

## TREATMENT OPTIONS FOR DISPLACED FRACTURE OF THE CALCANEAL TUBEROSITY

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### ABSTRACT

#### BACKGROUND

The aim of the study is to compare the outcome following conservative or surgical treatment for displaced fracture of the medial process of the calcaneal tuberosity.

#### MATERIALS AND METHODS

14 men and 4 women aged 20 to 44 years chose to undergo conservative (9 feet) or surgical (10 feet) treatment by a single surgeon for closed displaced fracture of the medial process of the calcaneal tuberosity. The injury mechanism was a fall from a height of <1.5 m; the mean time from injury to treatment was 3 (range 1-7) days. Conservative treatment comprised immobilisation in a plaster cast. Surgical treatment involved fixation with a half thread cannulated screw for large fragments (in 6 feet) or a mini-plate for comminuted fragments (in 4 feet). At the final follow-up, the American Orthopaedic Foot and Ankle Society (AOFAS) ankle and hind foot score was evaluated.

#### RESULTS

The conservative and surgery groups were comparable in terms of age, gender and fracture displacement. The mean follow-up duration was 20 (range, 14-24) months. All patients had bone union; none had implant loosening or breakage. One patient with surgical treatment developed skin numbness at the medial aspect of the heel that resolved following neurotrophic drug treatment for 3 months. The surgery group achieved earlier full weight bearing (5.8 vs. 7.5 weeks,  $p < 0.001$ ) and return to work (5.9 vs. 8.2 weeks,  $p = 0.048$ ), but comparable AOFAS score (89.0 vs. 88.2,  $p = 0.4$ ).

#### CONCLUSION

Surgery for displaced fracture of the medial process of the calcaneal tuberosity enabled earlier full weight bearing and return to work, but comparable AOFAS score.

#### KEYWORDS

Calcaneus, Surgical Procedures, Operative.

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#### BACKGROUND

Calcaneal fracture is the most common type of tarsal bone fracture. Isolated fracture of the medial process of the calcaneal tuberosity is rare and severity of its consequent dysfunction is always underestimated. The medial process of the calcaneal tuberosity is the lowest part of the foot arch and the starting point of the plantar fascia middle beam, abductor hallucis muscle and flexor pollicis brevis.<sup>1</sup>

#### AIMS

The foot arch plays an important role in stress conduction and weight bearing.<sup>2</sup> In falling injury, the bottom of the calcaneal tuberosity hits the ground while the foot is in an

everted position. The medial process is shifted upward and forward by the force and traction of the plantar fascia and abductor hallucis. Inappropriate treatment can cause heel pain and affect normal gait.<sup>3</sup>

#### OBJECTIVES

This study compared the outcome following conservative or surgical treatment for displaced fracture of the medial process of the calcaneal tuberosity.

#### MATERIALS AND METHODS

This study was approved by the ethics committee of our hospital.

#### Inclusion Criteria

Informed consent was obtained from each patient. Between January 2013 and October 2016, 14 men and 4 women aged 20 to 44 years chose to undergo conservative (9 feet) or surgical (10 feet) treatment by a single surgeon for closed displaced fracture of the medial process of the calcaneal tuberosity. The injury mechanism was a fall from a height of <1.5 m; the mean time from injury to treatment was 3 (range 1-7) days.

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### Exclusion Criteria

Patients with an open wound, peripheral vascular disease, skin infection or signs of compartment syndrome were excluded as were those with neurological deficit secondary to head injury or spinal injury or fractures involving other bones of the lower limbs.

### MATERIALS AND METHODS

For conservative treatment, the feet were immobilised in a plaster cast in a varus position for 2 weeks followed by a tube-type gypsum for the next 2 to 4 weeks before weight bearing. Moderate movements of the knee and hip were encouraged to avoid venous thrombosis of the lower extremity.

For surgical treatment, patients were placed in a supine position under subarachnoid anaesthesia with the use of a thigh tourniquet. A 3 to 5 cm incision was made on the medial aspect of the calcaneus. The site was devoid of major vessels and nerves except for the medial calcaneal cutaneous branch of the tibial nerve. The foot was kept

externally rotated with its lateral edge on the operating table. The soft tissue and blood clot were removed. The fracture was reduced and temporarily fixed with a Kirschner wire. Reduction was confirmed by C-arm fluoroscopy. Large fragments were fixed with a half-thread cannulated screw (in 6 feet) and comminuted fragments were fixed with a mini-plate (in 4 feet) (Figure). Position and length of implants were confirmed using the C-arm fluoroscopy.

Postoperatively, patients were instructed to flex and extend the ankle joint at day 1. Non-weight bearing walking was allowed for the first 2 weeks followed by partial weight bearing with a brace or crutches. Full weight bearing was allowed at week 5 to 6. Patients were followed up at 6 weeks, 3 months, 6 months and one year. At the final follow-up, the American Orthopaedic Foot and Ankle Society (AOFAS) ankle and hind foot score was evaluated.<sup>4</sup>

The 2 groups were compared using the independent sample t test. A p value of <0.05 was considered statistically significant.



**Figure (a) Horizontal Section and (b) Coronal View Computed Tomographic Images Showing a Displaced Fracture of the Medial Process of the Calcaneal Tuberosity. Axial Radiographs Showing (c) Screw Fixation of the Left Calcaneus at 2 Days and 3 Months and (d) Mini-Plate Fixation of the Right Calcaneus at 2 Days and 3 Months**

### RESULTS

The conservative and surgery groups were comparable in terms of age ( $30.5 \pm 6.3$  vs.  $29.3 \pm 6.9$  years,  $p=0.687$ ), gender and fracture displacement ( $1.08 \pm 0.1$  vs.  $1.1 \pm 0.16$  cm,  $p=0.864$ ). No patient had blisters preoperatively.

The mean follow-up duration was 20 (range 14-24) months. All patients had bone union; none had implant loosening or breakage. One patient with surgical treatment developed skin numbness at the medial aspect of the heel

that resolved with neurotrophic drug treatment for 3 months.

The surgery group achieved earlier full weightbearing ( $5.8 \pm 0.6$  vs.  $7.5 \pm 0.9$  weeks,  $p<0.001$ ) and return to work (defined as normal gait and no pain) ( $5.9 \pm 0.6$  vs.  $8.2 \pm 1.1$  weeks,  $p=0.048$ ), but comparable AOFAS score ( $89.0 \pm 2.8$  vs.  $88.2 \pm 1.5$ ,  $p=0.4$ ) (Table).

**DISCUSSION**

Calcaneal fractures can be divided into 4 types-  
 Type I- Extra-articular calcaneal avulsion fracture in elderly patients with osteoporosis.  
 Type II- Simple fracture of the medial process of the calcaneal tuberosity.  
 Type III- Type II fracture combined with extra-articular calcaneal avulsion fracture.  
 Type IV- Type II fracture combined with intraarticular calcaneal avulsion fracture.<sup>5</sup>

All our patients were young adults (mean age, 30.5 years) without osteoporosis and sustained the type II fracture secondary to a fall from a height of <1.5 m.

Whether surgical treatment is necessary for fractures of the medial process of calcaneal tuberosity remains controversial. Anatomic reduction helps maintain the foot arch and function of the foot lacking the stable structure inside the foot and being pulled by the tendons and

ligaments. The fragments of the medial process fracture tend to shift upward and forward resulting in more difficulty in achieving closed reduction.<sup>6</sup> Surgery can prevent loss of the weight bearing function of the hind foot, abnormal gait and tightness and pain of the heel.<sup>6</sup> In our study, surgical treatment enabled earlier full weight bearing and return to work. Nonetheless, conservative treatment is better for a displaced fracture <1.5 cm<sup>3</sup>, although it may result in malunion, degenerative arthritis and poor functional outcome. Soft tissues maybe inserted into fracture fragments and thus increase the risk of malunion and nonunion. In our study, the AOFAS score at the final follow-up was similar between the surgical and conservative treatment groups. Long-term follow-up is necessary as patients with conservative treatment may develop bunion that results in loss of the foot arch, joint degeneration and arthritis. Further randomised controlled trials with a larger sample size are needed to determine the optimal treatment and its indications.

Sex/Age (Years)	Fracture Side	Implant	Fracture Displacement (cm)	Full Weight bearing (Weeks)	Return to Work (Weeks)	American Orthopaedic Foot and Ankle Society Score
<b>Surgical Treatment</b>						
M/30	Left	Screw	1	5	5	87.00
M/21	Left	Screw	1.2	6	6	95.00
M/25	Right	Mini Plate	1	6	6	89.00
F/43	Right	Screw	1.1	5	5	86.00
M/25	Right	Screw	1	6	6	90.40
F/36	Right	Mini Plate	1.2	6	6	86.50
M/21	Left	Screw	1.1	6	6	90.00
M/32	Right	Screw	1.4	5	5	87.60
M/30	Left	Mini Plate	1.2	7	7	87.40
M/30	Right	Mini Plate	0.8	6	6	92.00
<b>Conservative Treatment</b>						
M/37	Right	*	1	8	10	89.30
M/30	Left	*	1.1	8	9	86.00
M/20	Right	*	1.3	8	9	89.00
F/36	Right	*	1.1	7	8	88.60
M/30	Right	*	1.1	9	9	87.30
F/37	Right	*	1	7	7	90.50
M/21	Left	*	1.2	6	7	86.00
M/35	Right	*	1	8	8	88.90
M/29	Left	*	1	7	7	88.00

**Table 1. Surgical Versus Conservative Treatment for Closed Displaced Fracture of the Medial Process of the Calcaneal Tuberosity**

**CONCLUSION**

Surgical treatment for displaced fracture of the medial process of the calcaneal tuberosity enabled earlier full weight bearing and return to work, but comparable AOFAS score.

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