

## Classification of Fractures of the Talus: Clear Differentiation Between Neck and Body Fractures

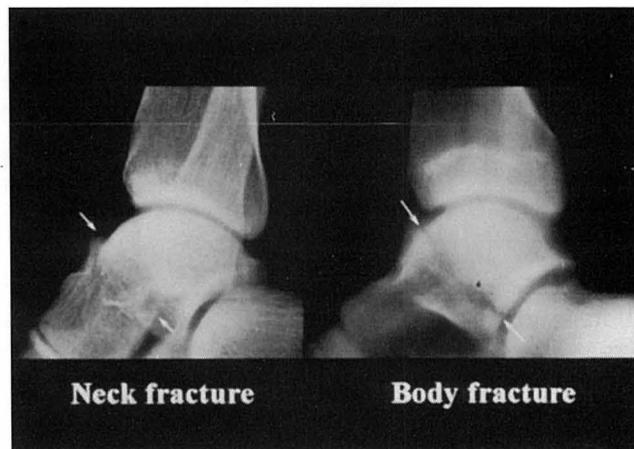
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### ABSTRACT

The treatment and prognosis of neck fractures (extra-articular) and body fractures (intra-articular) of the talus are different. Ratios between neck fractures and body fractures reported by different investigators vary widely (from 6:1 to 1:1), because it is difficult to differentiate fractures crossing the anteromedial aspect of the trochlea. We examined 215 fractures of the talus. By examining the inferior surface fracture line, we found that the 61 fractures crossing the anteromedial aspect of the trochlea could be differentiated into 28 neck fractures and 33 body fractures. We suggest classifying fractures of the talus based on the inferior, not superior, surface fracture line.

### INTRODUCTION

Neck fractures of the talus are extra-articular fractures, whereas body fractures are intra-articular, and thus many differences are evident between these two types of fractures in terms of treatment and prognosis. It is very important to classify them accurately to be able to make appropriate treatment decisions. Major fractures of the talus are usually classified into neck fractures and body fractures. Although that may seem easy and clear, it cannot be easily or clearly determined whether the common fractures crossing over the anteromedial aspect of the trochlea of the talus are neck fractures or body fractures. Similar fractures near the border between the neck and the body seem to be arbitrarily reported as neck fractures or body fractures without justification (Fig. 1). The range of ratios between neck fractures and body fractures reported in the literature is too wide to believe that the diagnoses are accurate. Because this lack of definition confuses discussions on the treatment and prognosis of these



**Fig. 1.** A neck fracture of the talus is shown on the left and a body fracture on the right. The course of both fracture lines on the superior surface is so similar that it is difficult to distinguish the neck fracture from the body fracture. However, on the inferior surface, the fracture on the left is seen to course to the tarsal sinus and the fracture on the right can be seen coursing to the lateral border of the posterior subtalar joint, making it is easy to differentiate between them.

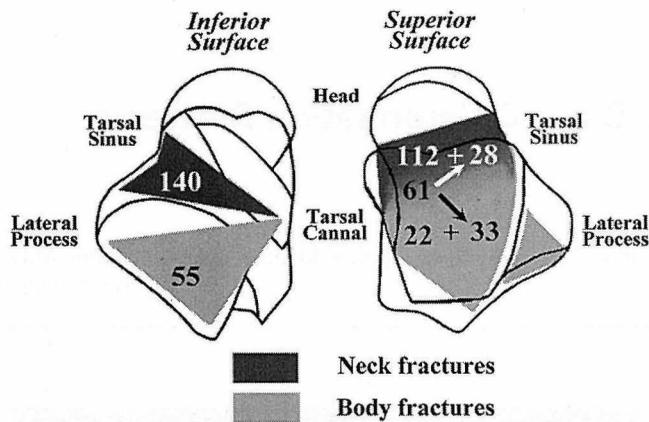
fractures, the aim of this article is to define neck and body fractures accurately.

### MATERIALS AND METHODS

Between 1971 and 1994, 215 major fractures of the talus were treated at Keio University Hospital and affiliated hospitals. We examined the simple radiographs, tomographs, computed tomography (CT) scans, magnetic resonance imaging (MRI) scans, and operation records of these cases and determined the fracture lines. We checked where the main fracture line crossed the inferomedial, inferolateral, superomedial, and superolateral margins of the talus on lateral, medial oblique, and lateral oblique views of the simple radiographs and the tomographs. As a result, we found that it was essential to determine whether the fracture line crossed over the lateral and medial margins of the trochlea, the upper arch of the tarsal sinus

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**Fig. 2.** Talus fractures. The neck fractures (140 feet, black area) and body fractures (55 feet, gray area) were clearly separated by the lateral process on the inferior surface of the talus (left), but they were not clearly separated on the superior surface (right). It was impossible to accurately diagnose 61 fractures on the anterior aspect of the trochlea. Based on the fracture line on the inferior surface, 28 of these 61 fractures were diagnosed as neck fractures and 33 as body fractures.

and tarsal canal, and the lateral border of the posterior subtalar joint to identify accurately the specific fracture.

## RESULTS

Figure 2 shows the distribution of fractures on the inferior surface and the superior surface of the talus. The fracture crossed the medial margin on the inferior surface of the talus at the medial entrance of the tarsal canal in 195 of 215 feet. In 140 of those feet, the fracture crossed the lateral margin on the inferior surface of the talus at the lateral entrance of the tarsal sinus, and in the other 55 feet, it crossed at the posterior subtalar joint.

The fracture crossed over the anteromedial aspect of the trochlea of the talus in 61 feet. In 28 of those feet, the fracture coursed along the sinus tarsi on the inferior surface of the talus, whereas it coursed along the posterior subtalar joint surface in the remaining 33 feet. We define "neck fracture" as a fracture crossing the lateral entrance of the tarsal sinus on the inferior surface of the talus, regardless of whether or not it crossed over the anteromedial aspect of the trochlea of the talus, and "body fracture" as a fracture crossing the lateral border of the posterior subtalar joint. Based on these definitions, we classified the former 28 fractures as neck fractures and the latter 33 fractures as body fractures.

## DISCUSSION

There are differences between the talar neck and body. Talar neck fractures are extra-articular fractures,

whereas talar body fractures are intra-articular. Body fractures that cause damage to articular cartilage with incongruity of the joint surface may cause osteoarthritis. Talar neck fractures may cause avascular necrosis with subsequent collapse of the talar body. It is important to classify neck and body fractures because of differences in treatment and prognosis.<sup>2-4</sup>

The ratio of neck fractures to body fractures varied widely in the literature,<sup>1,5-7</sup> from 1:1 to 5:1. No clear means of differentiating between fractures that occur at the border between the neck and the trochlea of the body can be found in the literature. We reported 140 neck fractures and 55 body fractures and diagnosed 28 of 61 fractures crossing over the anteromedial aspect of the trochlea as neck fractures and 33 as body fractures. If all of the fractures crossing over the anteromedial aspect of the trochlea had been diagnosed as body fractures, the ratio would have been about 1:1, whereas if they had been diagnosed as neck fractures, the ratio would have been almost 6:1 (Fig. 2). Thus, the discrepancy between the ratios reported by different authors may be attributable to differences in judgment concerning fractures crossing over the anteromedial aspect of the trochlea.

The dorsal aspect of the body of the talus is defined as the superior surface of the trochlea limited anteriorly by the anterior margin. Fractures crossing the anterior aspect of the trochlea should be diagnosed as body fractures, according to this definition. However, almost half of the fractures of the anteromedial aspect of the trochlea course in the sinus tarsi and are therefore not body fractures. It is impossible to differentiate fractures crossing the anteromedial aspect of the trochlea into body fractures and neck fractures based on the fracture line on the superior surface. Attempting to do so is the reason for the considerable confusion between neck fractures and body fractures found in the literature.

Neck fractures and body fractures can be distinguished more clearly on the inferior surface of the talus than on the superior surface. Almost all fractures passing through the medial entrance of the tarsal canal avoid the lateral process and are instead divided by it into an anterior portion and a posterior portion. Fractures crossing the lateral margin of the posterior subtalar joint can be diagnosed as body fractures; fractures into the sinus tarsi can be diagnosed as neck fractures. Neck fractures should be defined as fractures extending from the entrance of the tarsal canal to the lateral entrance of the tarsal sinus on the inferior surface of the talus, regardless of whether the fracture crosses over the anteromedial aspect of the trochlea or not. In the same way, body fractures should be defined as fractures that extend from the medial en-

trance of the tarsal canal to the posterior subtalar joint (see Fig. 1).

More than 90% of fractures cross at the medial entrance of the tarsal canal on the inferior surface. These fractures are separated clearly into an anterior part and a posterior part by the lateral process (Fig. 2), with the former corresponding to neck fractures and the latter to body fractures. The remaining 10% include other fractures, such as sagittal fractures, head fractures, lateral process fractures, posterior process fractures, and medial tuberosity fractures. We propose that fractures of the talus be classified on the basis of the fracture line on the inferior surface of the talus, not on the superior surface.

### CONCLUSIONS

Fractures that pass from the medial entrance through the lateral entrance of the tarsal sinus on the inferior surface should be diagnosed as neck fractures, even if the fracture crosses the anteromedial aspect of the trochlea on the superior surface, and fractures that pass through the lateral border of the

posterior subtalar joint should be diagnosed as body fractures. Fractures of the talus can be classified accurately and clearly by noting the route of the fracture on the inferior surface of the talus. Computed tomography scans and magnetic resonance images are not essential for classifying talus fractures into neck fractures or body fractures.

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