

Operative Treatment of Displaced Talar Neck Fractures

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Abstract

Twenty-two displaced talar neck fractures were treated by open reduction and internal fixation. Four open fractures were operated within 8 hours and 18 closed injuries were treated at an average interval of 13.8 hours after injury. Fractures were classified according to Hawkins' classification into 14 type II, 7 type III and 1 type IV. At an average follow up of 4.4 years, 18 cases obtained excellent or good results. Result was fair in 2 cases of delayed union and 1 case of avascular necrosis. Another case of avascular necrosis developed osteoarthritis of the ankle and had poor result. The overall incidence of avascular necrosis of the body of the talus was 9%.

Ann Acad Med Singapore 1998; 27:763-6

Key words: Early fixation, Hawkins' classification, Olerud and Molander score

Introduction

Talus is a weight bearing bone with peculiar anatomy and blood supply. It forms the ankle joint with the medial and lateral malleoli, subtalar joint with the calcaneum and talonavicular joint with the navicular bone. Displaced fracture neck of talus is an intra-articular injury and requires accurate anatomical reduction to prevent osteoarthritis. Satisfactory close reduction is difficult to achieve and prolonged immobilization can lead to joint stiffness and tissue atrophy. Open reduction and internal fixation is often required to obtain accurate reduction and rigid internal fixation. However, surgical access to the talus is difficult as it is bounded on both sides by the ankle mortise, anteriorly by the navicular bone and inferiorly by the calcaneum. Extensive dissection to expose the talus is undesirable, as devascularization of the bone may cause avascular necrosis. Placement of the screw needs careful consideration so that the screw head does not interfere with articulation and has to be countersunk below the level of the cartilage. We present our results of open reduction and internal fixation of displaced talar neck fractures using Hawkins' classification¹ and Olerud and Molander score.²

Materials and Methods

Between January 1990 and December 1994, open reduction and internal fixation were performed in 30 displaced talar neck fractures. Eight patients were foreign workers, leaving 22 patients available for evalua-

tion at an average follow up of 4.4 years (range 2 to 7 years).

There were 19 males and 3 females. Twelve patients were Chinese, 9 were Malays and 3 were Indians. The average age at the time of injury was 35.0 years (range 19 to 78 years). Fifteen fractures were a result of road traffic accident and 7 were from a fall from height. Four were Gustilo grade I open fractures³ and 18 were closed injuries. The open fractures were treated with wound debridement followed by internal fixation within 8 hours after injury. The closed fractures were treated with open reduction and internal fixation at an average of 13.8 hours (range 4 hours to 5 days). Thirteen fractures involved the right and 9 involved the left talus. Five had associated injuries involving the same foot (ankle fracture in 4 and fifth metatarsal fracture in 1) and 2 had other associated injuries (ipsilateral femoral fracture in 1 and stable compression fracture second lumbar vertebra with no neurological deficit in 1). The spine injury was treated conservatively. The other associated fractures were treated with open reduction and internal fixation. The talar neck fractures were classified according to Hawkins' classification.¹ There were 14 type II (subtalar dislocation), 7 type III (talar body dislocation) and 1 type IV (talar head dislocation).

Operative Technique

Nine patients were operated under general anaesthesia and 13 under spinal anaesthesia. An 8-cm incision

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was made along the medial border of the tibialis anterior starting proximal to medial malleolus and extending distally across medial malleolus to the tuberosity of the navicular bone. The tibialis anterior was retracted medially and the ankle joint exposed by opening the capsule using a longitudinal incision. Access to the talar fracture was adequate and no cases required medial malleolar osteotomy to improve surgical exposure. For those 4 cases with associated ankle fracture, the fibular fracture was fixed with 6 hole 1/3 tubular plate by another incision over the lateral aspect of the lower fibula. The talar fracture was fixed before the medial malleolus because the unfixed medial malleolus allowed better exposure of the talus. The medial malleolus was subsequently fixed with two 4-mm 1/2 threaded cancellous screws.

The talar fracture site was cleaned to remove blood clot and debris. Care was taken not to strip the soft tissue attachment of the fragments. Anatomic reduction of the fracture was performed. In 3 type III fractures, the posteriorly displaced body of the talus failed to reduce into the ankle. A 2-mm external fixator pin was inserted into this displaced fragment from the front. By applying traction to the pin, the displaced fragment was pulled into the ankle. The pin was also used as joystick to aid subsequent manipulation and reduction of fracture and was removed after fracture fixation. The talar fracture was fixed with two 4-mm 1/2 threaded cancellous screws in 16 cases, two cancellous screws and one Kirschner wire in 4, and multiple Kirschner wires in 2. The screws and wires were placed perpendicular to the fracture. All the screw heads were countersunk below the level of the cartilage. The wire was cut 5 mm above the cartilage and bent flush with it. Intraoperative radiographs were performed to assess fracture reduction, implant position and to ensure that the talus fitted properly within the ankle mortise. One case required change of a screw position. One suction drain was inserted and the capsule closed with interrupted Vicryl sutures. The skin was closed with interrupted Prolene sutures.

Postoperatively, free range of motion exercises were encouraged for the injured ankle and ambulation was permitted with crutches without weight bearing on the injured ankle. Radiographs were taken at 1, 2 and 3 months to assess fracture union and for any early evidence of avascular necrosis. At 12 weeks, union occurred in 18 cases and began weight bearing on the injured leg together with muscle strengthening exercises. In 1 type II fracture, union occurred at 6 months. In 1 type III fracture, cancellous bone grafting was required at 6 months and union occurred 3 months after the second operation. In 1 type II and 1 type III fractures, avascular necrosis was evidenced at six months and patellar tendon bearing brace was used on the affected ankle to allow partial weight bearing for a year. Implants

were removed in 6 cases at an average interval of 17 months with a range of 12 to 24 months.

Patients were assessed with interview, clinical and radiological examinations. The results were rated by the Olerud and Molander score.² Scores of 91 to 100 were graded as excellent results, 61 to 90 as good, 31 to 60 as fair and 0 to 30 as poor.

Results

The Olerud and Molander scores are summarized in Table I. Excellent result was seen in 13 cases, good in 5, fair in 3 and poor in 1. Increase density of the talus body suggesting avascular necrosis was seen at 6 months in 1 type II and 1 type III fractures.

One case of avascular necrosis and 2 cases of delayed union obtained fair result. Another case of avascular necrosis developed tibio-talar osteoarthritis and had poor result.

TABLE I: THE OLERUD AND MOLANDER SCORE

Parameter	Degree	Score	Number of patients
1. Pain	None	25	12
	While walking on uneven surface	20	6
	While walking on even surface outdoors	10	4
	While walking indoors	5	0
	Constant and severe	0	0
2. Stiffness	None	10	18
	Stiffness	0	4
3. Swelling	None	10	7
	Only evenings	5	14
	Constant	0	1
4. Stair-climbing	No problems	10	11
	Impaired	5	10
	Impossible	0	1
5. Running	Possible	5	18
	Impossible	0	4
6. Jumping	Possible	5	18
	Impossible	0	4
7. Squatting	No problems	5	18
	Impossible	0	4
8. Supports	None	10	17
	Taping, wrapping	5	5
	Stick or crutch	0	0
9. Work, activities of daily life	Same as before injury	20	18
	Loss of tempo	15	2
	Change to a simple job/part-time work	10	2
	Severely impaired work capacity	0	0

Discussion

Talus is a bone with unique biomechanical features and vascular supply. Fracture neck of talus constitutes

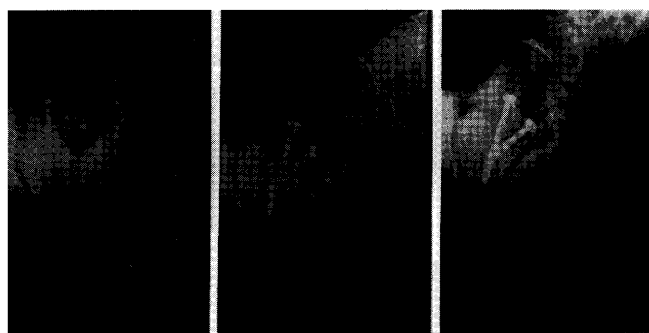


Fig. 1a.

Fig. 1b.

Fig. 1c.

Fig. 1 a. Lateral radiograph of a type II talar neck fracture.

Fig. 1 b. The fracture is fixed with two 4-mm cancellous screws

Fig. 1 c. Lateral radiograph at 2.5 years shows avascular necrosis of the body of the talus with increase in density. There is osteoarthritis of the tibio-talar joint.

50% of all major talar injuries' and represents 0.14% to 0.32% of all fractures.

Fabrizius⁴ in 1608 first described a fracture talus, which at that time was treated by talectomy. Since then, problems associated with these fractures have been identified.

Miller and Baker⁵ in 1939 pointed out the importance of adequate reduction by closed or open methods. In displaced talar neck fracture, closed reduction and plaster immobilization in equinus can be recommended if fracture reduction is satisfactory, but prolonged immobilization leads to joint stiffness and tissue atrophy. Open reduction is indicated if closed trials fail. Open reduction and internal fixation is technically difficult with regards to surgical approach and method of fixation. Care must be taken to preserve soft tissue attachment to the fragments. Implants must be carefully placed so that they do not interfere with the articulation. In a series of 71 talar neck fractures, Canale and Kelly⁶ concluded that good results depend on anatomic reduction and fixation to prevent posttraumatic arthrosis and emphasized the importance of an active rehabilitation programme.

In our series, fractures were operated as early as possible. Open fractures were treated within 8 hours after injury and closed fractures at an average of 13.8 hours after injury. Early operation has its advantages. It allows easy reduction of the fracture fragments without additional stripping and accurate apposition of the vascularized head to the body of the talus. Easy reduction will retain the retinacular attachments to the body and apposition of a vascularized neck surface would provide blood supply to the body.⁷ It also avoided problems with swelling, closure of the skin or skin necrosis from the presence of displaced fragments.⁸ Early decompression of the soft tissue, irrigation of hemarthrosis, anatomic reduction and reliable contact between the fragments are very important to minimise damage to the blood supply-and to promote revascularization and bony un-

ion of the displaced talar fracture. This allows early functional postoperative treatment which prevents joint stiffness, tissue atrophy and venous thrombosis.

Avascular necrosis is the major complication of talar neck fractures with a reported overall incidence varying between 16%⁷ and 71%.⁹ It is related to the peculiar vascular supply of the talus. Mulfinger and Trueta¹⁰ demonstrated that the blood supply is by three main arteries through a periosteal network. The artery of the tarsal sinus originates either from the dorsalis pedis, the lateral malleolar or the perforating peroneal artery, the artery of the tarsal canal originates from the posterior tibial artery and the artery of the superior neck originates from the dorsalis pedis. The arteries of the tarsal sinus and canal anastomose within the tarsal canal and penetrate into the inferior surface of the talar neck. Small branches from the peroneal artery join the calcaneal branches of the posterior tibial artery to form a plexus of capillaries over the talar posterior tubercle. The head of the talus is supplied from two sources. Branches from the anterior tibial (dorsalis pedis) supply the medial superior half. The inferolateral half of the head is supplied by the artery of the tarsal sinus. The body is supplied by two sources. Four or 5 branches from the anastomosis of the tarsal canal course posterolaterally into the body. Second blood supply is from the deltoid branches entering the medial part of the body through the periosteal surface. There are several small periosteal branches from the posterior tibial artery, which enter the posterior tubercle. A fracture of the neck with dislocation separates the posterior fragment from the blood supply arising from the above-mentioned anterior anastomosis. The direct vessels to the posterior tubercle are usually torn or insufficient to prevent avascular necrosis of the fragment. Treatment of avascular necrosis is to prevent collapse of the affected fragment while waiting for revascularization of the bone. Coltart¹¹ noted that weight bearing in a short leg cast did not lead to collapse of the talus. In our series, the two cases of avascular necrosis were allowed weight bearing on the injured ankle using a patellar tendon bearing brace. The brace decreases the stress on the talus and transmits considerable stress beyond the talus through the brace to the shoe. It also prevents varus and valgus strain on the talus. Hawkins' also noted no later problems with early-protected weight bearing. In our cases of avascular necrosis, revascularization without collapse occurred in one and osteoarthritis of the tibiotalar joint developed in another case.

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