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Fractures of the talus: current management strategies in Japan

The first report on Talar fractures associated with subtalar dislocation in the literature has been associated with Frabricus in 1608.[3,17] These fractures came into prominence in association with the use of airplanes, and many talar fractures occurred in "belly landings" of small aircraft, especially during the first and second World wars. These cases were so many that they were also called aviator's astragalus. Coltart gave a comprehensive review of these injuries, and reported more than two hundreds cases occurring in aviation accidents in World War II. [2] Many reports followed in the literature, and in modern times, the injury is most frequently associated with road traffic accidents or falls from heights.

Mechanism of trauma: Talar neck fracture had been believed to be a dorsiflexion injury, with impingement of the talar neck against the anterior tibial rim. However, Peterson proved experimentally in 1976 that the cause of talar neck fracture was concentration of stress onto the neck of the talus, which is one of its weakest points structurally. [18] Not only the neck fracture, but also the body fracture that occur in these injuries can be explained by this theory.

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Types of fractures : Central fractures of the talus are classified into neck fractures and body fractures, and there are many differences between them. Neck fractures are extra-articular fractures, whereas body fractures are intra-articular injuries. The ratios of neck to body fractures reported by different investigators have ranged from 6:1 to 1:1, suggesting that it maybe difficult to differentiate between these two injury patterns. Anatomically, there are three concave points (tarsal canal, tarsal sinus, and posterior subtalar joint) between three prominences (head, lateral process, and posterior process) on the inferior surface of the talus. The concave sites are structurally weak and susceptible to fracture, whereas the prominences are strong and resistant to fracture. [9]

The neck fractures occur between the tarsal canal and the tarsal sinus, and body fractures occur between the tarsal canal and subtalar joint(Fig.1).

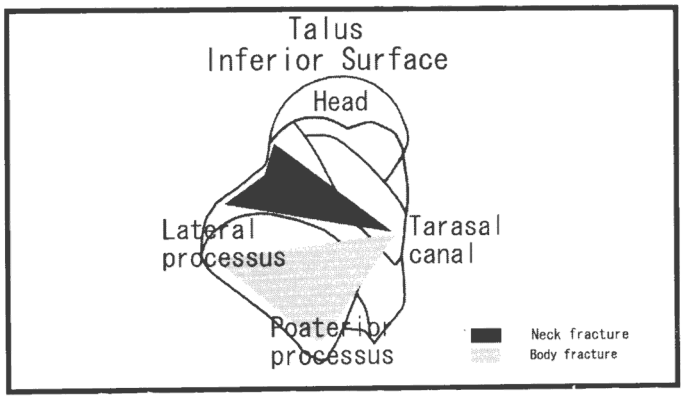

Figure 1 : Neck fractures occur in the black area on the inferior surface of the talus. Body fractures in the gray area. Both areas are separated clearly by lateral processus of the talus.

Both fractures, which account for 90% of the major fractures of the talus, pass through the same site on the medial side, the tarsal canal, and are clearly separated by the lateral process on the lateral side. The medial entrance of the tarsal canal is the key

MRI evaluation: In Japan, there were approximately 3,000 MRI in 1999. Radiological evidence of Hawkins' sign was the only practical method to diagnose aseptic necrosis in the early stages after injury until MRI was introduced into general practice. MRI is a very sensitive investigation, albeit costly, but has the disadvantage of occasionally being too sensitive in revealing aseptic necrosis. If there is no abnormal sign in MRI in a few days after the injury, aseptic necrosis can be ruled out. However, if any sign of aseptic necrosis are observed in MRI within a few days after the injury, it is not mandatory that Hawkins' sign will appear 6 weeks after injury. Similarly, one cannot know whether sclerotic change will be found in these cases on taking simple roentgengraphs 3 months after injury or not. There are the false positive findings of MRI for aseptic necrosis just after injury. However, MRI is very important to decide in the early stages that aseptic necrosis has not occurred, because there is no false negative finding, and if no AVN is noted on MRI, one can be sure that it will not occur. [15]

Abnormalities observed on MRI continue to be seen even as late as a few years after revascularization is observed in routine x-rays. Therefore, it may become difficult to decide by MRI when weight bearing should be allowed after fracture, even when there is plain radiographic evidence of revascularization. The fracture line is revealed by MRI for such a long time, that pseudoarthrosis or delayed union should not be diagnosed by MRI picture alone. [16]

MRI is very useful to reveal osteochondral lesions in trochlea of the talar body and spontaneous or idiopathic aseptic necrosis of the talus.

Treatment: The treatment of talus fracture-dislocation is difficult. The most common problem is aseptic necrosis of the body, which may ultimately be associated with Osteoarthrosis deformance (OA). Aseptic necrosis is followed by collapse of the trochlea and is cause of OA at talocrural and subtalar joints. Malunion of the talar neck may make its prognosis worse.

The ideal management consists of immediate accurate reduction, either by open or closed methods, and stable fixation by screw fixation. Previously stainless steel screws were employed, and these then evolved to cannulated variety to enable fixation over k-wires put under image intensifier control. There have been various reports highlighting the advantages and disadvantages of screw placement from the anterior or the posterior side, parallel or crossed screws placement, and the need for postoperative external immobilization.

Titanium cannulated screws have now become popular in Japan to enable fracture follow up by MRI. (Fig. 7, 8)

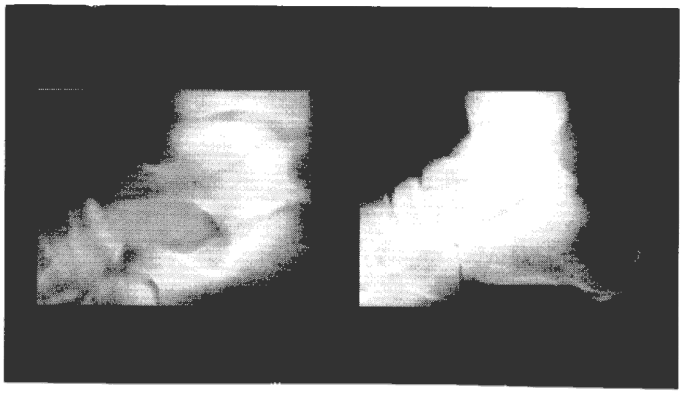

Figure 7 : Horizontal fracture of the talus. Fracture line runs from the head through the neck to the body. Left: Lateral view of simple Roentgen graph. Right: Lateral view of tomogram.

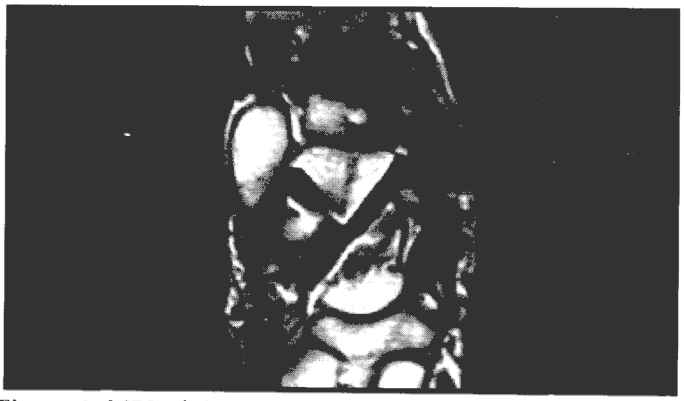

Figure 8: MRI of the talus fracture fixed by crossing double titanium cannulated screws. Axial view.

These screws can be orientated by guide pin under X-ray control are also very useful to gain anatomical reduction and firm fixation. Open reduction and

aseptic necrosis of the talus seldom occurs in type 1, dislocations are very rare. [12,13]

internal fixation (ORIF) have now become the accepted modality of stabilization, especially in displaced type 2 and 3 fractures, and the role of external immobilization by POP slab or plaster has significantly reduced. Stable fractures of the talar neck fixed by double titanium cannulated screws do not need external fixation. [14] At our center we advocate that a CPM (continuous passive movement) machine should be applied in such a case, to enhance venous flow and minimize residual ankle stiffness.

Some operative methods like vascularized bone graft have been tried to prevent aseptic necrosis and to promote revascularization after aseptic necrosis, but their effectiveness has not been adequately documented. At certain centers trials have been started to promote revascularization by multiple drilling of the necrotic talar body, but the methodology is experimental at best and needs sufficient follow up of many cases to be recommended as a routine procedure. Therefore, at the present time, there is no good method for enhancing revascularization after aseptic necrosis except waiting for revascularization by using standard non weight-bearing protocols either by orthoses or by PTB casts. The aim is to transfer weight proximally and to prevent collapse of the talar trochlea; other options include the use of vascularized bone grafts to promote bone union at the site of pseudoarthrosis. In established cases, the option of Blair's fusion is thought to be a good operation after collapse of the trochlea has occurred, because partial movement at the subtalar joint and the height of hind foot are restored. However, bone union is difficult and pseudoarthrosis is not rare in this procedure. Therefore, a small T shaped metal plate maybe used to reinforce the sliding bone graft.

Arthroscopic evaluation, not only in the talocrural joint but also in the subtalar joint, is more frequently being put in practice. It is also being employed in some centers as a useful aid to ensure the reposition of the talus fracture dislocation after closed or even open reduction. Drilling or fixation by biodegradable pins in osteochondral lesions of the trochlea under arthroscopy has now become very popular in Japan in the last decade.

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