Med. J. Cairo Univ., Vol. 62, No. 2, June : 605-615, 1994

Operative Treatment of Displaced Talar Neck Fractures

ASHRAF A. EL-NAHAL, M. D.; MOHAMED A. KADDAH, M.D.; NAGUIB Y. D. BASHA, M.D.; AHMED. A. N. MORRA, M. D. and MOHAMED ABDEL KHALEK, M.D.

The Department of Orthopaedic Surgery, Faculty of Medicine, Cairo University.

Abstract

Thirteen cases of displaced talar neck fractures were treated by open reduction and internal fixation. All cases were managed within 12 hours after injury. The medial approach was used, 6 cases had associated fracture of the medial malcolus. In three cases osteotomy of the medial malcolus was performed. The fracture was fixed by 4 mm cancellous screws perpendicular to the fracture line. Results were evaluated by a standard rating system. Prompt open reduction and internal fixation, maleolar osteotomy when needed, and protected weight bearing are recommended in the management of these cases.

Introduction

PROBLEMS associated with talar fractures have always confronted surgeons. Talectomy [1,2] and local fusion [3], to speed revascularization, are operations that yielded poor results [4]. Results of closed reduction and plaster fixation in equinus in these cases are not satisfactory as there is a high incidence of non union and avascular necrosis [3,5].

The talus bone is peculiar in the following manner [6]:

- Considerable mechanical loading from its anatomic position.

- Sixty percent of the surface consists of cartilage therefore most of the fractures are intra-articular.

- The blood supply is concentrated by three main arteries [7] through a periosteal network (Fig. 1) namely the artery of the tarsal sinus, the artery of the tarsal canal and the artery of the superior neck. In fractures of the neck of the talus with dislocation, the posterior fragment is separated

from the blood supply arising from the anterior periosteal anastomosis. The direct vessels to the posterior tubercle are usually torn or insufficient to prevent avascular necrosis of this fragment. Accordingly, avascular necrosis is the most common complication of displaced talar reck fractures with reported incidence varying between 16% [8] and 71% [9].

Hawkins [4] classified fractures of the neck of the talus into three groups (Table 1).

According to Hawkins [4], avascular necrosis does not occur in group I fractures. On the other hand a group III fracture dislocation can be complicated by avascular necrosis. In group II fractures, however, the incidence of avascular necrosis cannot be predicted.

Material and Methods

Thirteen cases of displaced talar neck fractures were treated in Cairo University Hospitals in the period between 1988 & 1992 by open reduction and internal fixation using 4 mm cancellous screws.

There were 11 males and 2 females, aged from 16 years to 48 years with an average of 29.4 years.

The mechanism of injury was a fall from a height in 9 cases and motor vehicle accidents in 4 cases, denoting varying degrees of dorsiflexion.

Eleven cases were of group II Hawkins classification (Figs. 2,3). Two cases were of group III (Fig. 4). Cases of group I were not included in this study.

Six cases had an associated fracture of the medial moleolus vertical in 4 cases and oblique in 2 cases, suggesting an element of adduction and external rotation in addition to dorsiflexion.

In only one case the fracture was open. This case was of group III Hawkins

Table (1): Hawkins Classification of Talar Neck Fractures.

Classification	Fracture of neck of talus
Group I	Undisplaced vertical fracture of the talar neck, undisplaced tibio-talar or subtalar joint.
Group I I	Displaced vertical fracture of the talar neck, undisplaced tibio-talar, displaced subtalar joint.
Group I I I	Displaced vertical fracture of the talar neck, displaced tibio-talar, and subtalar joints.

classification. The wound was thoroughly debrided, then the fracture was managed as usual.

All cases were managed within 12 hours after injury.

The follow up period was 12 months to 29 months, averaged 18.4 months.

Careful pre-operative assessment of the general condition of the patients were done to exclude other injuries. Postero-anterior, lateral and oblique radiographic views of the involved ankle were obtained and assessed for areas of comminution, the angle of the fracture line and the involvement of the body and the subtalar joint.

Surgery was performed under general anaesthesia, a torniquet was applied. The skin incision begins proximal to the medial maleolus and runs in front of the anterior border in a distal convex way to the navicular bone. The saphenous vein was ligated, the tibialis posterior tendon, the deltoid ligament and the neurovascular bundle were carefully identified. Care was taken to identify the fracture with minimal tissue stripping from the neck of the talus to preserve the blood supply. In addition to the 6 cases in which the medial moleolus was already broken, medial maleollar osteotomy was performed in 3 cases to allow reduction without heavy traction or stripping of the fragments. The osteotomy line was done parallel to the ankle joint line preserving its attachment to the deltoid ligament to preserve the medial blood supply entering through this ligament. The foot was then plantar flexed to expose and reduce the fragments. The reduction was held by K-wires and checked by image before definitive fixation. Fixation was done by 4 mm cancellous screws which were inserted vertical to the fracture line to achieve reliable stability. The screws had to be inserted through the cartilage in 2 cases to achieve maximum stability, the screw heads were countersunk in these cases. The medial maleollar fractures were fixed either by 4 mm cancellous screws or by screws and K wires according to the case. Cases where maleollar osteotomy had to be done were fixed by tension band wiring. Suction drainage and careful wound closure were important.

Post-operative Management:

Immediate post operative plaster slab was applied for 48 hours to prevent equinus during which the leg was elevated.

After removal of the drains and change of the dressings a below the knee well padded plaster cast was applied and the patient was allowed to mobilize non-weight bearing. Change of plaster and removal of the stitches was done in two weeks. Non-weight bearing was continued for 6 weeks. At that time a film out of plaster was analysed for the presence or absence of subcondral bone atrophy at the dome of the talus as a sign of vascularity. Comparison with roentgenograms of the normal side was usually needed. If avascular necrosis

was suspected a Tc. 99 bone scan was done. Patients with partial avascular necrosis were allowed partial weight bearing with the protection of a patellar tendon bearing brace (Fig. 5). Non weight bearing was continued for patients with complete necrosis for at least 6 months. The brace was discarded in 6 months and unprotected partial weight bearing was allowed.

Results

Clinical Results:

On the final follow up clinical results were assessed acording to Hawkins [4] criteria, four criteria were evaluated, the presence of a limp, and the range of motion of the ankle and subtalar joints.

Each patient was given a numerical rating in each of these four categories and the sum of the rating was used as a quantitative measure of the clinical results.

Pain was assigned 0 to 6 points (6 for no pain, 3 for pain after fatigue and 0 for pain on walking).

If there was no limp 3 points were scored and if there was a limp 0 points.

The range of motion of the ankle and subtalar joints were assigned 0 to 3 points each. Full motion being 3, partial motion 2, fusion 1 and fixed deformity 0.

An overall excellent result was scoring 13 to 15 points, good 10 to 12, fair 7 to 9 and poor 6 or less.

The clinical results of our study are shown in table (2).

Avascular Necrosis:

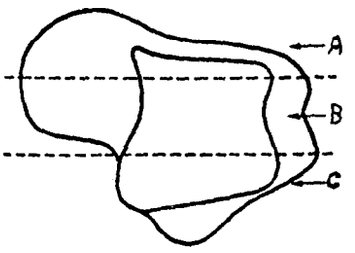
In our series 6 cases of group II Hawkins fractures developed partial avascular necrosis (54.5%). Two of these cases had an element of split fracture within the body. Recognition of avascular necrosis was done at the sixth week after injury depending on the presence or absence of

Table (2): Clinical Results of the Studied Cases.

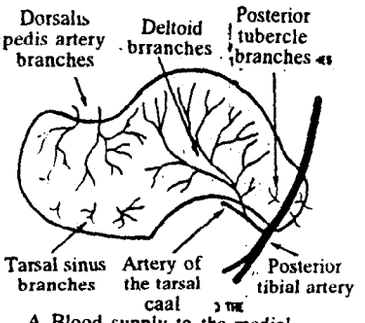
Cassification	No. of cases	Clinical results			
		Exc.	Good	Fair	poor
Hawinks I I	11	5	4	1	1
Hawinks I I I	2	-	-	1	1

subchondral atrophy in the dome of the talus. The presence of subchondral atrophy excludes avascular necrosis. All cases diagnosed to have avascular necrosis had a Tc. 99 bone scan. Apart from confirming the radiological diagnosis Tc.99 bone scan seemed to have no clinical prospective value. None of these cases developed collapse of the head of the talus properly due to the restricted regimen of non-weight bearing followed by protected weight bearing using the brace. It is interesting to stress that the presence of partial avascular necrosis in cases of Hawkins II did not affect our clinical results. Three of the 5 cases that showed excellent clinical results had partial avascular necrosis. In fact the two cases Hawkins II fractures that revealed fair and poor results did not develop avascular necrosis..

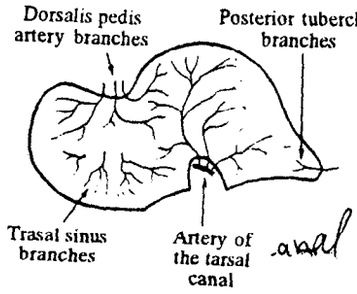
The 2 cases of Hawkins III fractures in this series developed avascular necrosis. They were both subjected to a restricted regimen of non-weight bearing. Minimal collapse of the dome occurred in one. Both are walking now with one crutch after discarding the brace. Our plan is to follow them up for a longer period of time with no intention of surgical interference unless symptoms dictate.



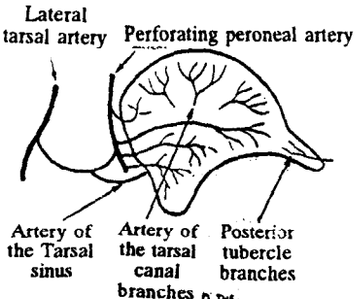
Dorsal view of the talus showing the areas covered by the following sections



A Blood supply to the medial one - third of the talus



B Blood supply to the middle one - third of the talus



C Blood supply to the lateral one - third of the talus

Fig. 1: Diaram Showing blood supply to the talus in sagittal section (after Mulfinger and Trueta [7]).

Fig. 2-A.

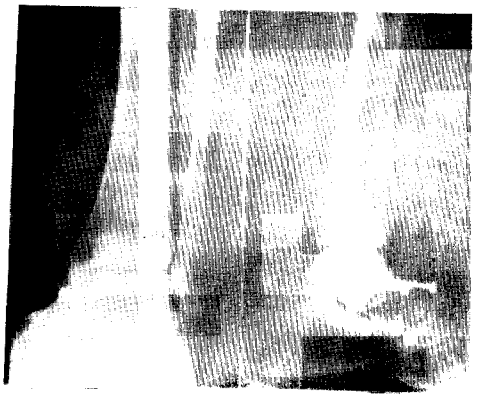


Fig. 2-B.

Fig. 2-C.

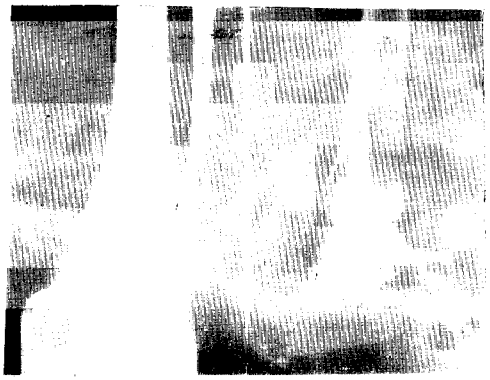


Fig. 2-D.

Fig. 2: **Male aged 27 years. Hawkins type II (A), Postoperative X-rays (B), 6 months post-operative (C), 12 months post-oiperative (D), Clinical result good.**

Fig. 3-A.

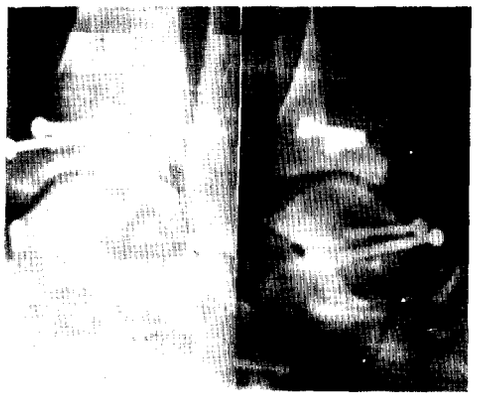
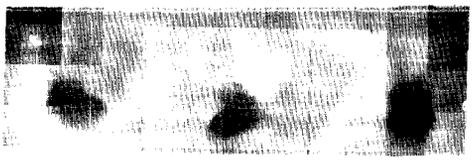


Fig. 3-B.



Lt. ankle: (lat.), (medial) & (ant.).

Rt. ankle: (med.), (lat.) & (ant.).

Fig. 3-C.: Blood pool images.

Fig. 3-D.

Fig. 3: Male aged 22 years. Hawkins type II Fracture of left talus medial maleollar fracture (A), Post operative X-rays (B), Tc.99 bone scan dome 6 weeks post operative showing partial avascular necrosis of left talus (C), X-rays 14 months post operative (D), Clinical results rated excellent.

Fig. 4-A.

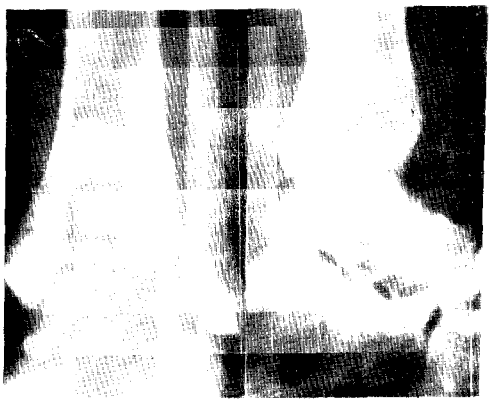


Fig. 4-B.

Fig. 4-C.

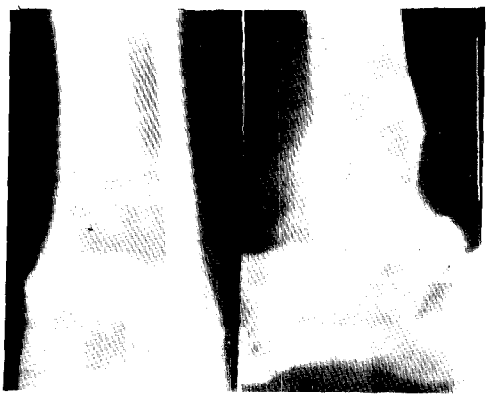


Fig. 4-D.

Fig. 4: Male aged 39 years. Hawkins type III (A), Post operative X-rays (B), 6 weeks postoperative (C), 12 months post-operative (D), clinical results fair.

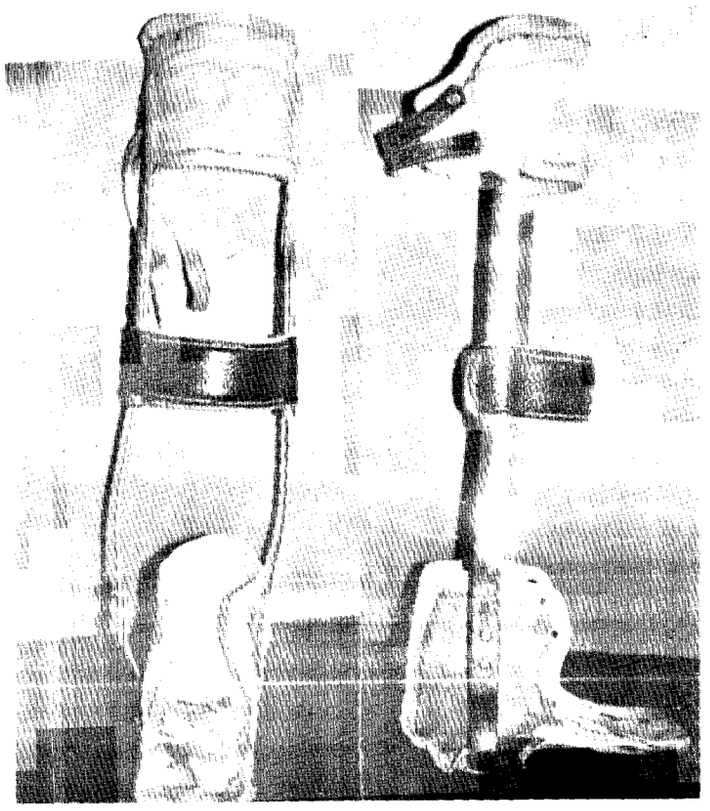


Fig. 5: Protective patellar tendon bearing brace used in this study.

Discussion

Early open reduction and internal fixation of displaced talar neck fractures seemes to be the most favorable line of treatment of these injuries. It allows easy reduction without excessive stripping of soft tissues and avoids the problems of skin necreosis from the presence of skin necrosis from the presence of displaced fragments seen with closed reduction [10]. Medial maleollar osteotomy improves exposure and reduction. It does not affect the end results. In this study, there was no incidence of malunion or non union, also no problems related to the associated fracture of the medial maleolus or the performed medial maleollar osteotomies. No skin problems were noticed.

However, it was found important to diagnose avascular necrosis early using the

sign of subchondral bone atrophy at the dome of the talus stressed upon by Hawkins [4].

The presence of avascular necrosis did no necessarily mean poor results as evidenced by the excellent clinical results in 3 cases Hawkins type II that developed partial necrosis. This co-incides with other series [6,11]. This remains true as long as collapse of the dome of the talus does not occur [6]. Non-weight bearing followed by protected-weight bearing in a patellar-tendon bearing brace was the line of management we followed for avascular necrosis. This line of treatment was the treatment of choice in other series [6,11].

Some authors [4,12] stated that collapse may take place several months after fracture healing has occurred. In this series minimal collapse was detected in one Hawkins type III case. Hawkins [4] stated that collapse of the dome of the talus was tolerated in most of the patients and that replacement in the body will take several years and only if symptoms dictate, the surgeon may have to interfere and at that time he will have a greater chance for successful fusion.

Finally, it is recommended to perform early open reduction and rigid internal fixation of talar neck fractures. Medial approach with or without medial maleollar osteotomy is sufficient for the procedure. Careful follow up for early signs of avascular necrosis should be done. Non-weight bearing followed by protected-weight bearing is recommended once avascular necrosis is noticed and yielded satisfactory results.

References

1. COLART, W. D.: Aviator's astragalus, J. Bone Joint Surg., 348: 545, 1952.

2. DUNN, A. R.; JACOBS, B.; and CAMPBELL, R. O.: Fractures of the talus. J. Trauma, 6: 443, 1966.

3. CANALE, S. I. and KELLY, F. B.: Fractures of the neck of the talus. J. Bone Joint surg., 60A: 143, 1978.

4. HAWKINS, L: Fractures of the neck of the talus, J. Bone Joint. Surg., 52A: 991, 1970.

5. LORENTZEN, J. E.; CHRISTENSN, S. B.; KROGSOE, O.; and SNEPPEN, O.: Fractures of the neck of the talus. Acta Orthop. Scand., 48: 115, 1977.

6. GROB, D.; SIMPSON, A.; WEBER, B. G.; and TRAY, T.: Operative treatment of displaced talar fractures. Clinical Orthop. and Related Research, 199: 88, 1985.

7. MULFINGER, G. L. and TRUETA, J.: The blood supply of the talus. J. Bone Joint Surg., 52B: 160, 1970.

8. PETERSON, L.; GOLDIE, I. F; and IRSTAM, L.: Fractures of neck of the talus. Acta Orthop. Scand., 48: 696, 1977.

9. McKEEVER, F. M.: Treatment of complications of fractures and dislocations of

the talus. Clin. Orthop., 30: 45, 1963.

10. PANTAZOPOULOS, T.; GALANOS, P.; VAYONOS, E.; MITSOU, A.; and HARTOFILAKIDIS, G.: Fractures of the neck of the talus. Acta Orthop. Scnd., 45: 296, 1974.
11. COMFORT, T.; AITHER, D.; DENIS, F.; and SIGMOND, M.: Long term results of displaced talus neck fractures. Clin. Orthop. and Related Research, 199: 81, 1985.
12. PENNY, J. N., and DAVIS, L. A.: Fractures and fracture dislocations of the neck of the talus. J. Trauma, 20: 1029, 1980.