

## **Small incision reduction and Kirschner wire internal fixation in the treatment of Sanders type II calcaneal fracture.**

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### **Abstract**

**Objective:** To observe and analyse the effect of small incision poking reduction and Kirschner wire fixation on the treatment of Sanders type II calcaneal fracture.

**Methods:** According to the different treatment plan, 80 cases with Sanders type II calcaneal fractures were selected as the objects. They were divided into two groups and the patients in study group were treated with small incision reduction and internal fixation with Kirschner wires while the patients in control group received open reduction and internal fixation with plate followed by the observation and analysis of therapeutic effect in each group.

**Results:** The results showed that there was no significant difference in excellent rate of treatment between the two groups. The operation indexes were compared as well, which included the operation time, intra-operative blood loss, incision healing time and hospitalization time. The results showed that all the indexes mentioned above in the control group were less than those in the observation group. But there was no significant difference in postoperative Bolher angle, Gissane angle, calcaneal width and Maryland foot score between the two groups.

**Conclusion:** The treatment of small incision reduction and internal fixation with Kirschner wires is beneficial to the rehabilitation of the patients with Sanders type II calcaneal fracture.

**Keywords:** Small incision, Reduction, Internal fixation with Kirschner wires, Sanders type II calcaneal fracture.

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### **Introduction**

In clinical practice, calcaneal fracture is a familiar phenomenon of such clinical manifestations as severe foot pain, swelling and ecchymosis. Those pains not only make influence in the walk capability of the patients but also cause a sense of significant tenderness for them. The fracture occurs when the external force is far greater than that the calcaneal can bear. In this situation, if patients are not able to receive effective treatments in time, they would be easily subject to unsatisfactory reduction, sequelae of traumatic arthritis and other problems. Consequently, it increases patients' suffering and pulls their life quality down. Calcaneal fracture is mainly treated with surgery at present. As numerous experience of practical treatment showed that the treatment of small incision reduction and internal fixation with Kirschner wire could effectively reduce the probability of incision complications caused by open reduction and internal fixation, enhancing the safety and reliability of treatment [1]. Based on the contrastive analysis, we selected 80 cases of type II Sanders calcaneal fracture patients as the research object and observed the effect of treatment of Sanders type II calcaneal fracture by small

incision reduction and internal fixation with Kirschner wire reported as below.

### **Materials and Methods**

#### ***General materials***

80 patients with Sanders type II calcaneal fracture treated in our hospital from May 2014 to May 2017 were enrolled in this study. All patients were received the relevant checks for definite diagnosis of Sanders type II calcaneal fractures. Meanwhile, they received the calcaneal lateral and axial X-ray examination, calcaneal CT scan, as well as the evaluation concerning comminuted calcaneal condition and talocalcaneal articular surface collapse and displacement degree at their admission time. Inclusion criteria: patients with age 18 and above; patients with unilateral Sanders type II calcaneal fractures; patients with follow-up for 12-24 months and complete clinical data. Those patients with foot deformities, other fractures in the same limb or mental disorders were eliminated. Among the 80 patients, there were, in terms of the injury cause, 20 cases of high fall injury and 60 cases of

automobile accident with all signing the formal informed consent. With the method of computer digital randomization, the patients were randomly divided into the control group and the observation group with 40 cases in each group where in the control group there were 25 males and 15 females at the age of 20~68,  $40.6 \pm 2.3$  y old on the average while in the observation group there were 22 males and 18 females at the age of 23~70,  $43.7 \pm 2.8$  y old on the average.

### Methods

The patients in reference group were treated with open reduction and internal fixation with plate fixation: the patients were given a continuous epidural anesthesia program and had pneumatic tourniquet applied on the thigh by the lateral decubitus position. With the L-shaped lateral incision, we started the vertical position of the incision from the tip of the fibula near the tip of the tendon and the front of the tendon. That mastering the horizontal position of the incision was started from the lateral calcaneal artery blood supply of distal silt purple skin to the distal part of the fifth metatarsal base, connecting the two parts to the heel and constructing a slightly curved right angle [2,3]. Next, we incised all layers of the outer part and separated the Kirschner wire for fixing on the talus and external malleolus at the same time. Following the actual form of fracture, we opened the outer wall, then exposed the posterolateral articular fragments, finally reset the fracture blocks and fixed them temporarily by Kirschner wire. After a satisfied effect of fracture reduction, it's the time to place the lateral calcaneal plate followed by screwing, wash patient's incision, and place the drainage tube followed by the closure of the incision. And then the operation was in the end [4,5].

Patients in the study group were treated with small incision reduction and internal fixation with Kirschner wires. The specific procedures were as follows: if the patients were single foot injury, they were told to keep a contralateral prone position and if the patients' feet were injured, they were told to keep a supine position. What should be paid attention to be the patients in either condition should be performed epidural anesthesia. Before surgery, we would tie the tourniquet on patients' injured limb. With the beginning of approaching in the lateral part of heel, the patients were given lateral malleolus under 2 cm as the center point, we cut a 5 cm short transverse incision paralleling to the facies articular posterior [6]. Afterwards, the skin and the subcutaneous layer were dissected to make the tendon periosteum and flap fully lifted, and the lateral wall of the calcaneus and subtalar joint were exposed. Then the position of the fracture line and displaced subsidence were easily to make clear [7,8]. The small periosteum detacher should be slowly put into the fracture line to open the poking reduction and collapsed articular surface, at the same time, we used the Kirschner wire to poke and correct Bohler angle, Gissane angle, valgus deformity and apply lateral extrusion which was a reasonable extrusion of the height and width of the calcaneus. In the C arm X-ray machine, 1 Kirschner wire was placed in front of the posterior margin of the tuberosity of the calcaneus, allowing the needle to cross the articular surface of the calcaneus and to fix it to the talus firmly. After obtaining

a good reset effect, another Kirschner wire was inserted and fixed in a crossed manner [9,10]. Later, one Kirschner wire was placed in the direction of the joint calcaneocuboid at the lower part of the calcaneal tuberosity. Next, it's the time to clean the wound strictly, suture the incision with stratification and place the skin drainage. The Kirschner wire was bent before putting into the skin, leaving 1.5 cm in length, and a cotton pad was taken to compression bandage as well as a plaster for external fixation. Postoperative treatments such as routine antibiotics and swelling were performed and patients' rehabilitation training was enhanced [11-13].

### Observation index

Observation and statistics were conducted on such related surgery indicators of the two groups as operation time, intraoperative blood loss, incision healing time, hospitalization time, postoperative Bolder angle, Gissane angle, calcaneal width, and the Maryland foot score in accordance with standard of Maryland foot scale, which included scores of pain and function with the full score respectively as 45 points and 55 points, the total score being 100 points [14]. A total score of 90 points or above signified an excellent result, the score ranging from 75 points to 90 points a good was performance, the score ranging from 50 to 75 points an optional result and the score less than 50 points indicated a poor result.

### Statistical analysis

The relevant data were analysed and processed by SPSS 21.0. The counting data were expressed by number and percentage and tested by Chi-Square test. The measurement data were represented by mean  $\pm$  standard deviation and tested by t-test.  $P < 0.05$  suggests that the difference is statistically significant.

## Results

### Comparison of relative operative parameters between two groups

As shown in Table 1 below, by comparing related surgical parameters of the patients, the results showed that the study group was clearly superior to the reference group (Table 1).

**Table 1.** Comparison of relative operative parameters between two groups.

Group	Operation time (min)	Intraoperative blood loss (ml)	Length of stay (d)	Incision healing time (d)
Study group	$64.35 \pm 9.86$	$22.16 \pm 5.35$	$5.64 \pm 2.40$	$6.87 \pm 1.20$
Reference group	$99.64 \pm 10.23$	$70.38 \pm 9.65$	$11.69 \pm 3.28$	$12.78 \pm 1.63$
t	0.91	0.87	0.80	0.85
P	0.035	0.010	0.022	0.027

**Overall treatment effect of patients in two groups**

As shown in Table 2 below, by comparing the patient's treatment excellence rates, the results showed no significant difference between the groups.

**Table 2.** Overall treatment effect of two groups' patients.

Group	Excellent	Good	Fair	Poor	Excellent rate
Study group	26	11	2	1	37 (92.50)
Reference group	16	15	3	2	35 (87.50)
$\chi^2$					3.17
P					0.736

**The Bolder angle, Gissane angle and calcaneus width of patients in two groups after operation**

Comparison of the Bolder angles, Gissane angles, and calcaneus widths of the two groups showed that there was no significant difference between two groups (Table 3).

**Table 3.** The Bolder angle, Gissane angle and calcaneus width of patients in two groups after operation.

Group	Bolder angle (degree)	Gissane angle (degree)	Median width of calcaneus (mm)
Study group	31.68 ± 2.34	136.92 ± 6.42	29.78 ± 1.56
Reference group	31.30 ± 3.20	135.80 ± 7.35	30.69 ± 1.65
t	1.95	2.16	2.09
P	0.732	0.615	0.801

**Comparison of Maryland foot scale of patients in two groups**

Comparison of the Maryland foot scores of patients' two groups showed that there was no significant difference between two groups (Table 4).

**Table 4.** Comparison of Maryland foot scale of patients in two groups.

Group	Pain score	Function score	Total mark
Study group	37.69 ± 6.42	45.16 ± 8.35	83.69 ± 15.37
Reference group	36.88 ± 7.32	44.87 ± 8.20	82.65 ± 15.38
t	2.05	2.17	2.15
P	0.379	0.403	0.392

**Discussion**

For patients with calcaneal fractures, what they need most is maximum extent of the restoration of the length, width and height of the calcaneus and the articular surface [15]. Usually calcaneal fracture is characterized by complexity, which should be treated with ORIF (Open Reduction and Internal Fixation). In Sanders type II tongue fracture, calcaneus joint surface has a relatively intact and joint surface has the same consistency with the calcaneal nodules, so it is relatively easy to be reset [16,17]. In view of this, small incision reduction and internal fixation with Kirschner Wires is the best way to treat Sanders II calcaneal fracture.

In this study, patients in the study group were treated with small incision reduction and internal fixation with Kirschner wires and received good recovery in Bolder angle, Gissane angle and calcaneal width by poking reduction with small incision [18]. Compared with open reduction and internal fixation, this kind of the operation has the advantage of convenience, less operation time, smaller wound. Moreover, it can obviously reduce patients' hospitalization time [19,20]. Through the treatment of small incision reduction and internal fixation with Kirschner wires can significantly reduce the incision infection, skin necrosis, postoperative scar formation, effective prevention of subtalar joint stiffness, which can promote the recovery of the Bolder angle, Gissane angle and calcaneal width as soon as possible, thus facilitating patients' fracture healed as soon as possible. Therefore, this surgery had an ideal effect.

**Conclusion**

To sum up, for the patients with Sanders type II calcaneal fracture, small incision reduction and Kirschner wire internal fixation treatment can obtain better effect and reduce hospitalization time, which were conducive to the rehabilitation of patients. Therefore, the small incision reduction and Kirschner wire internal fixation was of huge value for popularization and application.

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