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KASHIWAGI, Daiji

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DIAGNOSIS AND TREATMENT OF FRACTURES OF THE OS CALCIS

Daiji KASHIWAGI M. D. and Noboru INAMATSU M. D.

Department of Orthopedic Surgery
Kobe Medical College

INTRODUCTION

Although the fracture of the os calcis is very difficult to treat and many patients complain of some kind of longstanding troubles after treatment, little attention has been paid to the diagnosis and treatment of this condition and very few reports have been published in Japan, concerning this matter, in the past.

One of the authors has already reported about the diagnosis and subtalar arthrodesis before.

The number of these fractures is not so high but recently it is increasing in the fields of heavy industry and building construction.

There are various kinds of classifications of this fracture in the world litterature, worked out by many authors such as Böhler, Watson-Jones, Palmar, Arnesen and so on.

We classified our cases according to Arnesen. (Table 1.)

Table 1. Figures and type of fractures. (1956—1962)

Group 1.	Extra-articular fractures		30
Group 2.	Intra-articular fractures		51
	a. Tongue type	0	
	b. Depression type	19	
	c. Stamp type	24	
	d. Crushing type	8	
Total			81 fractures

Factors of disability due to os calcis fractures

Most of the patients, specially the cases involving the posterior joint surface, complain of longstanding pain, deformities and disabilities.

In Table 2, the authors summarized the factors connected with the arising of these complaints.

The purpose of treatment of this fracture should be concentrated in the prevention of those factors.

Before starting treatment, an accurate X-ray diagnosis is very important, specially to have a clear-cut picture of the posterior joint surface displacement; this can be done by many methods of projection.

X-ray examination

As a routine, we are using the following methods of projection :

a) Lateral projection — through this projection the change of the tuber-joint angle, the bony prominence towards the sole and the fracture lines of the lateral cortical wall of the calcaneous body are examined.

b) Axial projection — is useful for observing the longitudinal fracture lines, along the calcaneous axis, and the eventual lateral or medial bony bulging.

By this method we can decide, beforehand, if a Westhues' pin should be driven in or not, in order to accomplish the reduction of the fracture.

c) Medial oblique projection — is an important one for examining the posterior subtalar joint.

We either use a projection method according to Anthonsen (1943) or our modification using a special box, with an angle of 25 degrees, on which the lateral side of the foot is placed.

The technic is as follows: The foot is brought into slight dorsiflexion with its lateral side towards the film. The central ray is directed towards a point just below the malleolus medialis with an inclination of 25 degrees in cranio-caudal direction and 30 degrees in dorso-ventral direction. (Fig. 1, 2)

By this method, the posterior subtalar joint surfaces are seen as two parallel lines and if, due to the fracture, joint incongruity or displacement occur, these parallel lines become interrupted or the calcaneous joint surface is seen uneven.

This is one of the most important causes of pain and late osteoarthritis.

d) Peroneal tenography (Kashiwagi)

Lateral cortical bulging beneath the lateral malleolus is a typical deformity of this fracture. Many patients with this deformity complain of pain at this point for a long time.

According to our experience, many changes around the peroneal tendons and the site of the fractured bone can be observed, at the time of surgery, using a lateral approach.

For instance, in some cases, the peroneal tendons were buried in the callus or caught by fragments of the lateral cortical wall, in other cases, they were pushed by a bulged bone prominence beneath the tendon and in still other cases, severe adhesions were found. (Fig. 3, a, b)

We call such symptoms, caused by the above mentioned changes, "the peroneal tendon syndrom" (Table 2.) and we have been using a special X-ray projection method to examine these changes occurring between the tendons and the bone fragments through the injection of contrast medium into the peroneal tendon sheath, called "peroneal tenography". We usually take two X-ray pictures: anteroposterior and lateral projections.

Table 2. Main factors of longstanding troubles in fractures of the os calcis.

1.	Incongruity of the subtalar joint
2.	Diminution of tuber-joint angle—insufficiency of calf muscles
3.	Pes planus deformity
4.	Varus or valgus deformity of the heel
5.	Abnormal bony prominence
6.	Peroneal tendon syndrom

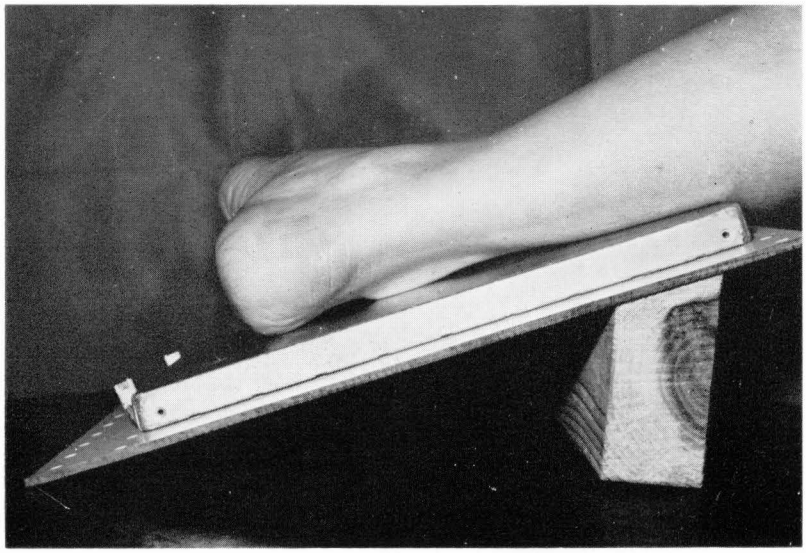

Fig. 1 Medial oblique projection ; (Author's modification)
The picture shows the 25 degrees inclination craniodistally, the central ray should be directed 30 degrees dorsoventrally at the same time.

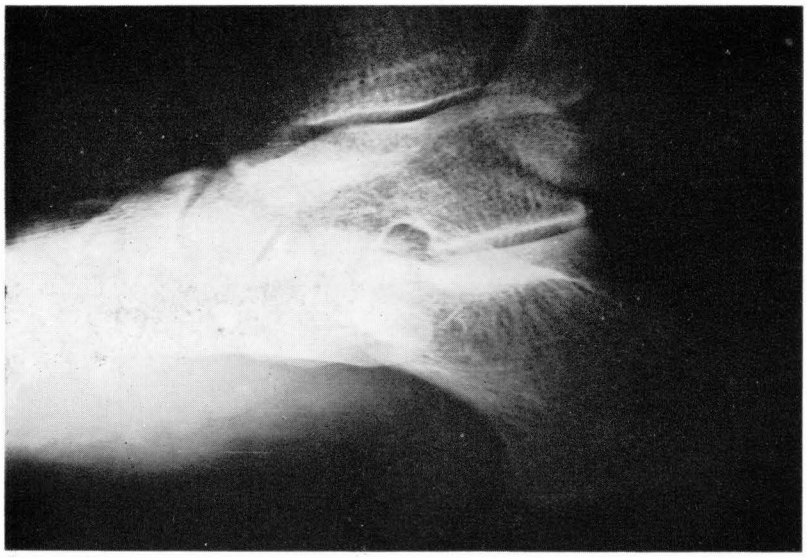

Fig. 2 Normal appearence of subtalar joint in medial oblique projection.

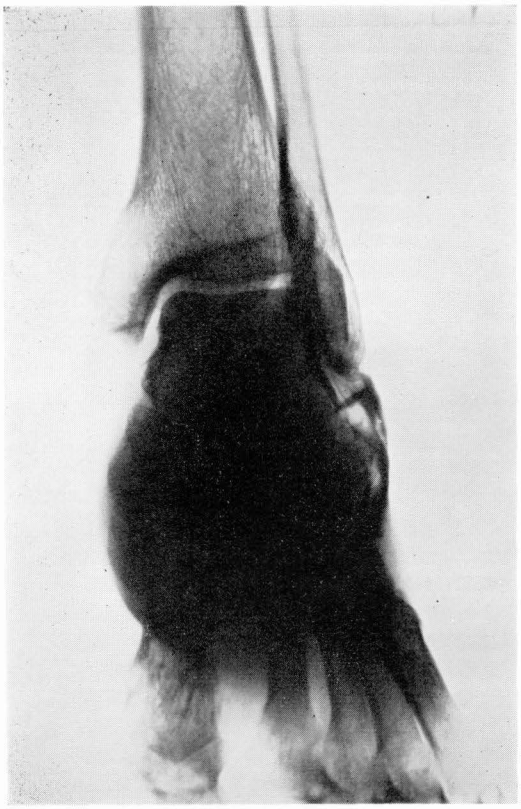

Fig. 3 a) Peroneal tenography ; Fracture case.
Anteroposterior view shows lateral deviation of the contrast material due to "buldging" of the fractured fragment.

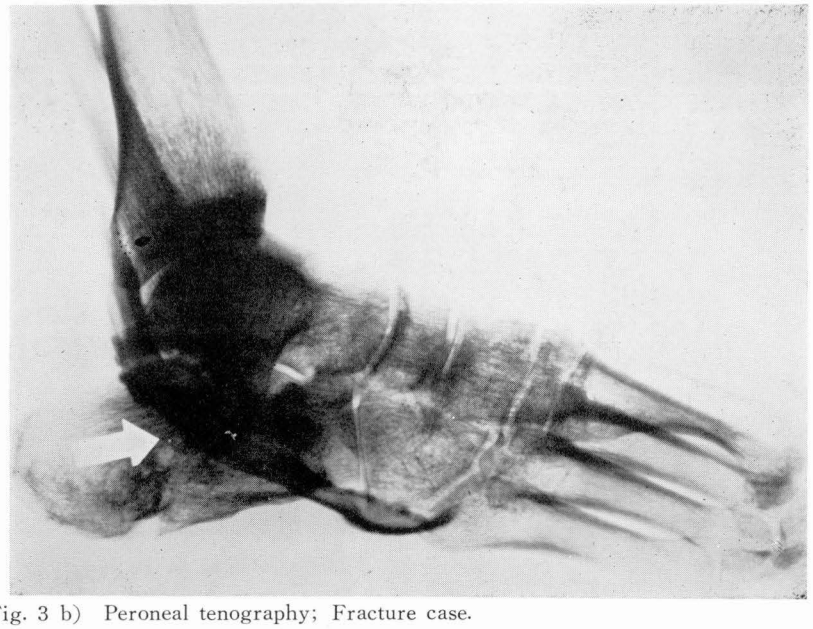

Fig. 3 b) Peroneal tenography; Fracture case.
This lateral view shows a slight deviation from normal appearance.

Our method of treatment

a) Reduction and fixation with Westhues' pin

The tongue type fracture is the best indication of this method. With a Westhues' pin inserted from tuber calcanei, the displaced fragment is reduced to restore the normal tuber-joint angle; sometimes one or two Kirschner wires are helpfull in achieving a more tight fixation. A cast, enclosing the pin, is applied and remains for three or four weeks.

b) Open reduction

For many cases of depression and stamp type fractures, open reduction was performed.

By a lateral approach, we strip the soft tissues and periostium from the lateral wall and pull them upwards including the peroneal tendons, without opening their sheaths; by this way the bulged fragments are visible.

Resecting the fragmented cortical shells, the details of the displaced joint surface can be inspected, as well as reduction and fixation of the fragments can quite easily be attained.

If a big dead cavity remains in the cancellous bone of the calcaneous body, iliac cancellous bone are packed in and the resected lateral cortical wall is replaced by a iliac cortical bone graft. Sometimes one or two Kirschner wires are used for fixation.

For the reduction of the depressed fragment the the calcaneous body, Westhues' pin is very helpful. After reduction and bone grafting, if the fragment is well kept in a good position without the help of pin or wires, the foot is put in a cast for three or four weeks and then the patient starts to move his foot, for active exercises.

If the fixation required pin or wires, the patient is kept in a cast like the Westhues' method, above mentioned.

c) Subtalar arthrodesis

There are many papers discussing about the ideal time for arthrodesis.

If the joint surface is very severely destroyed and can not be reduced, subtalar arthrodesis should be performed at an early stage.

To decide upon the indication the medial oblique projection is very helpful.

We use the iliac bone grafting, after denuding subtalar joint cartilage, or sometimes fixation with Smith-Petersen nail which is a very simple method and after that the patient can wear his shoes and walk within a week.

d) Resection of bony prominence

If there is pain around the peroneal tendons or the sole due to bony prominences, their resection should be recommended.

e) Early movement treatment

Older patients, more than fifty years old, are treated conservatively with non-weight-bearing early movement method.

SUMMARY

1. Accurate radiological examination is very important for treatment of the fracture of the os calcis.

2. The routine methods of X-ray projection in our department are explained.

3. The medial oblique projection is a very helpful method to examine the incongruity of the subtalar joint.

4. The peroneal tenography is also an interesting technique to find a cause of peroneal tendon syndrom.

5. Many treatment methods, which we are doing, are described.

6. At the time of open reduction, the authors recommend resection of the lateral cortical fragments and iliac bone grafting.