Tibial periosteal reactions in soldiers

A scintigraphic study of 29 cases of lower leg pain

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Twenty-two soldiers with tibial pain along the posteromedial tibial border (29 painful tibias) entered the study. The tibias were evaluated using radiographs and scintigraphs. Follow-up scintigraphs of 12 tibias were performed. The scintigraphic lesions were classified as Stages 0–V depending on the percentage of bone thickness involved. No attempts were made to differentiate between shin splints and stress fractures. Twenty-four symptomatic lesions and five asymptomatic lesions were found by scintigraphy. Radiographic changes were found in all the lesions classified as Stage III or higher, in some Stage II lesions, but never in Stages 0 and I lesions. Because intense scintigraphic uptake is seen in bone tumors, radiographs are needed to exclude this diagnosis. Radiographs were, however, not as sensitive as scintigraphs for differentiating the periosteal injuries seen in this study. The initial scintigraphs can be used to classify the lesions. Follow-up scintigraphs are not useful because they take months to return to normal. Consequently, the clinical symptoms and the level of pain should be the guidelines for treatment.

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We report radiologic examinations of different types of tibial periosteal injuries seen in trained soldiers with lower leg pain.

Material and methods

Twenty-two trained male soldiers from the Royal Danish Lifeguard with complaints of tibial pain for a median of 1 (0.5–6) months entered the study after informed consent. All the patients had pain along the posteromedial tibial border, usually relieved by rest, but some still had a dull aching pain during rest. Fifteen patients had unilateral tibial pain and 7 patients had bilateral pain for a total of 29 painful tibias.

Standard AP and lateral radiographs were taken of the painful tibia and classified as positive if periosteal bone reactions were seen.

Within a week after the initial clinical examination and the initial radiograph, a bone scan was performed using 400 MBq ^{99m}Technetium-methylene-diphosphonate (MDP), injected intravenously. The patients were examined with a General Electric Maxi-camera 2 hours after the injection. Both tibias were examined, usually in AP and lateral projections. The scintigraphic lesions were classified according to Matin (1988) depending on the percentage of bone thickness involved (Table 1). The findings at the first clinical examination are shown in Table 2 together with all the radiographic and scintigraphic findings.

The patients stopped physical activity for 4–6 weeks and were treated with nonsteroid anti-inflammatory drugs.

Follow-up radiographs of 17 tibias were taken 7 (2–16) weeks after the initial examination. In the remaining 12 tibias, follow-up radiographs were not performed because the patients did not want to participate in additional examinations after the pain had completely disappeared.

Table 1. Scintigraphic classification of tibial periosteal injuries/stress fractures

Stage of Injury	Percentage of bone thickness involved	Comments
0	0	No detectable abnormality
I	0–20	Minimal periosteal reaction
II	20–40	Moderate periosteal reaction
III	40–60	Early stress fracture
IV	60–80	True stress fracture
V	80–100	Full thickness stress fracture

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Table 2. Initial clinical findings compared with radiographic and scintigraphic findings

No.	Tibia	Duration (weeks)	Pain during strain/rest	Tenderness, direct/indirect	Initial radiograph[a]	Initial scintigraph, stage	Follow-up radiograph[a]	Follow-up scintigraph, stage
1	R	4	+/+	+/–	n	IV	c	–
2	L	3	+/+	+/–	n	IV	c	II
3	R	3	+/–	+/–	n	0	–	0
	L	3	+/–	–/–	n	I	–	0
4	L	6	+/+	+/+	n	IV	c	II
5	L	2	+/–	+/–	n	IV	c	IV
6	L	26	+/–	+/–	n	0	n	0
7	R	4	+/–	+/–	c	III	c	–
8	R	8	+/–	+/–	c	III	–	–
9	R	2	+/–	+/–	–	II	n	–
10	R	26	+/+	+/–	n	I	–	–
	L	26	+/+	+/–	n	I	–	–
11	R	3	+/–	+/–	n	I	n	–
	L	3	+/–	+/–	n	I	n	–
12	R	3	+/+	+/–	n	II	–	–
	L	3	+/+	+/–	n	I	–	–
13	R	8	+/+	+/+	n	0	–	–
14	L	6	+/+	+/–	n	0	–	–
15	R	3	+/+	+/–	n	III	c	I
16	L	8	+/+	+/–	n	I	n	–
17	R	4	+/–	–/–	–	III	c	II
	L	4	+/–	+/–	n	III	c	II
18	R	2	+/–	+/–	n	0	n	–
	L	2	+/–	+/–	n	II	c	–
19	R	6	+/+	+/–	–	III	c	–
20	L	3	+/–	+/–	c	III	n	II
21	R	2	+/–	+/–	n	II	–	–
22	R	4	+/–	+/–	c	II	–	I
	L	4	+/–	+/–	–	II	–	I

[a]c callus, n normal.

In 12 tibias a new bone scan was performed 19 (12–32) weeks after the initial examination. Follow-up bone scans were not performed in the remaining 17 tibias for the reasons mentioned above; in 6 cases the patients had moved to another part of the country.

However, all the patients had repeated clinical examinations until the tibial pain disappeared.

Results

The initial radiographs were positive in only 4/29 tibias (Table 3). Repeat examinations showed periosteal reactions in another nine tibias.

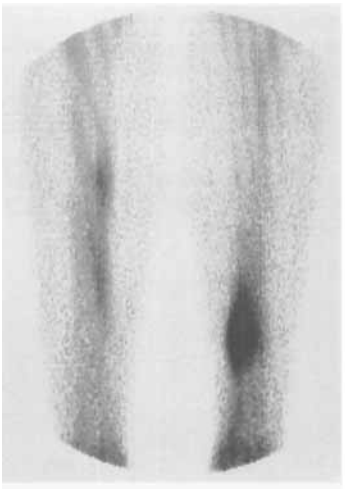
An additional five asymptomatic lesions were discovered by the initial scintigraphs: three Stage I and two Stage II lesions. Two of the Stage I lesions and one of the Stage II lesions had follow-up radiographs, with only the latter showing a radiographic periosteal reaction. One additional patient developed a Stage II lesion in the other tibia. Most of the repeat scintigrams had lost in intensity (Table 4).

Table 3. Scintigraphic findings in 29 painful tibias compared with the number of positive radiographs

Scintigraphs		Positive radiographs
Stage	No.	Total (initial exam)
0	5	0 (0)
I	7	0 (0)
II	6	2 (1)
III	7	7 (3)
IV	4	4 (0)
Total	29	13 (4)

Table 4. Scintigraphic and clinical findings at follow-up of 12 painful tibias

Evolution of scintigraphic findings	Number of lesions	Pain disappeared	Pain decreased	Pain unchanged
Disappearance of lesion	1	0	0	1
Lesion decreased in intensity	8	4	2	2
Lesion unchanged				
Stage 0	2	0	0	2
Stage IV	1	1	0	0



Initial scintigraph showing a Stage IV lesion in the left tibia and an asymptomatic Stage II lesion in the right tibia. The corresponding radiographs were normal.

Radiographs 3 months later showing periosteal bone reaction in the left tibia.

Follow-up scintigraph 6 months after the initial examination. A Stage IV lesion is still found in the left tibia, although painless for 4 months. The Stage II lesion in the right tibia is still asymptomatic.

Figure 1. Radiologic findings in lower leg pain.

Discussion

Scintigraphs have been used to differentiate between shin splints and stress fractures (Holder 1984, Matin 1988). The scintigraphic appearance of shin splints is more elongated and less intense in uptake than the typical fusiform uptake seen in true stress fractures. However, in some cases, it may be impossible to differentiate shin splints from Stages I and II lesions (Matin 1988).

Clinically, we found that Stage I and perhaps Stage II lesions cannot be distinguished from shin splints; and it will probably be of no clinical interest, as the treatment is the same. Consequently, we classified the scintigraphic lesions as shown in Table 2, and made no attempt to differentiate between shin splints and stress fractures.

We found radiographic confirmation (periosteal bone reactions) in all Stages III and IV lesions and in some Stage II lesions, suggesting that they represent stress fractures, although no fracture lines were seen. The radiographs remained normal in all the Stage I lesions and in some Stage II lesions. Similar results have been found in other studies (Zwas et al. 1987). Therefore, the term stress fracture should only be used for Stages III–V lesions, whereas Stage I and possibly Stage II lesions should be termed periosteal reactions.

The initial scintigraphs were positive in 24 painful lesions (Table 3) together with five asymptomatic Stages I and II lesions, i.e., one fifth of the lesions in this study were asymptomatic. Zwas et al. (1987) reported that 40 percent of the scintigraphic lesions were asymptomatic. An explanation for these asymptomatic lesions might be that continuous stress will result in remodeling of the bone, and this does not have to be painful.

The scintigraphic lesions will usually decrease in intensity as the pain decreases (Table 4), but will take several months to return to normal, as found in this and other reports (Chisin et al. 1987, Matin 1988). On one occasion, we still found a Stage IV lesion in a patient who had been free from tibial pain for 4 months (Figure 1). This makes the scintigraphy unsuitable for routine follow-up.

We also found one tibia that had been painful for several months, although the scintigraphs remained normal (Table 4). It is possible that a three-phase bone scan (Holder 1984, Rupani et al. 1985) could have revealed some abnormality of the soft tissues in this patient.

Because intense scintigraphic uptakes are seen in bone tumors, the radiographs are needed to exclude this diagnosis. Radiographs are, however, not as sensitive as scintigraphs for differentiating the periosteal reactions seen in this study.

We conclude that an initial scintigraphy can be diagnostic, because Stages IV and V lesions will need longer rehabilitation than Stages I and II lesions. However, the clinical symptoms and the level of pain should be the guidelines for the physician in the follow-up.

References

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