Comparison of Two Surgical Approaches for Displaced Intra-articular Calcaneal Fractures: Minimally Invasive Sinus Tarsi Versus Extensile Lateral Approach

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Comparison of Two Surgical Approaches for Displaced Intra-articular Calcaneal Fractures:

Minimally Invasive Sinus Tarsi Versus Extensile Lateral Approach
Abstract

Background Two common surgical approaches are used for displaced intra-articular calcaneal fractures such as the minimally invasive sinus tarsi and extensile lateral approach. The purpose of this study was to compare the outcomes between these two approaches for Sanders II and III of displaced intra-articular calcaneal fractures.

Methods Open reduction and internal fixation using the sinus tarsi and extensile lateral approach was studied in 100 cases with displaced intra-articular calcaneal fractures (40 sinus tarsi and 60 extensile lateral). All patients were evaluated both clinically and radiologically.

Results Mean AOFAS score was 27.4 ± 6.1 in the sinus tarsi group and 27.1 ± 7.4 in the extensile lateral group preoperatively, and these improved to 88.6 ± 4.9 and 86.8 ± 6.3 at the final follow-up, respectively. Mean Böhler and Gissane angle in the sinus tarsi and extensile lateral group showed improvement, from 17.9 ± 8.4, 121.1 ± 10.9 and 18.3 ± 11.3, 118.7 ± 14 preoperatively, to 26.7 ± 8.6, 115.2 ± 6.9 and 25.1 ± 9.7, 116.8±13.3 at the final follow-up, respectively. Mean calcaneal height, length, and width in the sinus tarsi and extensile lateral groups showed improvement, from 40.3 ± 5.6, 76.3 ± 8.1, 39.5 ± 6.0 and 40.7 ± 5.1, 75.1 ± 6.0, 41.0 ± 6.5 preoperatively, to 46.1 ± 4.5, 77.4 ± 6.3, 38.3 ± 5.3 and 46.3 ± 5.0, 76.1 ± 5.6, 39.0 ± 4.1 at the final follow-up, respectively. No significant differences in clinical and radiologic outcomes were observed between the two groups. However, wound complication rate (13.3%) in the extensile lateral group was significantly higher than that (0%) in the sinus tarsi group.

Conclusions The final clinical and radiological outcomes between the two approaches for Sanders II and III intra-articular calcaneal fractures were comparable and equally successful. The selective minimally invasive sinus tarsi approach appears to be an effective and reliable method for the treatment of displaced intra-articular calcaneal fractures Sanders II and III.

Keywords Calcaneus, Intra-articular fracture, Sinus tarsi approach, Extensile lateral approach
**Background**

Displaced intra-articular calcaneal fractures (DIACF) have been recognized as a source of significant disability and are one of the most difficult articular fractures to treat [1]. There has historically been debate over the best option for treating these fractures [1,2]. DIACF are often accompanied by long-term functional disability and complications after the treatment period [2,3]. Therefore, clinical outcomes do not satisfy surgeons and patients.

Treatment of calcaneal fractures is divided into conservative and operative management; however, it is generally accepted that operative management of DIACF is warranted in most cases to avoid the negative consequences of malunion [1-4]. Operative treatment for DIACF consists of open reduction internal fixation, the Essex–Lopresti reduction maneuver, and primary arthrodesis [4].

The goal of operative treatment is to acquire anatomic reduction of the articular surface, restore the subtalar joint, and to maintain this reduction with stable fixation [3-5]. Thus, recently open reduction internal fixation has been considered the gold standard treatment for DIACF [6].

Several open surgical techniques such as medical, lateral, combined lateral and medial, and posterior approaches have been described, of which the extensile lateral approach has gained wide popularity for open reduction internal fixation of DIACF [4,7,8].

The extensile lateral approach provides excellent visualization of the fracture site, allowing access to manipulate and rigidly fix the injury and directly reduce the displaced fracture fragment [3,7]. Despite meticulous attention to soft tissue management, a fairly high complication rate has been seen with this approach, including wound healing complications, deep infections, sural nerve injuries, and subtalar arthritis [9-11].

Because of these problems, there has been renewed interest in small incision surgery for calcaneal fractures [12]. A small incision has been described with various modifications, such as the sinus tarsi approach [12,13]. These techniques all attempt to minimize soft tissue trauma, thereby minimizing the risk of operative complications, while still allowing good fracture reduction. However, these approaches also have some problems such as technical difficulties, poor visualization of the fracture site, and difficulty with manipulation [14].
Several studies have described the clinical outcomes associated with the extensile lateral and sinus tarsi approached [11-13]. However, few studies have compared results of operative fixation of DIACF treated with the minimally invasive sinus tarsi approach versus those treated with the traditional extensile lateral approach. One study reported that the clinical results are similar between DIACF treated by the extensile lateral approach and those treated by a minimally invasive approach. However, the minimally invasive approach has a significantly lower incidence of wound complications and secondary surgeries [14].

We hypothesized that the outcomes between Sanders classification II and III of DIACF treated with the sinus tarsi and extensile lateral approaches are comparable and successful. Accordingly, the purpose of the present study was to compare the clinical and radiological outcomes between the two surgical approaches for Sanders II and III of DIACF.

Methods

Patient populations

A total of 130 cases underwent open reduction and internal fixation for treatment of DIACF from September 2004 to February 2011. All procedures were performed by a single surgeon. Inclusion criteria included patients over the age of 17 years, fracture classified as Sanders type II and III, and fractures treated with operative management via a minimally invasive sinus tarsi or extensile lateral approach. 30 cases who were less than 17 years of age (4 cases), were classified as Sanders types I and IV (18 cases), and those with extra-articular fractures (8 cases), were excluded.

The remaining 100 cases were enrolled in this cohort study. The 100 cases were divided into 2 group; a minimally invasive sinus tarsi approach group (40 fractures, ST group) and an extensile lateral approach group (60 fractures, EL group)

A meticulous clinical chart and radiographic review was performed for all patients. Demographic data were collected for all patients including age, sex, tobacco use, presence or absence of diabetes, injury side, time to surgery, operation time, and follow-up duration. The Sanders classification was determined based on computed tomography (CT) scans. Demographic data are shown in Table 1. The ST group consisted of 25 men and 15 women (mean age, 45.8 years). The mean follow-up duration was 47.6 (26-100) months. The EL group consisted of 38 men and 22 women (mean age, 42.2 years). The mean follow-up duration was
57.7 (36-96) months. The ST group had 8 tobacco users (20%) versus 13 tobacco users (21.6%) in the EL group. The ST group had 1 patient (2.5%) with diabetes mellitus versus 2 patients (3.3%) in the EL group. The mean time to surgery in the ST group was 6.5 days versus 8.2 days in the EL group. Mean operation time was 61.7 minutes in the ST group versus 78.7 minutes in the EL group. CT scans with reconstructions were obtained on all patients before surgery. The ST group consisted of 25 patients in Sanders classification II (62.5%) and 15 in Sanders classification III (37.5%) versus the EL group with 37 Sanders classification II (61.6%) and 23 Sanders classification III (38.4%).

Radiological evaluations

CT scans were obtained to confirm Sanders classification preoperatively and were used to detect the posterior facet and fracture to assist in preoperative planning. Classification of DIACF according to Sanders [6] is based on coronal computed tomographic scans. All non-displaced articular fractures were considered type I. Type II was defined as two-part fractures of the posterior facet; three subtypes, IIA, IIB and IIC. Type III consisted of three-part fractures characterized by a centrally depressed fragment; subtype included IIIB, IIIAC, and IIIBC. Type IV or four-part fractures were highly comminuted and often had more than four articular fragments.

The plain radiologic evaluation included anteroposterior and lateral view of the calcaneus, the calcaneal tangential view, and Broden’s view to evaluate the posterior facet in all patients. The Gissane and Böhler angles were evaluated. Calcaneal height, length and width were also evaluated.

Clinical evaluations

American Orthopedic Foot and Ankle Society (AOFAS) ankle-hindfoot scale scores, visual analog scale (VAS) pain scores, and the foot function index (FFI) were used to evaluate clinical outcomes. Results were obtained preoperatively using these instruments and at the final follow-up. The 100-point AOFAS scoring system combines subjective and objective data to evaluate clinical parameters; points are allocated as follows: pain (40 points), function (45 points), and alignment (15 points). This system considers a score of ≥ 90 points as excellent, 80–89 points as good, 70–79 points as fair, and a score of ≤ 69 points as poor. The VAS pain score was used to measure the amount of pain patients felt between 0 and 10 points and contained
word descriptors. The scale is most commonly anchored by “no pain” (score of 0) and “the worst imaginable pain” (score of 10).

The 230-point FFI provides information on how foot pain affects the patient’s ability to manage everyday life; points are allocated as follows: pain subscale (90 points), disability subscale (90 points), activity limitation (50 points). All data collection was initially performed by an unbiased study coordinator to minimize any biased when answering the questions.

The rates of wound healing complications, deep infections, sural nerve injuries, peroneal tendinitis, and subtalar arthritis were evaluated.

Operative techniques

The initial treatment with ice and elevation should be continued until soft tissue swelling subsides and skin wrinkles are apparent.

Minimally invasive sinus tarsi approach: Approach was performed by placing the patient in either lateral decubitus or semilateral position with the use of a beanbag on a translucent table. We used a straight incision on the lateral side of the foot just distal to the tip of the fibula and roughly horizontal to the sole of the foot. The incision started approximately 1 cm posterior to the fibula and continued distally for about 3-4 cm. The extensor digitorum brevis was retracted cephalad, and the peroneal tendon was retracted inferiorly for allowing exposure of the sinus tarsi. A Schanz pin was placed in the lateral aspect of the calcaneal tuberosity fragment to restore calcaneal length and height and to correct the varus deformity. Once the fractures were reduced, temporary K-wire fixation was used to hold the fragments in place. Then, a 3.5mm cannulated lag screws (Dupey Synthes, West Chester, PA, USA) were passed across the fracture site from lateral to medial to hold the sustentacular bone. A 6.5 mm cannulated screws (Dupey Synthes, West Chester, PA, USA) were then placed percutaneously from the posterior aspect of the calcaneus. Once rigid fixation was achieved, the incision sites were closed in a layer by layer fashion (Figure 1A).

Extensile lateral approach: Approach was performed by placing the patient in either the lateral decubitus or semilateral positions with the use of a beanbag on a translucent table. The extensile lateral L-shaped incision was performed with standard fashion. The fracture line at the level of the Gissane angle was identified, and the thin lateral wall was retracted inferiorly to expose the articular fracture fragments. Attention was turned
to restoring the height, width, and length of the calcaneus, with was accomplished by complete reduction of articular fragments. Then, 3.5mm cannulated lag screws were placed from the lateral cortex toward the sustentaculum [15]. An H-plate (Dupey Synthes, West Chester, PA, USA) or calcaneal locking plate (Dupey Synthes, West Chester, PA, USA) were applied for the calcaneus to stabilize the posterior facet, the anterior process, and the posterior tuberosity. The reduction was again verified under fluoroscopy and the wound was closed (Figure 1B).

The postoperative management regimen was the same for both groups. The patient was placed in a well-padded short leg splint and a bulky dressing with the elevated for 2-3 days. Once the wound was healed after 2 weeks postoperatively, the splint was converted to a non-weight bearing short leg cast for 4-6 weeks. This cast was followed by progression to weight bearing as tolerated over the next 6-8 weeks.

Statistical analysis

The independent \( t \)-test was used for age, follow-up duration. The Mann-Whitney \( U \)-test used to determine the significance of inter-group differences for the clinical and radiographic outcomes. Pearson’s chi-square test was performed to determine the significance of intergroup differences for the prevalence of complications. A \( p \)-value < 0.05 was considered significant and the statistical analysis was independently performed by a statistician.

Results

Radiological outcomes

The radiographic results are summarized in Table II. All fractures achieved successful union without any adverse events. Mean Gissane angle was 121.1 ± 10.9 in the ST group and 118.7 ± 14 in the EL group preoperatively; it improved to 115.2 ± 6.9 and 116.8 ± 13.3 at the final follow up, respectively. Mean Böhler angle was 17.9 ± 8.4 in the ST group and 18.3 ± 11.3 in the EL group preoperatively; it improved to 26.7 ± 8.6 and 25.1 ± 9.7 at the final follow up.

Mean calcaneal height improved from 40.3 ± 5.6 preoperatively to 46.1 ± 4.5 at the final follow up in the ST group and from 40.7 ± 5.1 preoperatively to 46.3 ± 5.0 at the final follow up in the EL group. Mean calcaneal length improved from 76.3 ± 8.1 preoperatively to 77.4 ± 6.3 at the final follow up in the ST
group and from 75.1 ± 6.0 preoperatively to 76.1 ± 5.6 at the final follow up in the EL group. Mean calcaneal width improved from 39.5 ± 6.0 preoperatively to 38.3 ± 5.3 at the final follow up in the ST group and from 41.0 ± 6.5 preoperatively to 39.0 ± 4.1 at the final follow up in the EL group. Radiologic outcomes were not significantly different between the two groups (p-value > 0.05) (Figures 2, 3).

Clinical outcomes
The clinical results are summarized in Table III. Mean AOFAS scores were 27.4 ± 6.1 points in the ST group and 27.1 ± 7.4 points in the EL group preoperatively and improved to 88.6 ± 4.9 points and 86.8 ± 6.3 points at the final follow up, respectively. The overall results according to AOFAS scores were excellent in 24 (60.0%) patients; good in 15 (37.5%), fair in one (2.5%) in the ST group and were excellent in 30 (50%) patients; good in 28 (46.6%), and fair in 2 (3.4%) in the EL group; yielding a 96.6% and 97.4% excellent or good rating in both groups, respectively. Mean VAS scores improved from 7.6 ± 0.9 points preoperatively to 2.1 ± 1.0 points at the final follow-up in the ST group and from 7.7 ± 0.9 points preoperatively to 2.3 ± 1.3 points at the final follow-up in the EL group. Mean FFI scores improved from 135.1 ± 18.6 points preoperatively to 22.1 ± 3.2 points at the final follow-up in the ST group and from 136.3 ± 19.6 points preoperatively to 22.8 ± 4.6 points at the final follow-up in the EL group. No significant differences were observed between the groups for these scores (p-value > 0.05).

Complications
The complications are summarized in Table IV. 8 cases (13.3%) of wound healing complications occurred in the EL group. However, none required operative treatment. No wound healing complications were observed in the ST group. The presence or absence of residual numbness in the sural nerve distribution was determined from clinical review. 4 of 60 patients (6.6%) in the EL group complained of sural nerve symptoms. However, no patient required exploration or sural neuroma excision. 2 of 40 patients (5%) in the ST group complained of sural nerve symptoms but no patient required intervention. 1 case of peroneal tendinitis was observed in the EL approach group. However, none required operative treatment. No peroneal tendinitis was observed in the ST group. 5 of 60 patients (8.3%) in the EL group complained of painful subtalar arthritis, and one required exploration and surgical release. 4 patients reduced their pain by doing
subtalar circle motion exercises. 3 of 40 patients (7.5%) in the ST group complained of painful subtalar arthritis, and 1 required exploration and surgical release. 2 patients reduced their pain by subtalar circle motion exercises.

Discussion

This study is to compare the outcomes between ST group and EL group for DIACF. The major finding of study were that the final clinical and radiologic outcomes between the two group for Sanders II and III of DIACF were comparable and equally successful. The EL group had a higher complication rate, particularly wound healing complications, than that in the ST group.

Two common surgical approaches are used for DIACF such as the minimally invasive sinus tarsiand extensile lateral approach. The most popular approach for the open reduction and internal fixation of calcaneal fracture has been the extensile lateral approach [4,7,8,16]. This approach provides excellent visualization and allows access to manipulate and rigidly fix the injury with direct reduction [8,12], but wound complications arise with this approach [9-11]. Wound complication rates following the extensile lateral approach vary from 11–25% [9,10,17]. Moreover, Weber et al [18], reported that the rate of injuries to the sural nerve was 7.7% in their patients treated via the extensile lateral approach. In our study, 13.3% of wound complication rate and 6.6% of sural nerve injury rate were also observed in EL group.

Because of these problems with the extensile lateral approach, there has been renewed interest to develop alternative techniques to manage of intra-articular calcaneal fractures and minimize soft tissue complications [12,13,19,20]. Many techniques have been described over the last 10 years [19,21,22], including percutaneous fixation, arthroscopic assisted, external fixation, trans-articular, and small medial, posterior, lateral or a combined incision technique [12,19-23]. The minimally invasive approach has been described such as the sinus tarsi approach [12,13]. These techniques all attempt to minimize the risk of operative complications, while still allowing good fracture reduction. We focused here on our studies describing the minimally invasive sinus tarsi approach.

Holmes [13] described the minimally invasive sinus tarsi approach for 56 cases of displaced intra-articular calcaneal fractures. The author reported that the sinus tarsi approach provides for adequate exposure to accomplish successful reduction and fixation without soft-tissue compromise. This approach
also reduces the significant risk of postoperative infection and has no reported problems with wound
dehiscence or osteomyelitis. Hospodar et al [24] evaluated 16 consecutive cases using the minimally
invasive sinus tarsi approach. No major wound complications were reported. The posterior facet joint was
successfully reduced to < 2 mm of displacement in 14 patients, and 12 patients were back to work by 6
months postoperatively. In our study, we also achieved successful reduction, bony union, and no wound
complication in 38 patients.

In terms of outcome comparison of these two approaches for DIACF, Kline et al [14] reported on a
retrospective randomized trial of 112 displaced intra-articular calcaneal fractures treated with the extensile
lateral (79 cases) or sinus tarsi (33 cases) approaches. The author described that the clinical results were
similar between calcaneal fractures treated with the two approaches. However, the sinus tarsi approach had a
significantly lower incidence of wound complications and secondary surgery. They concluded that the
minimally invasive approach was a valuable method for treating intra-articular calcaneal fractures.

There are some limitations in this study. First, our average follow-up period was approximately 3 years,
relatively short-term follow-up period. Although this would have certainly revealed any early complications,
it would did not capture all patients who developed symptomatic subtalar arthritis in the future. However,
the present study can provide useful information on the outcome comparison between the two approaches
for treating the DIACF. Second, largely inherent in its retrospective manner. As there was no randomization
and the decision for the type of treatment was at the discretion of the surgeon and was not based on an
established protocol.

In conclusion, the final clinical and radiological results of the sinus tarsi approach were similar and
favorable to the extensile lateral approach. Moreover, the sinus tarsi approach had a lower rate of wound
complications than that of the extensile lateral approach. We believe that the minimally invasive sinus tarsi
approach has become an effective and reliable method to treat Sanders II and III intra-articular calcaneal
fractures.

**Abbreviations**

DIACF: Displaced Intra-Articular Calcaneal Fracture, ST: Sinus Tarsi, EL: Extensile lateral, AOFAS:
American Orthopedic Foot and Ankle Society, VAS: Visual Analog Scale, FFI: Foot Function Index
Competing interests

The authors declare that they have no competing interest

Authors’ contributions

JHY conceived of the study and participated in its design and collected patient’s data and analysis. KBL participated in its design and helped to draft the manuscript. SKK participated in its design and statistical analysis. HJC carried out statistical analysis and drafted the manuscript. All authors read and approved the final manuscript.

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Figure of legends

Figure 1 Photograph showing skin incision line and surgical approach (A) Minimally invasive sinus tarsi approach (B) Extensile lateral approach

Figure 2 Radiologic evaluations of a 55 year old male patient with Sanders II intra-articular calcaneal fracture treated with open reduction and internal fixation using the sinus tarsi approach. (A) Preoperative plain radiographs and CT scans (B) Postoperative plain radiographs

Figure 3 Radiologic evaluations of 52 year old male patient with Sanders II intra-articular calcaneal fracture treated with open reduction and internal fixation using the extensile lateral approach. (A) Preoperative plain radiographs and CT scans (B) Postoperative plain radiographs
**Table I.** Demographic data between the sinus tarsi and extensile lateral approach groups

<table>
<thead>
<tr>
<th></th>
<th>Sinus tarsi (N=40)</th>
<th>Extensile lateral (N=60)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex, male/female, n</td>
<td>25/15</td>
<td>38/22</td>
</tr>
<tr>
<td>Age, y</td>
<td>45.8 (20 to 65)</td>
<td>42.2 (17 to 64)</td>
</tr>
<tr>
<td>Tobacco, n (%)</td>
<td>8 (20%)</td>
<td>13 (21.6%)</td>
</tr>
<tr>
<td>DM, n (%)</td>
<td>1 (2.5%)</td>
<td>2 (3.3%)</td>
</tr>
<tr>
<td>Side of injury, Rt/Lt, n</td>
<td>22/18</td>
<td>36/24</td>
</tr>
<tr>
<td>Time to surgery, d</td>
<td>6.5 (0 to 14)</td>
<td>8.2 (0 to 16)</td>
</tr>
<tr>
<td>Operation time, min</td>
<td>61.7 (40 to 75)</td>
<td>78.7 (65 to 95)</td>
</tr>
<tr>
<td>Sanders classification, n (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IIA; IIB; IIC</td>
<td>15;8;2 (62.5%)</td>
<td>13;18;6 (61.6%)</td>
</tr>
<tr>
<td>IIIAB; IIAC; IIIBC</td>
<td>10;5;0 (37.5%)</td>
<td>11;8;4 (38.4%)</td>
</tr>
<tr>
<td>Follow-up duration, m</td>
<td>47.6 (26 to 100)</td>
<td>57.7 (36 to 96)</td>
</tr>
</tbody>
</table>

*Values are expressed as mean (range) unless otherwise indicated.*
Table II. Radiographic outcomes between the sinus tarsi and extensile lateral approach groups

<table>
<thead>
<tr>
<th>Radiologic outcomes</th>
<th>Sinus tarsi</th>
<th>Extensile lateral</th>
<th>p-value†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Preop</td>
<td>Final follow-up</td>
<td>Preop</td>
</tr>
<tr>
<td>Gissane angle,°</td>
<td>121.1</td>
<td>(95.1 to 148.6)</td>
<td>118.7</td>
</tr>
<tr>
<td>Böhler angle, °</td>
<td>17.9</td>
<td>(0.1 to 35)</td>
<td>18.3</td>
</tr>
<tr>
<td>Height, mm</td>
<td>40.3</td>
<td>(23.2 to 54.1)</td>
<td>40.7</td>
</tr>
<tr>
<td>Length, mm</td>
<td>76.3</td>
<td>(46.7 to 92.0)</td>
<td>75.1</td>
</tr>
<tr>
<td>Width, mm</td>
<td>39.5</td>
<td>(29.6 to 54.2)</td>
<td>41.0</td>
</tr>
</tbody>
</table>

*Values are expressed as mean(range).
† Mann–Whitney U-test
Table III. Clinical outcomes between the sinus tarsi and extensile lateral approach groups

<table>
<thead>
<tr>
<th>Clinical score</th>
<th>Sinus tarsi</th>
<th>Extensile lateral</th>
<th>p-value†</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Preop</td>
<td>Final follow-up</td>
<td>Preop</td>
</tr>
<tr>
<td>AOFAS‡</td>
<td>27.4</td>
<td>88.6</td>
<td>27.1</td>
</tr>
<tr>
<td></td>
<td>(10 to 33)</td>
<td>(76 to 94)</td>
<td>(15 to 35)</td>
</tr>
<tr>
<td>VAS‡</td>
<td>7.6</td>
<td>2.1</td>
<td>7.7</td>
</tr>
<tr>
<td></td>
<td>(6 to 10)</td>
<td>(1 to 5)</td>
<td>(6 to 9)</td>
</tr>
<tr>
<td>FFI‡</td>
<td>135.1</td>
<td>22.1</td>
<td>136.3</td>
</tr>
<tr>
<td></td>
<td>(107 to 194)</td>
<td>(18 to 31)</td>
<td>(107 to 168)</td>
</tr>
</tbody>
</table>

*Values are expressed as mean (range).
†Mann–Whitney U-test
‡AOFAS, American Orthopedic Foot and Ankle Society ankle-hindfoot score; VAS, visual analog scale; FFI, foot function index
Table IV. Complications between the sinus tarsi and extensile lateral approach groups

<table>
<thead>
<tr>
<th>Complication</th>
<th>Sinus tarsi</th>
<th>Extensile lateral</th>
<th>p-value†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonunion</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Wound complication</td>
<td>0</td>
<td>8 (13.3%)</td>
<td>0.004</td>
</tr>
<tr>
<td>Deep infection</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Sural nerve injury</td>
<td>2 (5%)</td>
<td>4 (6.6%)</td>
<td>0.430</td>
</tr>
<tr>
<td>Peroneal tendinitis</td>
<td>0</td>
<td>1 (1.6%)</td>
<td>0.444</td>
</tr>
<tr>
<td>Subtalar stiffness</td>
<td>3 (7.5%)</td>
<td>5 (8.3%)</td>
<td>0.458</td>
</tr>
<tr>
<td>Reoperation</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

*Values are expressed as number (percentage).
†Pearson’s chi-square test