Patients with diabetic neuropathy or idiopathic peripheral neuropathy, and Ulcer duration for less than 6 weeks

Plantar hallux ulcerations present for longer than 6 weeks

Amputations

Control group of various offloading techniques

Consists of prominent bone and joint resection that contribute to increased pressure and contractures, and neuropathy (1). Traditionally, neuropathic ulcerations are treated non-surgically with wound debridement and local wound care throughout the treatment periods. Post operative course consisted of protected weight bearing and toe-off walking. All patients in group 2 received standard offloading techniques with either total contact casting, or custom made offloading shoes. Patients received appropriate wound debridement and local wound care throughout the treatment periods.

Figure 1. Procedure

A 5 year retrospective review comparing HIPJ arthroplasty with non-operative treatment of recurrent plantar hallux ulcerations was performed. Patients were treated between January 2008 and May 2013 at the Cleveland Clinic, Cleveland, OH. This study was conducted with Institutional Review Board approval. Patients with chronic plantar or plantar-medial ulcerations were identified utilizing an electronic medical record database. Each case was reviewed by two investigators (EE, CN). The authors hypothesis was that patients who undergo HIPJ arthroplasty yield favorable outcomes in the immediate and long-term post-operative course.

Inclusion Criteria:

• Patients with diabetic neuropathy or idiopathic peripheral neuropathy, and
• Plantar hallux ulcerations present for longer than 6 weeks

Exclusion Criteria:

• Prior hallux surgery
• Ulcer duration for less than 6 weeks
• Ulcers not located on the plantar or plantar medial surface of the hallux
• Patients with incomplete documentation or lost to follow-up

Patients were placed into one of two treatment groups:

HIPJ arthroplasty

• Control group of various offloading techniques

Outcomes explored:

• The number of ulcers after ulcer healing after initiation of treatment
• Ulcer recurrence rate
• Amputations
• Other variables for an association with non-healing and patient co-morbidities

Also Correlated:

• Demographics: age, gender, and body mass index (BMI)
• Ulcer duration (weeks) and size prior to treatment (cm²) (Figure 1a)
• Co-morbidities: diabetes mellitus, hypertension, congestive heart failure, peripheral arterial disease (PAD), hemoglobin A1c, and tobacco use.
• Surgical complications: incidence of infection, dehiscence, reinsert, new ulcer site, and deep vein thrombosis

Figure 2. Range of Motion

A total of 109 patients with chronic plantar hallux ulcerations were treated between January 2008 and May 2013 within the Podiatric Centers at the Cleveland Clinic. 55 patients met inclusion criteria for review after applying exclusion criteria. 13 cases of HIPJ arthroplasty were allocated to group 1 (surgical). The remaining 42 were placed into group 2 (control). Furthermore, 13 age-matched patients were selected from group 2 to comprise the final comparison control group. See Table 1 for comparison of patient characteristics. Average age was 55 years with a range of 5 to 208 weeks. Median healing time was found to be 9 weeks in the control group and 13 weeks in the surgical group (p = 0.22). Ulcer recurrence rate was 13.7% (3/22) in the surgical group and 71.4% (16/23) in the control group (p = 0.001). Amputation rate was 0.81% (2/252) in the surgical group and 4.7% (10/213) in the control group (p = 0.24). These results showed significant improvement in healing time, recurrences, and amputations between the two groups.

In conclusion, HIPJ arthroplasty for the treatment of recalcitrant hallux ulcerations yields favorable outcomes in the immediate and long-term post-operative course.

Table 1: Comparison of Characteristics of Patients

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Surgical Group (N = 42)</th>
<th>Control Group (N = 42)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>55 (25, 69)</td>
<td>55 (25, 69)</td>
<td>0.79</td>
</tr>
<tr>
<td>Gender</td>
<td>M: 26; F: 16</td>
<td>M: 26; F: 16</td>
<td>0.82</td>
</tr>
<tr>
<td>BMI &gt; 25.0</td>
<td>16 (38.1)</td>
<td>12 (28.6)</td>
<td>0.38</td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
<td>16 (38.1)</td>
<td>12 (28.6)</td>
<td>0.38</td>
</tr>
<tr>
<td>Chronic Kidney Disease</td>
<td>7 (16.7)</td>
<td>5 (11.9)</td>
<td>0.52</td>
</tr>
<tr>
<td>History of Hypertension</td>
<td>18 (42.9)</td>
<td>18 (42.9)</td>
<td>1.00</td>
</tr>
<tr>
<td>History of Tobacco Use</td>
<td>7 (16.7)</td>
<td>7 (16.7)</td>
<td>1.00</td>
</tr>
<tr>
<td>Ulcers per patient</td>
<td>1.8 (1.0, 2.0)</td>
<td>2.0 (1.0, 3.0)</td>
<td>0.47</td>
</tr>
</tbody>
</table>

Table 2: Comparison of Outcome Measures

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Surgical Group (N = 13)</th>
<th>Control Group (N = 23)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healing Time (weeks)</td>
<td>9.3 (3.2, 11.3)</td>
<td>13.0 (6.0, 20.9)</td>
<td>0.02</td>
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<tr>
<td>Ulcer Recurrence Rate (%)</td>
<td>13.7 (3/22)</td>
<td>71.4 (16/23)</td>
<td>0.001</td>
</tr>
<tr>
<td>Amputations Rate (%)</td>
<td>0.81 (2/252)</td>
<td>4.7 (10/213)</td>
<td>0.24</td>
</tr>
</tbody>
</table>

Results of this study reveal HIPJ arthroplasty is effective in the treatment of recalcitrant hallux ulcerations in diabetic patients with neuropathy. Our results support the findings of this single center study performed over 25 years ago. The concept of internal offloading in diabetic patients has been described and applies to other areas of the foot (9). Oclusive prominence of the NFL along with plantar contractures and restricted motion predisposes the plantar aspect of the hallux to ulceration in neuropathic patients. Recognizing this joint prominence internally relieves pressure on the soft tissue eliminating one key factor in ulcer development and recurrence.

In the surgical group, ulcers healed over a shorter period with no amputations occurring post-operatively. All patients used custom inserts and protective footwear after ulcers healed, which played a key role in preventing ulcer recurrence (3). One ulcer recurrence was observed in this group of 42 post-operatively. Further evaluation of this patient identified co-morbidities characteristic of advanced disease. In addition to a diagnosis of CHF, CKD, and PAD, this patient had 10% ankle brachial index (ABI) and ankle pressure < 5 cmH2O. This patient also took the longest to heal post-operatively (12 weeks). This change in findings, we expect that patients with vasculopathy, longstanding diabetes, and comorbidities will have slower healing rates.

Furthermore, 13 age-matched patients that formed the 2nd 25% in patients to the plantar 2nd metatarsal phalangeal joint in 1 patient. These healed unreliably without surgical intervention. HIPJ arthroplasty may render the hallux unstable and shortened if there is excessive resection of the proximal phalangeal head. Thus, potential sequelae of this procedure are transferred losses to the 2nd ray. The surgeon will need to determine how much tension is required to close any wound defect, while taking into account 2nd digit length, to avoid transfer lesions, ulcer recurrence, hallux instability, and excessive shortening. Additional fixation with a 0.02 K wire was not used in the presence of deeper ulceration or suspicion of infection.

Conclusions of this study include the retrograde nature which was found to be incomplete or missing records. Also the number of patients in both treatment groups was small, limiting stronger statistical analysis powers pertaining to time to event outcomes. There also is the possibility of selection bias relating to patient enrollment in the surgical group. More advanced, higher-powered, prospective or randomized control trial studies are needed in the future to better understand the outcomes of HIPJ arthroplasty.

In conclusion, HIPJ arthroplasty for the treatment of recalcitrant hallux ulcerations yields favorable outcomes in the immediate and long-term post-operative course.

This procedure is a viable option for the foot and ankle surgeon in preventing hallux ulcer recurrence and amputations in patients with diabetes related neuropathy.

To the authors knowledge, only one study has evaluated the efficacy of HIPJ arthroplasty for the treatment of recalcitrant hallux ulcerations (2). In 1994, Tham and coworkers reviewed the outcomes of 40 patients for chronic plantar ulcerative ulcers. The found that 31% of patients had healed with no evidence of new ulcer formation, which ranged from 4 to 44 months. This study concluded that HIPJ arthroplasty is a valuable procedure for chronic ulcerations. There have been several proposed surgical treatments for healing of digital ulcers including metatarsal head resection, arthrodesis, and amputation (3).

References


Figure 2. Range of Motion

Figure 3. Preventive Offloading