BRIEF REPORTS

HEEL-PAD COMPRESSIBILITY AFTER CALCANEAL FRACTURES: ULTRASOUND ASSESSMENT

P. S. KERR, D. A. SILVER, K. TELFORD, H. S. ANDREWS, R. M. ATKINS

It has been suggested that fracture of the calcaneum produces considerable damage to the heel pad with subsequent atrophy and symptoms related to loss of its protective effect (Kuhns 1949). These may be sufficiently severe to jeopardise the normally satisfactory results of open reduction, internal fixation and early mobilisation seen in other intra-articular fractures (Heckman 1991; Kenwright 1993; Parmar, Triffitt and Gregg 1993).

We have previously studied the thickness of the unloaded heel pad using ultrasound (Silver et al 1994). We compared the thickness on the injured side with that on the normal side in patients who had suffered unilateral fractures of the calcaneum, but were unable to show any thinning. The heel pad on the injured side was actually slightly thicker than normal. Prichasuk (1994) has shown that subjects complaining of idiopathic heel pain have significant differences in the 'compressibility' of their heel pads when compared with normal volunteers.

In view of the significance that has been attributed to

disruption of the heel pad after calcaneal fracture, we have assessed the area during the resting state, and under compressive load such as occurs during standing or walking. We now describe a method for measuring changes in heel-pad thickness under compression and present our results.

Patients and methods. We studied ten patients who had had unilateral displaced intra-articular fractures of the calcaneum, at a mean time of 35 months from injury (16 to 55). Four had been treated by operation and six conservatively.

Ultrasound measurements of heel-pad thickness were obtained using an ATL machine (Advanced Technology Laboratories, Redmond, Washington) and a 5 MHz mechanical sector array transducer by a method described previously (Silver et al 1994). A commercial compression-extension device was clamped to the ultrasound transducer to determine the change in heel-pad thickness with an applied load. One observer applied a measured load, while a second recorded the ultrasound measurements.

Fig. 1

P. S. Kerr, FRCS, Research Registrar
K. Telford, MB ChB, Senior House Officer
R. M. Atkins, MA, DM, FRCS, Consultant Senior Lecturer
Department of Orthopaedic Surgery
D. A. Silver, BSc, MRCP, FRCR, Senior Registrar
H. S. Andrews, DMRD, MRCP, FRCR, Consultant Radiologist
Department of Radiology
Bristol Royal Infirmary, Marlborough Street, Bristol BS2 8HW, UK.

Correspondence to Mr R. M. Atkins.

©1995 British Editorial Society of Bone and Joint Surgery
0301-620X/95/3R33 \$2.00
J Bone Joint Surg [Br] 1995;77-B:504-5.
Received 11 April 1994; Accepted 6 July 1994

Readings were taken in a random order with applied forces of 0, 3 and 6 kg. The contact surface area of the transducer was 2 cm² giving loads of 1.5 and 3 kg/cm², respectively. The mean pressure passing through the standing foot in adults has been shown to be 0.9 kg/cm² (0.6 to 1.8) (Betts et al 1980), increasing to 5 kg/cm² at impact during walking (Perry 1983). Our experimental model recreates forces of a similar magnitude.

Results. Before loading, our findings were similar to those previously reported (Silver et al 1994). The mean heel-pad

Table 1. Heel-pad thickness (mm) and percentage compression under maximal loading

	Loading (kg/cm ²)			Percentage compression*
	0	1.5	3	
Normal side	17.9	11.0	9.8	45.3
Injured side	19.4	12.5	10.7	44.8
p value	NS	NS	<0.03	NS

* see text

thickness was slightly greater on the injured than on the normal side. Application of a load to either side gave a progressive loss of thickness in every case, but at each loading point the mean thickness remained greater on the injured side (Fig. 1).

When the percentage reduction in thickness obtained with maximum (3 kg/cm²) pressure applied was compared, there was no significant difference between the injured (44.8%) and normal side (45.3%) (Table 1).

Conclusions. The absence of any significant difference in the behaviour of the heel pad on either side reinforces our

belief that permanent damage to the soft tissues of the heel does not occur at the time of calcaneal fracture and should no longer be regarded as an objection to open reduction and internal fixation.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

REFERENCES

- Betts RP, Franks CI, Duckworth T, Burke J.** Static and dynamic foot-pressure measurements in clinical orthopaedics. *Med Biol Eng Comput* 1980;18:674-84.
- Heckman JD.** Fractures and dislocations of the foot. In: Rockwood CA, Green DP, Bucholz RW, eds. *Fractures in adults*. 3rd ed. 1991;24:2041-182.
- Kenwright J.** Editorial: fractures of the calcaneum. *J Bone Joint Surg [Br]* 1993;75-B:176-7.
- Kuhns JG.** Changes in elastic adipose tissue. *J Bone Joint Surg [Am]* 1949;31-A:541-7.
- Parmar HV, Triffitt PD, Gregg PJ.** Intra-articular fractures of the calcaneum treated operatively or conservatively: a prospective study. *J Bone Joint Surg [Br]* 1993;75-B:932-7.
- Perry J.** Anatomy and biomechanics of the hindfoot. *Clin Orthop* 1983;177:9-15.
- Prichasuk S.** The heel pad in plantar heel pain. *J Bone Joint Surg [Br]* 1994;76-B:140-2.
- Silver DA, Kerr PS, Andrews HS, Atkins RM.** Heel pad thickness following calcaneal fractures: ultrasound findings. *Injury* 1994;25:39-40.

BONY BRIDGES AND OTHER VARIATIONS OF THE SUPRASCAPULAR NOTCH

J. G. EDELSON

Man is the only animal in which a small, discrete suprascapular notch may develop, sometimes bridged by bone (Fig. 1).

Fig. 1

J. G. Edelson, MD, FAAOS, Chief
Department of Orthopedic Surgery, Poriya Hospital, Tiberias 15208,
Israel.

©1995 British Editorial Society of Bone and Joint Surgery
0301-620X/95/3R31 \$2.00
J Bone Joint Surg [Br] 1995;77-B:505-6.
Received 23 February 1994; Accepted 17 May 1994

We have recently investigated two patients for 'lytic lesions' of the scapula (Fig. 2) which were later shown to be normal variants of the anatomy of the suprascapular notch. Both were subjected to a bone scan, CT, MRI, and a variety of blood studies. These would not have been necessary had we appreciated this variation in anatomy.

Subsequent examination of 1000 museum specimens has allowed description of variations in the anatomy of the suprascapular notch.

Materials and methods. We examined 700 scapular bones from the Huntington Collection of the Smithsonian Institution in Washington. This collection came from diverse ethnic groups in New York City during the first half of this century. We also examined an additional 300 adult specimens from Alaskan Eskimos and from South-Western United States Indians from the Museum of Natural History in New York City. The scapular anatomy in six gorillas and six chimpanzees was also reviewed.

Results. A suprascapular notch, completely bridged over by bone, was found in 37 specimens (3.7%) (Fig. 1). In a true anteroposterior radiograph there appears to be a 'hole' in the bone which is obscured in the oblique projection used in the standard shoulder or chest films. Partial bridges of bone were found in an additional 81 specimens (8.1%) (Fig. 3).

Discussion. A wide variety of configurations of the supra-