermediate dorsal cutaneous nerves, which traverse over the area. Once the deformity has been resected, the superficial, deep fascia, and skin is closed in layers to prevent formation of a hematoma. (Fig. 4).

Postoperative Care

A light sterile compressive dressing is applied and is removed 1 week postoperatively. If the dorsal exostectomy was performed as an isolated procedure, the patients were instructed to bear weight in a surgical shoe, in addition to applying ice and elevating the limb. Additional compression dressings were used for 2 to 4 weeks after the procedure to control edema and pain. Patients who had undergone adjunctive procedures, such as osteotomies, were casted for several weeks and transitioned into athletic shoes within 3 months of the procedure.

Statistical Analysis

The mean measures of pain before surgery were calculated for group 1 versus group 2 and compared using a *t* test. The mean pain score for group 1 was 7.31 and for group 2

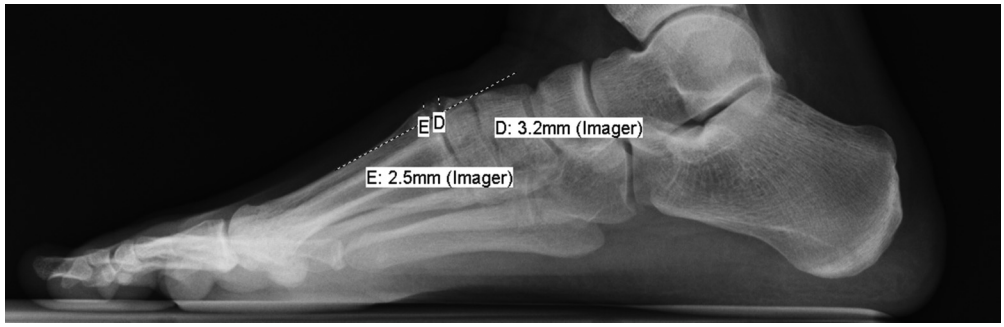

Fig. 2. Lateral weightbearing radiograph measuring dorsal protrusion distance of the metatarsal and cuneiform.

was 6.67, resulting in a t test value of 0.531 ($p = .600$). Therefore, no significant difference was found between the 2 measures. Subsequently, the mean values for group 1 versus group 2 were tested at 1 week, 3 months, 6 months, and 1 year after surgery. At each point, no significant differences were found between the 2 groups ($p = .328$ at 1 week and $p = .474$ at 3 months).

Therefore, paired t tests were performed comparing the mean pain measures at 1 week, 3 months, 6 months, and 1 year after surgery with the pain measure before surgery across both groups. All t values were significant at the $p < .001$ level. These results indicate that statistically significant reduction in pain had occurred 1 week after surgery, with complete resolution of pain at 6 months.

Results

A total of 26 patients (n = 28 feet; 24 females and 2 males) underwent surgical resection of the dorsal exostosis of the metatarsocuneiform joint. Two patients had undergone procedures on both feet. The mean age was 57.61 ± 14.29 (mean ± standard error; range 11 to 80). Surgery was performed on the left foot in 15 patients and the right foot in 13. The patients were separated into 2 groups: group 1, those with neuritis and bursitis before surgery (n = 13; 46.4%), and group 2, those with bursitis without neuritis (n = 15; 53.5%). Both groups were evaluated using an 11-point visual analog scale administered preoperatively and ≤1 year postoperatively. Dorsal exostosis was present at the first metatarsocuneiform joint in 3 feet (10.7%), second metatarsocuneiform joint in 5 feet (17.9%), first and second metatarsocuneiform joint in 12 feet (42.9%), first, second, and third metatarsocuneiform joints in 3 feet (10.7%), second and third metatarsocuneiform joints in 3 feet (10.7%), and across the entire tarsometatarsal joint complex in 2 patients (7.2%; Fig. 5). Neuritis before surgery was noted in 13 feet (46.4%) and was absent in 15 feet (53.5%). Neuritis of the medial dorsal cutaneous nerve before surgery was noted in 11 feet (39.3%), intermediate dorsal cutaneous nerve in 3 feet (10.7%), and deep peroneal nerve in 1 foot (3.6%). Additional surgical procedures (Table 1) unrelated to the dorsal exostosis deformity were performed in 14 of the 28 feet (50.4%).

The mean pain rating using the visual analog scale in group 1 before surgery was 7.31 ± 2.8 (standard deviation) and was 6.67 ± 3.4 in group 2, both had decreased to 1.69 ± 1.9 and 2.60 ± 2.7 at 1 week, 0.23 ± 0.8 and 0.07 ± 0.2 at 3 months, and 0 at 6 months and 1 year after surgery. The mean pain measures for both groups when combined at 1 week, 3 months, 6 months, and 1 year after surgery compared with the pain measure before surgery indicated a statistically significant reduction of pain ($p < .001$).

After surgery, 7 patients (25.2%) experienced neuritis. Of the 7 patients, 4 had continuation of neuritis that was present before surgery and 3 patients experienced an onset of neuropraxia that was secondary to the surgery itself. This might have resulted from retraction of the nerves during spur removal. Eventually, all cases of neuritis resolved. All patients who experienced neuritis after surgery were treated with compression dressings and steroid injections and were pain free at 6 months.

One patient (3.6%) developed cellulitis with abscess and was subsequently admitted to the hospital and treated with intravenous antibiotics. That patient then underwent an incision and drainage procedure and had returned to full activity and was pain-free within 1 month of surgery. One pediatric patient (3.6%) experienced regrowth of their dorsal exostosis deformity 2 years after surgery. Targum and Beloff (1) in 1983 reported that the dorsal exostosis deformity in children has been related to both structural and biomechanical abnormalities and can be seen in children as young as 3 years old. Our patient experienced regrowth of her dorsal exostosis deformity 2 years after her surgery was performed, possibly secondary to sustaining a traumatic injury when playing softball. The patient was given a methylprednisolone (Medrol) dose pack and was pain free within 3 months. She was subsequently lost to follow-up thereafter.

One patient(3.6%) who had had a dorsal exostectomy of the first and second metatarsocuneiform joint developed allodynia with severe pain at the level of the medial dorsal cutaneous nerve and third metatarsocuneiform joint after surgery, consistent with complex

Fig. 3. Intraoperative view showing resection of the dorsal exostosis using medial approach.

Fig. 4. Postoperative radiographs showing saucerization of the metatarsocuneiform joint.

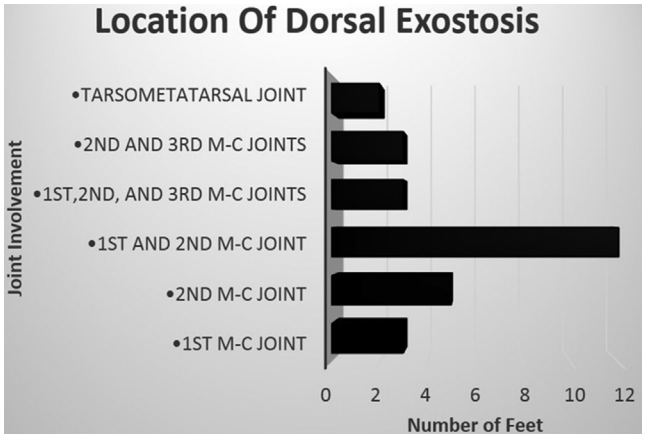

Fig. 5. Distribution of exostosis at the level of the metatarsocuneiform joint.

regional pain syndrome symptoms. The patient underwent further imaging studies, including magnetic resonance imaging, which showed no significant abnormality in the foot, except for the presence of Lisfranc joint arthritis. The patient was also referred to a pain specialist, and complex regional pain syndrome was ruled out. The patient was subsequently treated with compression dressings, bracing, and pain medication. The patient returned to full activity and was pain free at 6 months after the surgical procedure.

On radiographic examination of 26 patients (n = 28 feet) before surgery, the mean dorsal protrusion distance of the first metatarsal was 3.17 mm and of cuneiform was 3.40 mm. Lisfranc joint arthritis was noted in 21 of the 28 feet (75%). In the comparison group of patients without pain at the dorsal exostosis at the metatarsocuneiform joints and who did not undergo surgery, the mean dorsal protrusion distance of the first metatarsal was 1.46 mm and of cuneiform was 1.40 mm. Lisfranc joint arthritis was noted in 12.5% of the patients. This would suggest that the dorsal protrusion distance of the metatarsal and cuneiform on lateral weightbearing radiographs is greater in patients whose deformity is symptomatic. Additionally, uneven protrusion distances on either side of the metatarsocuneiform joint, along with the presence of Lisfranc joint arthritis might exacerbate patients' symptoms.

Discussion

The results of the present study indicate that resection of the dorsal exostosis of the metatarsocuneiform joints is highly effective in treating patients with this deformity. Recent published data discussing the surgical outcomes, complications, and presence of neuritis before and after surgery are lacking. In addition, no method is currently available to measure the spurs radiographically. Marcinko and McGlamry (3) in 1985 reported in their study of 22 patients that the metatarsocuneiform dorsal exostosis occurs equally in both sexes and that an osseous fault in the metatarsocuneiform joint of 5° was indicative of the condition. They found that medial dorsal cutaneous nerve entrapment at the time of surgery was noted in 27% of their patients (3). In our study, we found that the prevalence of medial dorsal cutaneous nerve neuritis after surgery was lower. Tobin et al (2) in 1989 examined the presence of the medial dorsal cutaneous nerve in relation to the first metatarsocuneiform joint in 20 human cadaver feet and found that in all 20 cadaver dissections, the nerve crossed the first metatarsocuneiform joint. The results of the present study demonstrate the importance of identifying the presence of neuritis in patients before and during surgery to prevent further postoperative neuropraxia. Parker (6) in 2005 reported deep peroneal nerve neuritis associated with the dorsal exostosis deformity of the metatarsocuneiform joints in 9 patients. He described surgically decompressing the deep peroneal nerve with concomitant resection of the dorsal exostosis. He related that, postoperatively, patients might experience neuritis secondary to healing of the nerve after decompression and spur resection, which can last ≤3 to 6 months (6). This would suggest that postoperative neuritis is not a complication secondary to resection of the spur but a continuation of the neuropraxia that was present before surgery. In our study, 1 of our patients had medial dorsal cutaneous nerve neuritis, in addition to deep peroneal nerve neuritis secondary to a dorsal exostosis deformity occurring at the level of the second metatarsocuneiform joint. After decompression of the nerves and dorsal exostosis resection, she was pain free within 3 months. Parker (6) commented that the anatomic location of any nerve can vary as much as 17%, and, in fact, an accessory deep peroneal nerve is present in 28% of patients, which can cause discomfort in some patients.

Information in published studies describing surgical resection of the dorsal exostosis of the second and third metatarsocuneiform joints and on patients with neuritis of the intermediate dorsal cutaneous nerve is lacking. Arthrodesis of the Lisfranc joint is an alternative option for these patients; however, it is more technically difficult to perform and should be reserved for patients with more significant joint damage or dislocation at the level of the tarsometatarsal joint. In our study, all patients were pain free and had returned to full activity within 6 months after undergoing simple spur resection at the level of the tarsometatarsal joint.

The present study had several weaknesses. Because all the patients were from our practice, it is possible that the patients had underrated their postoperative pain level in a conscious or unconscious effort to please us. In addition, all our patients were followed up only to 1 year after surgery, a short interval. An additional 5 to 10 years of follow-up might be necessary to determine the long-term clinical outcomes.

In conclusion, resection of the dorsal exostosis of the metatarsocuneiform joints appears to be an effective option for treating patients with this deformity. In our study, resection ensured a minimal recovery period and a return to full pain-free activity within 6 months after surgery. The results of our investigation could be used in the development of future randomized controlled trials on this topic.

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