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FROM THE ROENTGEN INSTITUTE OF THE ROYAL SERAPHIMER HOSPITAL, STOCKHOLM.
(CHIEF: PROF. G. FORSSELL)

ON INSUFFICIENCY FRACTURES OF FEMUR AND TIBIA[1]

by

C. J. Hansson

The injury to the metatarsal bones which goes under the name of »march»-fracture is a condition well-known both to clinics and roentgenological institutes. In Sweden, it has been described by, inter alia, RUNSTRÖM.

As regards tibia, a similar form of fracture has been described by ALEMAN (Sweden) as early as 1929 and, later on, by GENZ (Germany) and OLLONQVIST (Finland). ALEMAN states that, in the Swedish army, there are reported, yearly, about one hundred cases of so-called periostitis tibiae ab exercitio. He objects to this name and designates the affection, Insufficiency fracture. He states that he has never observed a fracture-line but merely the callus formation. In all the above material, the patients were recruits who had suffered the injury at the beginning of their service, when they were unused to the hardships of military service. Below, I shall give an account of a typical case which had been investigated at the Roentgen Department of the Seraphimer Hospital, Stockholm.

Case 1. An iron-worker, 20 years old.

Previously, always well. On May 14, 1938, the patient began his military service. After serving for a month, he noticed an increasing aching and unpleasant feeling in the right lower leg during movements, most on concussions, e. g., when he jumped. Never any spontaneous achings during the night. Tumour being suspected, the patient was sent to the Radium Home for treatment. On examination, there was found, on palpation, on the median edge of the right tibia, about the middle of the bone, a certain tenderness. No swelling, nor tumour of any soft part. Roentgen investigation, $^{9}/_{7}$, 1938, showed medially, posteriorly, on the right tibia, somewhat above the middle of the bone, periostal deposit and there was observed, indistinctly a fracture running through the superficial part of corticalis. Roentgenologically, the alteration was interpreted as being an insufficiency fracture. Temperature and S. R. were both normal. W. R. in the blood, neg. Fig. 1 and 2.

[1] Submitted for publication Oct. 27, 1938.

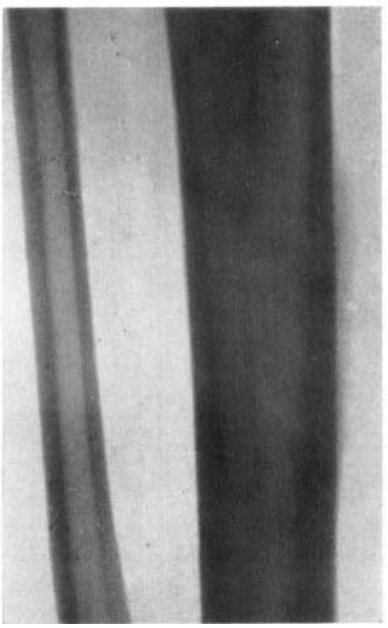

Fig. 1.

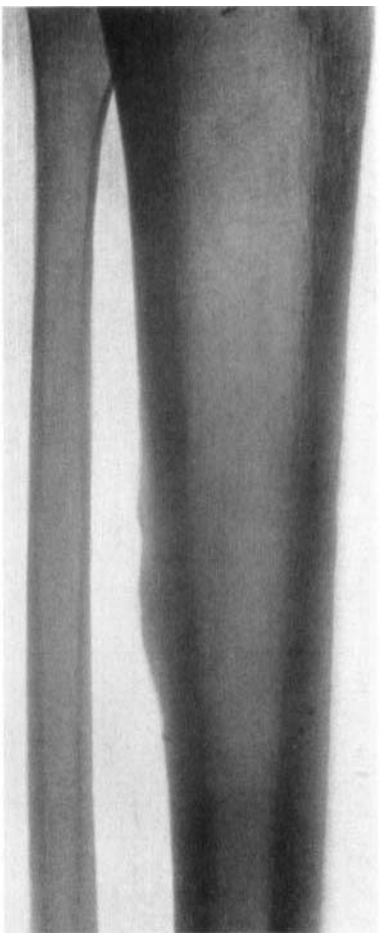

Fig. 2.

From what I have been able to find in the literature, this form of fracture on femur has not been observed, so that one is justified in giving an account of two cases which we have had the opportunity of observing at the Seraphimer Hospital during the last few years.

Case 2. Woman, 40 years old, butleress.

The patient came, $^{10}/_{12}$, 1934, to the surgical policlinic for treatment of aching pain on the anterior side of the right thigh. She had had this distress since 1928 and the pains had grewn worse after bodily exertion. No trauma ever known of. On the clinical examination there was palpated on the anterior, lateral, part of the right tigh, deep down, a slightly tender resistance, above which the patient had a feeling of straining. The roentgen investigation, $^{12}/_{12}$, 1934, discovered, on a scarcely decimetre-long area on the median side of the right femur, a spindle-shaped sclerosis and thickening of corticalis, both exteriorly

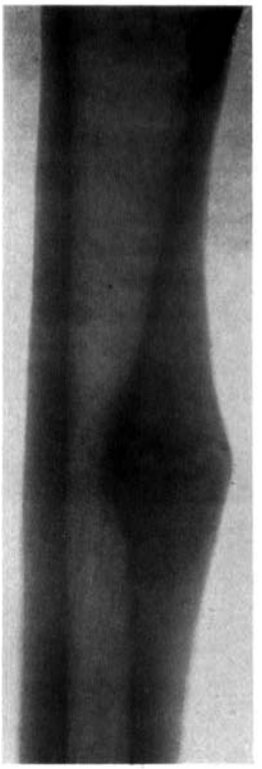

Fig. 3.

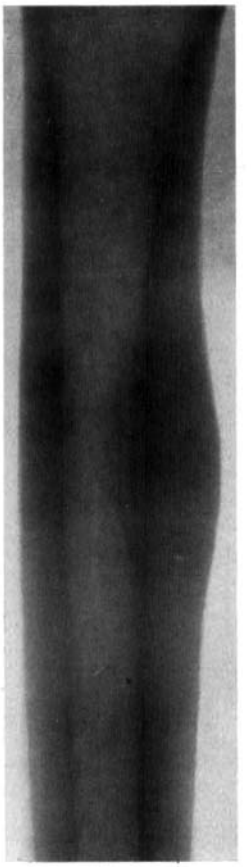

Fig. 4.

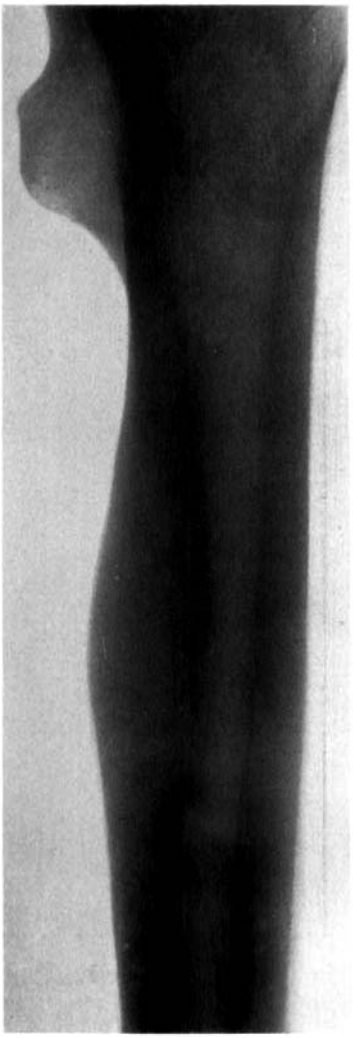

Fig. 5.

and inwards towards the bonemarrow cavity (which, at the narrowest place, was compressed to one-half of its normal width). A narrow, irregular fracture-line running through the sclerosized area. Fig. 3. The patient was advised to keep quiet and to rest, and improved on doing so. Both temperature and S. R. were normal during the entire duration of the course of the affection. W. R. in blood, neg. Nutrition-condition normal. No other pathological alterations of the skeleton. Roentgen-control was carried out a couple of times during 1935, but the fracture-line could still be observed, although somewhat more indistinctly than before. Roentgen-control, $^{6}/_{10}$, 1936, however discovered nothing but the spindle-shaped swelling of corticalis, without any fracture-line. Fig. 4.

On control examination in February, 1937, the patient was quite free from symptoms Roentgen still showed swelling of corticalis.

Case 3. Man, 20 years old, shopman.

In May, 1936, the patient began to feel pricking pains in the left calf. These pains gradually went over to the left knee and finally localized themselves in the middle of the left thigh. He was sent to the Radium Home from a provincial hospital, malign tumour being suspected. He had not fever; S. R. 13 mm. W. R. in blood, neg. On examination there was discovered inconsiderable atrophy of the left thigh; no resistance palpable. Roentgen investigation, $^{18}/_{11}$, 1936, discovered in the upper part of the left thigh a spindle-shaped thickening of corticalis on the median side, extending downwards from trochanter minor, about $1^1/_2$ decimetre. No structural alteration could be found anywhere else in femur or in any other part of the skeleton; normal nutrition condition. In this case, no fracture line was visible. Fig. 5. The alteration was considered to be a healing-condition after an infraction.

All insufficiency fractures, whether localized to the metatarsal bones, to tibia or femur, are characterized clinically by pains localized to the place where the fracture is situated. The pains become more severe after walking or after bodily exertion, and disappear when the patient goes to bed. There exists no connection between the rise of the pains and a definite trauma. On roentgen investigation we discover a spindle-shaped thickening of corticalis, both periostally and endosteally, and within and through this thickening there is visible, now and then, a fracture-line, some mm. broad. Cases 1 and 2 of our patients exhibited such a fracture-line. The skeletal system, in other respects, is without pathological alterations and the patients have a normal nutrition condition.

In pathologically altered bone, such as in rachitis, osteogenesis imperfecta, or in hunger-osteopathy, such loading-fractures are often described. Specially known from a large number of publications are the socalled pseudo-fractures in hungerosteopathy. This form of disease appeared specially in Germany during and immediately after the Great War and it is, too, German authors especially who have devoted great attention to problems connected with it.

In rachitis and osteomalacia LOOSER discovered fracture-like lines in the bone, to which he devoted detailed study. He found now and then in bone altered pathologically in this way a transverse or oblique fissure-formation, around which callus was being formed. Ordinary clinical fracture features were wanting. Similar conditions in hunger-osteopathy are described by him and a number of other German authors, such as FROMME, SEELIGER and HOENIGMANN. Common to all these cases is, that they could not be explained as arising from a definite trauma. It was assumed that the fracture-formation arose in consequence of a resorption process arising from insufficient nutrition. As a result of the defective nutrition, the normal balance between apposition and resorption in the bone would, it was considered, be disturbed; resorption would get the upper hand and, in this way, give rise to the formation of these fracture-like conditions. WALTER MÜLLER and KOCH, on the contrary,

stated that such insiduous callus formations arose in consequence of long-lasting mechanical and statical irritation, and they showed, experimentally, that long-lasting physical exertion and loadings gave rise to similar callus formations in bone, too, which was not pathologically altered.

Even in our cases, where the bone was not pathologically altered, we must assume that the cause of such pathological pictures was over-exertion and overloading of the leg.

Consequently, there does not exist any principal difference between the method of origin of such fractures in the tibia and femur, and the rise of a »march»-fracture in the metatarsal bones.

On over-loading, there arises, on the most exposed part, a lesion of the bone trabeculae which may be more or less pronounced. For instance, there arises in the one instance a visible fracture-line in the bone (Case 1 and 2) and, in the other, the injury to the bone trabeculae is so slight that it is not apparent to our ordinary means of observation (Case 3). In all the cases there arises a callus formation which is very clearly observable to roentgen.

I have wished to draw attention to this form of fracture because, as ALEMAN pointed out, the term, periostitis ab exercitio, is misleading, and also because this form of fracture can easily be misinterpreted as being tumour of the bone. This latter objection is illustrated by the fact that two of the cases were referred to the Radium Home for treatment, under the diagnosis: malign tumour of bone.

SUMMARY

The author describes a case of insufficiency fracture in tibia and two similar cases in femur. He considers that there is no principal difference between this type of fracture and the so-called »march»-fracture in the metatarsal bones.

ZUSAMMENFASSUNG

Verf. beschriebt einen Fall von Insuffizienzfraktur der Tibia und zwei ähnliche Fälle von solchen Frakturen im Femur. Seiner Ansicht nach besteht kein prinzipieller Unterschied zwischen diesem Frakturtyp und der sogen. »Marsch»-Fraktur in den Metatarsalknochen.

RÉSUMÉ

L'auteur décrit un cas de fracture d'insuffisance du tibia ainsi que deux cas similaires au fémur. Il estime qu'il n'existe aucune différence de principe entre ce type de fractures et celle, appelée »fracture de marche», des os métatarsiens.

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