SOFT-TISSUE INTERPOSITION OF FEMORAL FRACTURES

DETECTION BY ULTRASONOGRAPHY DURING CLOSED NAILING

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We have compared the sonographic findings of six femoral fractures with soft-tissue interposition which required open reduction with those of a control group of 40 other femoral fractures. Ultrasound assessment before operation showed that the fractured end of the proximal fragment had penetrated the quadriceps muscle anteriorly while the distal fragment lay beneath it. Transverse scans showed less soft-tissue thickness over the end of the proximal fragment in the problem cases. Radiographic image intensification did not provide any additional information.

Ultrasound is of value in demonstrating soft-tissue interposition at the fracture site before femoral nailing.

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The successful closed reduction of closed femoral fractures may be impossible when there is soft-tissue interposition at the site of injury. Physical examination and radiography cannot demonstrate this; recognition of the problem may therefore be delayed and lead to fruitless manipulation and more injury to the soft tissues.

We report a retrospective study comparing the sonographic findings in six fractures with soft-tissue interposition with those in a control series of 40 other fractures.

PATIENTS AND METHODS

Between September 1989 and October 1994 at Srinagarind Hospital and Siriraj Hospital, we performed closed femoral nailing on 251 femoral-shaft fractures in 245 patients using

ultrasound to monitor fracture alignment and the insertion of the guide wire from the proximal to the distal fragment by the method already described (Mahaisavariya et al 1991; Mahaisavariya and Laupattarakasem 1993).

Six fractures could not be reduced due to soft-tissue interposition, even with the use of an image intensifier. The fractures were in five men and one woman of mean age 23.8 years (20 to 30). The sonograms recorded from these six patients were studied and compared with those from 40 patients without soft-tissue interposition.

RESULTS

Details of the six patients are shown in Table I. In only one (case 4) was a skin dimple present on the thigh. Sonography showed that the proximal fragments of the femora of all six patients had penetrated the quadriceps anteriorly while the distal fragments lay beneath it (Fig. 1). By contrast, sonograms from all 40 of the control group showed both the proximal and the distal ends of the bone fragments beneath the quadriceps muscle (Fig. 2). Ultrasound scans on the axial plane showed similar findings (Fig. 3). The mean soft-tissue thickness over the proximal fragment at the fracture site in the problem cases was 13.7 mm (12 to 16) and in the control group it was 31.2 mm (21 to 45).

DISCUSSION

Soft-tissue interposition between the bone fragments in closed femoral-shaft fractures is not uncommon and a definite diagnosis is possible only after the fractures have been explored. In our first patient, we did not recognise the abnormal sonographic findings, and the fracture was manipulated for 15 minutes without success. A further closed reduction was tried for ten minutes using an image intensifier, again with failure. The fracture was then opened and the proximal fragment was found to have penetrated the quadriceps muscle anteriorly.

Re-evaluation of the sonograms showed that they demonstrated the soft-tissue interposition. The findings were striking and not difficult to interpret. In the other five patients in the series diagnosis was made promptly using ultrasound. The fractures were manipulated briefly under image intensification to confirm that closed reduction was not possible and all five then had open reduction.

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Fig. 1a

Fig. 1b

Diagram and examples of ultrasound scans in the transverse plane of a fracture with soft-tissue interposition. The proximal fragment (P) lies anterior to the quadriceps muscle (arrow head) while the distal fragment (D) lies deep to it.

Fig. 2a

Fig. 2b

Diagram and examples of ultrasound scanning in the transverse plane of a fracture with no soft-tissue interposition. The proximal (P) and the distal (D) fragments lie beneath the quadriceps muscle. The skin-to-bone interval (arrows) are measured at the fractured end of the proximal fragment.

Fig. 3a

Fig. 3b

Image displays on the axial plane showing the proximal fragment penetrating the quadriceps muscle anteriorly (arrows) (a) and the proximal and distal fragments lying beneath the quadriceps muscle (b).

Table I. Details of the six patients with irreducible fractures due to soft-tissue interposition, and of the control group

Case	Age (yr)	Sex	Side	Level	Fracture	Comminution†	Duration from injury to surgery (days)	SBI* (mm)
Problem group (n = 6)								
1	20	F	L	Midshaft	Transverse	-	5	14
2	30	M	L	Midshaft	Transverse	Winqvist I	3	16
3	27	M	L	Midshaft	Short oblique	-	3	13
4	21	M	L	Distal 1/3	Butterfly	Winqvist II	10	12
5	25	M	R	Distal 1/3	Transverse	-	6	14
6	20	M	L	Distal 1/3	Transverse	-	7	13
Mean	23.8						5.7	13.7 ± 1.4 (SD)
Control group (n = 40)								
34	M	23L	Midshaft (30)	Transverse (18)	Uncomminuted (29)			
6	F	7R	Proximal 1/3 (6)	Short oblique (11)	Winqvist I (4)			
			Distal 1/3 (4)	Butterfly (7)	Winqvist II (7)			
				Spiral (4)				
Mean	26.3						3.8 (1 to 10)	31.2 ± 8.4 (SD) (21 to 45)

* skin-to-bone interval of the fractured end of the proximal fragment measured from the sonogram at the anterior aspect of the fractured thigh

† Winqvist, Hansen and Clawson (1984)

Our experience with ultrasound has enabled us to recognise the problem more easily and to proceed rapidly to open reduction. This helps to save time and avoid further soft-tissue damage.

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