RECURRENT STRESS FRACTURES IN MILITARY RECRUITS

ONE-YEAR FOLLOW-UP OF 66 RECRUITS

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Of 66 recruits who sustained stress fractures during basic training and returned to training after a period of rest, seven (10.6%) suffered recurrent fractures within one year. None of the recurrences was at the original anatomical site.

All of the recruits with recurrent stress fractures had had at least one of their initial stress fractures in the femur. This suggests that a femoral stress fracture carries a high risk of recurrence at other sites.

Once an athlete or military trainee has sustained a stress fracture he becomes worried by the pains that often occur during arduous training, fearing that they may herald another fracture.

Gilbert and Johnson (1966) reviewed 12 years' experience of more than 2000 military stress fractures and stated that stress fractures rarely recur at the same site, but recurrence in other sites is more common. Brahms, Fumich and Ippolito (1980) reported an isolated case of recurrent stress fracture. However, no series of patients has been followed-up after stress fracture long enough to determine the incidence of recurrence.

Our experience in treating soldiers at the stress fracture clinic of Hadassah University led us to believe that recurrent stress fractures are not rare. The incidence is important in the management of runners as well as military trainees. A prospective study of stress fractures was begun in February 1983 at the Osteoporosis Institute in Jerusalem (Milgrom *et al.* 1985), and 66 of the 91 soldiers who sustained stress fractures during basic training were kept under review for at least one year to determine the incidence of recurrence.

The 14-week period of basic training had included daily runs and calisthenics with twice weekly marches carrying heavy packs and guns. Much of it was on rocky, hilly terrain and there was some parachute training at the

end of the course. During the subsequent year, each soldier did additional, even more physically demanding, courses.

PATIENTS AND METHODS

A group of 295 male Israeli infantry recruits were studied prospectively from February 1983, being encouraged to report symptoms suggestive of stress fractures and having free access to medical staff with mandatory examinations every three weeks. Details of the methods of examination, radiography and scintigraphy are given by Milgrom *et al.* (1985) as are the incidence and site of the fractures. The diagnosis of stress fracture was made on the basis of positive radiographs or a positive scintigram (Prather *et al.* 1977). Of 295 recruits, 171 had symptoms and 91 (31%) had stress fractures, over half being in the tibia and one-third in the femur. Patients with stress fractures were rested until they were free of symptoms and then returned to duty, usually after a minimum of six weeks for a tibial stress fracture, eight weeks for a femoral stress fracture and two to three weeks for a metatarsal fracture. These periods follow the guidelines of Orava (1980).

At the end of basic training all the recruits were reviewed by an orthopaedic surgeon and told to report back to the stress fracture clinic if they had symptoms suggestive of stress fracture during future training courses. If this happened the recruit was assessed by the same orthopaedic surgeon; radiographs were taken and scintigraphy performed when these were indicated clinically.

One year after completion of basic training 66 (72.5%) of the 91 soldiers who had sustained stress fractures during basic training were seen for follow-up by the same team of doctors and interviewed about any musculoskeletal pain experienced since basic training. Their medical records from the stress fracture clinic were reviewed, as were records from any other institution at

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Table I. Details of patients who sustained a recurrent, symptomatic stress fracture after treatment for the initial injury

Case number	Initial stress fracture		Recurrent stress fractures	
	Onset of pain (month of training)	Sites	Onset of pain (months of training)	Sites
1	1	R proximal femur	8	L mid-femur
2	1	R mid-femur	14	R proximal tibia
	2	R distal femur		R mid-tibia
	1	L mid-femur		L mid-tibia
3	2	L distal femur	8	R patella
	2	R mid-tibia		
	2	R distal femur		
	2	L ilium		
4	Painless	R proximal femur	7	R mid-femur
	3	L mid-femur		
	Painless	R medial femoral condyle		
	Painless	R medial tibial plateau		
5	Painless	R proximal femur	8	L mid-femur
	1	L mid-tibia		
6	Painless	R distal femur	14	R mid-tibia
	Painless	L distal femur		L mid-tibia
	2	L proximal tibia		
7	Painless	R distal femur	11	L metatarsus
	1	L mid-tibia		

Table II. Relation between the presence of a femoral stress fracture during initial training and later recurrence of stress fractures

Later recurrence	Femoral stress fractures		
	Present	None	Total
None	21	38	59
Present	7	0	7
	28	38	66

By χ^2 test $P = 0.0011$

which they had been seen for a musculoskeletal complaint. Each soldier was examined for signs of stress fracture and any areas of bony tenderness were investigated and evaluated in the same manner as those found during basic training.

The statistical significance of the findings of this review was evaluated by the chi-square test.

RESULTS

Of the 66 soldiers, 13 had symptoms suggestive of stress fracture during the period of follow-up after basic training. Scintigrams were repeated from one to four weeks after the onset of the new symptoms, and seven of the 13 soldiers showed recurrent stress fractures, a recurrence rate of 10.6%.

The mean time between the initial and the new symptoms was 10 months (range 7 to 14 months). At the time of the repeated scans, five of the seven soldiers were found to have complete resolution of their earlier stress fractures; the other two showed a decrease in the activity

of the original foci. All the recurrent stress fractures were at new anatomical sites. The location and time of onset of all stress fractures in these seven soldiers is given in Table I. In all patients who had suffered recurrent stress fractures, at least one of their initial stress fractures had been in the femur, and 25% of those with an initial stress fracture in the femur had had a recurrent fracture at another site. No patient whose initial fractures did not include one in a femur had a recurrent injury. This difference is statistically significant at $P = 0.0011$ (Table II).

The scintigram of a recruit who developed pain in the proximal right thigh in the first month of basic training is shown in Figure 1. At that time both radiograph and scintigram showed a femoral stress fracture. He returned to training after eight weeks' rest and was symptom-free for five months until he developed pain in the left mid-thigh. At first, radiographs of his left femur were normal. Scintigraphy showed resolution of the original focus in the right femur and a new focus in the mid-shaft of the left femur (Fig. 2); one month later this

was confirmed radiographically as a definite stress fracture.

DISCUSSION

Stress fractures involve mainly runners and military recruits. The incidence in runners is not known, but an incidence as high as 63% was reported by Sahi (1984) in Finnish paratroop recruits and we have reported a 31% incidence in Israeli infantry recruits (Milgrom *et al.* 1985).

The incidence of recurrent stress fracture after treatment and return to training is important, since with this knowledge better medical advice can be given to both the trainee and his instructors, both on future training programmes and on the need for medical supervision. The one-year follow-up in this study allows several conclusions to be drawn.

1. The recurrence rate can be quite high (10.6% in our series), but was lower than the incidence of the original stress fractures during basic training (31%).
2. All the soldiers who suffered a recurrent stress fracture had at least one of their original stress fractures sited in the femur. This suggests that a patient who has recovered from a stress fracture of the femur is particularly at risk for a second, later stress fracture (25% in our series), and should therefore be closely monitored.
3. There was no recurrence of a stress fracture at the same anatomical site in our study.
4. Of the soldiers with clinical findings suspicious of stress fracture during basic training, 91 of 171 (53%) were found to have stress fractures on the basis of scintigraphy. Of the soldiers with suspected recurrent stress fractures 7 of 13 (52%) were found to have new stress fractures on repeated scintigraphy. The proportion of confirmed stress fractures among those patients about whom there was clinical suspicion was nearly identical both during and after basic training. Stress fracture is

Fig. 1

Fig. 2

Figure 1—Scintigram in the fourth week of basic training showing a lesion in the right proximal femur. Figure 2—Scintigram of the same patient, 27 weeks later, showing resolution of the right-sided stress fracture and a new lesion in the mid-shaft of the left femur.

therefore possible in any patient with bone pain on exertion no matter when it occurs in the course of a training programme.

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