

## Management of dorsal lip avulsion fracture of Navicular bone

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**Abstract:**Navicular injuries are not so uncommon nowadays with the advent of increased sports and physical training. There are three main types of fracture to navicular bone namely cortical avulsions, fractures of the tuberosity and fractures of the body. Stress fractures are occasionally seen in athletes. Most common ones are the cortical avulsion fractures which are the result of a twisting injury rupturing the strong talonavicular capsule and the most anterior fibres of the deltoid ligament with a bone fragment being avulsed. Conservativetreatment consists of a short leg walking cast for 6 weeks. If the fragment includes more than 20% of the articular surface, or if there is significant instability seen on a stress-x-ray, it should be stabilized with screws. In this case report we illustrate the management of one such cortical avulsion of the navicular managed with percutaneous screw fixation with excellent outcome according to Karlsson and Peterson scoring system for ankle function.

**Keywords:**Navicular Fracture, Percutaneous Fixation, Cortical Avulsion fracture

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### I. Introduction

Navicular injuries are not so uncommon nowadays with the advent of increased sports and physical training. <sup>[1]</sup>The navicular plays an important role in maintaining the medial longitudinal arch of the foot. <sup>[2]</sup> Commonly, fractures of the navicular are not evident on plain radiographs. This often leads to a delay in diagnosis, which may result in prolonged disabling foot pain in individuals, particularly young athletes. The 3 types of navicular fractures are (1) cortical avulsion, (2) tuberosity, (3) body. <sup>[3]</sup> Stress fractures are also reported. Avulsion fracture, the most common fracture of the navicular, is often associated with ligamentous injuries and results from twisting forces on the mid foot. <sup>[4]</sup> An avulsion of the posterior tibial tendon insertion must be differentiated from an accessory navicular.

### II. Navicular Biomechanics

The navicular is part of 2 important structures that are essential for normal gait: <sup>[5]</sup>

- (1) the medial longitudinal arch
- (2) the transverse tarsal joint (also called the midtarsal or Chopart joint).

The medial longitudinal arch is composed of the navicular, calcaneus, talus, 3 cuneiforms, and 3 medial metatarsals. This arch provides support for normal gait, in particular from mid stance until push-off. <sup>[6,7]</sup>

The transverse tarsal joint is essential for normal gait and is composed of the talonavicular joint and the calcaneocuboid joint. At heel strike, this joint is flexible and plays an important role in absorbing ground impact and accommodating the foot to the ground. At push-off, the transverse tarsal joint is locked and is helpful in forward propulsion. <sup>[6,7]</sup>

Navicular avulsion fractures are usually related to excessive plantarflexion forces with eversion or inversion components. <sup>[8]</sup> The posterior tibial tendon insertion onto the medial navicular tuberosity provides a traction point for midfoot twisting injuries and the medial anchoring point for dorsal stress. <sup>[9]</sup> The bifurcate ligament attachment on the lateral navicular is the lateral anchoring point for dorsal tension stress. The dorsal tension created by these opposing forces results in the fracture's perpetuating from the dorsal articulation with the talar head. <sup>[10,11]</sup> The palpable pain is noted dorsally on the navicular just lateral to the anterior tibial tendon insertion ("N" spot). <sup>[12]</sup>

### **III. Clinical Features**

Tenderness at the "N spot," which is defined as the proximal dorsal portion of the navicular.<sup>[12]</sup> This is the most important physical finding. Tenderness at the midmedial arch over the navicular and pain with active inversion/passive eversion with mild dorsal midfoot swelling.<sup>[13]</sup>

### **IV. Investigations**

A plain radiograph of the foot rarely demonstrates the presence of a navicular fracture. For this reason, negative radiographic findings cannot be used to rule out the presence of a navicular fracture.<sup>[14,15]</sup> However the avulsion fracture normally is recognized on a lateral radiograph of the foot.

The tarsal navicular is frequently underpenetrated during routine standing anteroposterior (AP), lateral, and oblique views of foot. However, a coned-down AP radiograph that is centered on the tarsal navicular may help in visualization.<sup>[15,16]</sup> The continuity of the cortical bone, especially on an AP radiograph, should be carefully examined because when a fracture is present, the lateral fragment may resemble a separate tarsal bone and can be easily overlooked. However, even with special techniques and a careful examination, a radiograph is not sufficient to rule out a fracture of the tarsal navicular. Further imaging with CT and MRI may be needed to evaluate the cause of the dorsal midfoot pain with negative x ray findings.<sup>[17]</sup>

### **V. Management**

Fractures that are complicated by dislocation are assessed for stability following reduction. If the navicular is stable, then treatment may continue as outlined for uncomplicated acute fractures with immobilization in a boot, cast, or ankle-foot orthosis (AFO) with a period of rest.<sup>[18]</sup> Return to play generally was directed toward an asymptomatic ability to play. When the players were pain free with provocative testing, they were allowed return to sports. For a direct traumatic injury, this generally took 7 to 10 days of initial immobilization followed by 2 to 3 weeks of PT strengthening and proprioceptive retraining with accommodative arch supports.<sup>[19]</sup>

Navicular fractures can cause prolonged pain and an extended duration for recovery. Internal fixation is mainly indicated for avulsion fractures involving > 25% of articular surface, tuberosity fractures with > 5mm diastasis or large intra-articular fragment, displaced or intra-articular fractures.<sup>[20]</sup>

If the navicular is unstable, then internal fixation is required. A complete fracture with wide separation may benefit from early surgical intervention. In addition, if the patient is not expected to tolerate the rehabilitation program, surgical correction may be considered. Return to sport, particularly in elite athletes, may be quicker with surgical vs non-surgical treatment.<sup>[20]</sup>

### **VI. Case Report**

Our case is a 35 years old male who came with complaints of pain and swelling in the dorsal aspect of the foot following sudden plantar flexion due accidental fall of a heavy weight over the foot. On examination there was tenderness at the N spot along with pain on inversion and eversion and normal gait is altered and painful. Radiological evaluation revealed a displaced dorsal avulsion fracture of the navicular bone involving the articular surface. Surgical management in the form of percutaneous screw fixation was planned since the fracture involved the articular surface with significant displacement. Post op period was secured with a below knee slab for 4 weeks and mobilisation was started thereon and outcome is analysed with Karlsson and Peterson scoring system for ankle function. Outcome pointed to excellent grade and fracture united at 6 weeks on follow-up.



Figure showing the Pre Op and Post Op X rays of the Dorsal Navicular Lip avulsion fracture managed surgically by Percutaneous Screw fixation method.

## VII. Conclusion

Cortical avulsion fractures of navicular are the result of a twisting injury rupturing the strong talonavicular capsule and the most anterior fibres of the deltoid ligament with a bone fragment being avulsed. Because of the high incidence and difficulty of detection, a high level of suspicion is necessary in order to address the injury without any delay. Surgical management of unstable articular displaced fractures gives good functional outcome when addressed by minimal invasive technique of percutaneous screw fixation.

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