



## Nutcracker fracture of the cuboid : Management and results

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**Nutcracker fractures of the cuboid are rare and often missed at an initial visit. They can be difficult to manage and convey a high risk of long-term pain in the foot. During the last six years, 6 recent cuboid fractures in 6 patients were treated at our hospital by open reduction, allogeneic bone grafting (where necessary) and internal fixation. Shortening of the lateral column of the foot existed in all these fractures. At the time of follow-up the results concerning pain and function were good in 2 and fair in 4 patients. We recommend open treatment for cuboid fractures with shortening of the lateral column of the foot or articular displacement of more than 1 mm.**

**Keywords :** midfoot ; fracture ; cuboid ; ORIF ; lateral column ; trauma.

### INTRODUCTION

The annual incidence of mid-foot fractures is 3.6/100 000. Fractures of the cuboid are very rare, and account for 50% of all mid-foot fractures (2). The overall average age is 36.9 years. Improper treatment of nutcracker fractures of the cuboid conveys a high risk of long-term pain in the foot.

Various methods of treatment of this rare fracture have been described (3,6,7,10,13,15,16) such as plaster immobilisation, external fixation, open reduction and internal fixation with or without bone grafting and midtarsal fusion. The indications and the best method of surgical treatment have not been established due to the rarity of the fracture and the paucity of literature.

We report a series of recent nutcracker fractures of the cuboid treated by open reduction and internal fixation. The mechanism of this rare injury as well as the indications and advantages of open reduction and fixation are discussed.

### PATIENTS AND METHODS

From October 2005 to September 2010, six patients with nutcracker fractures of the cuboid were treated by open reduction and internal fixation at our institution. All 6 patients had a recent fracture of the cuboid with shortening of the lateral column of the foot. At the time of follow-up weight-bearing and standard radiographs were taken (Figs. 1, 2 & 3). The cuboid fractures were classified according to the Orthopaedic Trauma Association (OTA) classification. The system groups cuboid fractures as extra-articular (A), partial articular (B) and articular (C). Each group is divided into some subtypes

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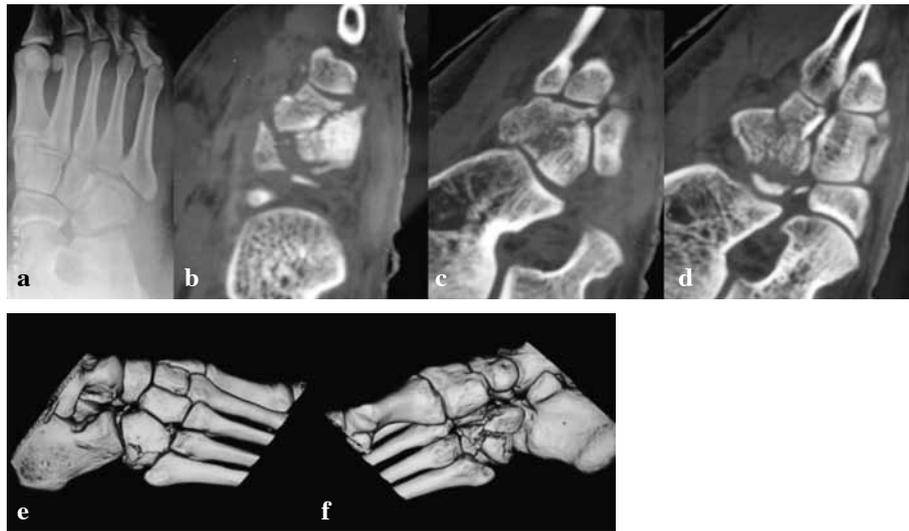
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**Fig. 1.** — Radiograph and CT scan showing the shortening of the lateral column and the articular injuries



**Fig. 2.** — Radiograph showing the restoration of the lateral column and joints

(Table I). All 6 patients were evaluated using the AOFAS standardized clinical scoring system for the midfoot (9). Following Kitaoka *et al* (9) the results were rated as excellent with 90-100 points, good with 80-89, fair with 70-79, or poor with < 70 points.

### Surgical Intervention

Surgery was performed under lumbar or epidural anaesthesia. The patient was placed in a supine position with a pillow under the ipsilateral buttock to avoid excessive external rotation of the limb and facilitate approach to the cuboid. A pneumatic tourniquet was applied at the thigh and the surgical field was prepared leaving the leg exposed. A longitudinal incision was made over the

cuboid at the lateral border of the extensor brevis muscle and proximal to the sural nerve. The incision extended from the sinus tarsi to the base of the fourth metatarsal. Calcaneocuboid and tarsometatarsal joints were exposed. The lateral column was opened with a distractor to allow access to the articular surfaces for inspection and reduction. After reconstruction of the fragments especially the joint surfaces, freeze-dried allogeneic bone (Shangai Anjiu BioTechnology, Shangai, China) was grafted to stabilize the articular ends and to maintain the length of the lateral column. A dorsolateral miniplate not crossing the neighbouring joints fixed the reduction obtained. Postoperative treatment was immobilization for 6 weeks and non-weight bearing for 12 weeks. The implants were removed about one year after union of the cuboid.



Fig. 3. — Preoperative and postoperative oblique radiograph

## RESULTS

A total of 6 patients were included in the study. They were followed up for 14 months on average (range : 12 to 24 months). The mean time to bone union was 10.5 weeks (range : 8 to 16 weeks). Outcome variables are shown in table I and results rated using the midfoot scale (100 points total) according to Kitaoka *et al* (9). The outcome of the recent fractures was good in two and fair in four (Table I). One fracture developed superficial infection, which resolved with vacuum drainage and oral antibiotic therapy.

## DISCUSSION

The cuboid articulates with the calcaneus, the lateral cuneiform, the navicular and the fourth and fifth metatarsals, and has strong capsular ligamentous attachments. The cuboid is the only bony structure supporting the lateral column of the midfoot. The cuboid is involved in all intrinsic movements of the foot (11). The cuboid-metatarsal articulations provide for nearly all of the dorsal and plantar motion of the lateral column of the foot (1). The mobility of these two joints is up to three times

Table I. — Statistical description of fresh cuboid fracture classification, surgical management, and outcomes

Variable	Number/Mean $\pm$ SD
Age (years)	42.67 $\pm$ 16.28
Female sex	2
OTA classification	
76-B1.2	1
76-B1.3	1
76-C1	4
Shortening < 2 mm	1
Shortening > 2 mm	5
Internal fixation with miniplate	6
Superficial infection	1
Average AOFAS score	77.17 $\pm$ 5.49
Excellent (90-100)	0
Good (80-89)	2
Fair (79-70)	4
Poor (< 70)	0

greater than in the three medial tarsometatarsal joints (12). The cuboid is an important stabilizer of the lateral side of the foot. Finally it contributes to the function of the calcaneocuboid joint.

The mechanism of the nutcracker fracture of the cuboid is usually compression between the calcaneus and the base of the fourth and fifth metatarsals when the foot is forcefully plantar flexed on a fixed forefoot (8).

Local swelling and oedema are common with cuboid injuries. A medial oblique radiographic view is helpful in assessing the cuboid injury. Sonography (5) can detect an occult fracture ; CT scan and/or MRI should be done when the diagnosis is unclear or the fracture is complex (4,14).

Robert and John (10) advised operative reconstruction in all cases presenting with lateral column shortening or articular displacement. Holbein (7) suggested surgery when displacement of the joint surface is more than 1mm or when the lateral column of the foot is shortened more than 3 mm. Others recommend surgery when longitudinal compression is present (1). We think open reduction and fixation is indicated when the lateral column shortening or articular displacement exceeds 1 mm. In these cases non-operative treatment leads to poor

results. Shortening of the lateral column and damage to the articular surface usually leads to lateral instability and early arthritic changes. The goals of operative management are to restore the lateral column length and plantar support of the midfoot, to preserve the mobility of the tarsometatarsal joints, and to restore articular integrity to the calcaneocuboid joint. The fourth and fifth tarsometatarsal joints provide for nearly all of the dorsal and plantar motion of the lateral column of the foot and allow us to adapt to an uneven ground. Their mobility is more important to the overall foot function than the mobility of the calcaneocuboid joint. A miniplate not crossing the surrounding joints maintains the length of the lateral column and preserves motion at the fourth and fifth tarsometatarsal joints, thus avoiding stiffness as caused by bridge-plating or Kirchner wire fixation.

Primary arthrodesis is only indicated in severe comminution and articular damage in less active patients or in symptomatic cases presenting with delay (7). Secondary arthrodesis can be done in those patients with poor results after open reduction and internal fixation.

In conclusion, the major impact of a cuboid nutcracker fracture is loss of the lateral structural integrity of the foot and the loss of motion at the lateral tarsometatarsal joints. We believe that lateral column shortening or articular displacement of more than 1 mm with cuboid fracture should be treated by open surgery and a mini-plate.

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