STRESS FRACTURES OF THE LOWER LIMB IN PATIENTS WITH RHEUMATOID ARTHRITIS

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Thirteen patients suffering from rheumatoid arthritis had 19 stress fractures of the tibia or fibula. These patients characteristically presented with sudden, severe, unexplained pain with localised tenderness just below the knee or above the ankle. In seven patients examination of the adjacent joint indicated a flare-up of disease activity or a pyogenic arthritis. In six patients the diagnosis was delayed by the late appearance of callus in minute fractures. All patients had rheumatoid deformities of the ipsilateral lower limb: valgus deformities of the knee and subtalar joints occurred most frequently. All patients had osteoporosis; all except two had received steroid treatment and five had abnormalities of calcium metabolism.

We suggest that deformities of the knee and ankle predispose patients with rheumatoid arthritis and osteoporosis to stress fractures of the tibia and fibula.

Stress fractures in the long bones and the neck of the femur are frequently found in patients with rheumatoid arthritis (Baer 1940; Haider and Storey 1962; Devas 1966). Generalised osteoporosis is considered to be important in the pathogenesis of these fractures which can also occur at identical sites in patients without rheumatoid arthritis who are otherwise well (Devas 1966). Corticosteroid treatment, osteomalacia and disuse of the limb predispose patients with rheumatoid arthritis to the loss of bone and stress fractures.

Deformity of the knee in patients with rheumatoid arthritis has been cited in two reports as a contributory factor in the aetiology of stress fractures of the tibia and fibula. Wheeldon (1961) described three such elderly female patients with rheumatoid arthritis and flexion deformities of the knee, and Reynolds (1972) described three rheumatoid patients with valgus deformities of the knee who developed stress fractures.

In our report of stress fractures of the tibia and fibula in patients with rheumatoid arthritis, rheumatoid deformities of the knees, ankles and subtalar joints were probably contributing factors. Valgus deformity of the knee and of the subtalar joints, associated with stiffness of the ankle, occurred most frequently.

CLINICAL MATERIAL AND METHODS

Thirteen patients (11 female, 2 male) with stress fractures of the tibia and fibula were seen over a period of four years. All except one patient were Caucasian and all had been diagnosed as having definite or classical rheumatoid arthritis according to the American Rheumatism Association criteria (1959). The rheumatoid arthritis was severe, erosive and longstanding, and all except three patients were seropositive for rheumatoid factor. In no case was there any history of trauma. The following information was available: a full history including details of diet, mobility, and past and present treatment. Clinical assessment of both hips, knees and ankles was made and the degree of valgus and fixed flexion deformity of the affected knee or ankle measured and compared with the other leg. Anteroposterior and lateral instability and the range of movement were also assessed.

Radiographs of the fracture site, ankles and knees were taken and a skeletal survey made to exclude the possibility of osteomalacia. Routine haematology, serology and biochemistry were performed. Three consecutive fasting serum calcium, albumin phosphate and alkaline phosphatase estimations were made using a Vicker's autoanlyser. When possible, three consecutive 24 hour estimations of urinary calcium and phosphate were performed while the patient was receiving a hospital diet. In some cases more extensive investigations for metabolic bone disease were indicated.

Table 1. Assessment of 13 patients with rheumatoid arthritis and stress fractures of the tibia and fibula

<table>
<thead>
<tr>
<th>Clinical features</th>
<th>Number of fractures</th>
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<tr>
<td>Acute pain with localised tenderness</td>
<td>10</td>
</tr>
<tr>
<td>Acute pain and hot swollen joint</td>
<td>7</td>
</tr>
<tr>
<td>Swollen joint, No pain</td>
<td>1</td>
</tr>
<tr>
<td>Asymptomatic</td>
<td>1</td>
</tr>
</tbody>
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RESULTS
The mean age of the 13 patients was 62 years (range 33 to 80 years) and the mean duration of disease was 19 years (range 5 to 30 years). All except two patients had received some form of steroid treatment and of these only one was not taking steroids at the time of fracture. Patients presented with either a sudden onset of severe pain, which was worse on activity with tenderness localised around the ankle or knee but with no previous trauma; or with pain as described, but associated with the development of a hot swollen joint suggesting a flare-up of joint disease or a septic arthritis (Table I). Eleven of the fractures were correctly diagnosed at the first consultation in the hospital. The diagnosis of six fractures was delayed for two to six weeks, since hairline fractures are easily missed and callus formation is often delayed; a further two were initially missed because radiographs were not performed.

CASE REPORTS
Case 1. In February 1976 a 42-year-old woman with seronegative erosive rheumatoid arthritis presented with spontaneous pain and swelling of the left knee. Examination revealed a hot, swollen knee with 15 degrees of valgus and a range of flexion from 10 to 100 degrees. There was an area of tenderness over the upper and medial part of the left tibia. She had stiff ankles and a valgus subtalar joint on the left. She had previously had a successful osteotomy of the right knee. Radiographs (Fig. 1) showed an undisplaced stress fracture of the uppermost third of the left tibia coinciding with the tender area. One year later, she complained of severe pain in the left ankle. This
Diagnosis of the stress fractures was often delayed. Three of the 13 patients had investigations for suspected septic arthritis and four were thought to have relapses of their joint disease. Three other patients who presented with marked pain and erythema near a joint were initially thought to have cellulitis and in two cases the diagnosis was missed initially because radiographs were not taken.

There were five fractures of the uppermost third, and six fractures of the lowermost third of both the tibia and fibula; three fractures of the uppermost third and two of the lowermost third of the tibia alone; and two fractures of the upper and one of the lower fibula alone. All except two patients had ipsilateral valgus deformities of the knee and subtalar joints which were associated with stiffness of the ankle. Valgus deformities were also found in four of the contralateral knees but these deformities were less severe than those on the ipsilateral side, excluding one patient whose knees were equally affected. This patient fractured both her tibiae and fibulae on separate occasions.

Table II shows the details of any valgus deformity of both knees in each patient. All except two patients also had fixed flexion deformities of the knee on the affected side with a mean range of movement of 87.7 degrees (±5.5 degrees) compared to 112.7 degrees (±7.4 degrees) on the contralateral side. The mean range of movement of the ipsilateral ankle joint was 19.6 degrees (±4.5 degrees) compared to 33.7 degrees (±5.7 degrees) on the normal side. Twelve patients had a valgus deformity of the subtalar joint. When this deformity was bilateral it was worse on the affected side. One patient had varus deformities of both the knee and ankle on the side of the fracture. A minor degree of anteroposterior and lateral instability of the knee was present in all patients.

![Fig 8](Image)

Case 3. Radiograph of both knees.
Skeletal surveys showed that the 13 patients had generalised osteoporosis, but none had evidence of osteomalacia (Milkman 1930). A biochemical screen for metabolic bone disease was performed on 12 patients. Two had malabsorption, one caused by Crohn's disease and one by primary biliary cirrhosis with obstructive jaundice. Three patients had a low urinary calcium. These patients were widows who were virtually housebound, living alone and on diets with lower vitamin D and calcium than that recommended by the Ministry of Health (1966). Fourteen of the 19 fractures occurred during the winter months, November to February. Eleven patients were classed as Grade III on the functional scale (Steinbrocker, Traeger and Batterman 1949). Five patients were completely housebound, but still relatively mobile.

DISCUSSION

Stress fractures of the uppermost and lowermost thirds of the tibia and fibula have been described and clinical descriptions of the different types reported by Devas (1975). Similar clinical descriptions of spontaneous pain aggravated by activity, marked tenderness with signs of inflammation localised at the fracture site, and the initial absence of radiological changes were seen in our 13 patients. However, we would like to emphasise the delay and difficulty in diagnosis of stress fractures which may occur in rheumatoid patients. The local warmth, redness, and swelling near a joint in a patient with severe rheumatoid arthritis taking steroids is often interpreted as either a relapse of disease in the joint or development of septic arthritis, or cellulitis. This results in a delayed diagnosis and further unnecessary investigations. The minute hairline crack may initially be overlooked and callus may not be apparent for several weeks (Proctor, Campbell and Dobelle 1944). The sudden onset of symptoms, and the association of a tender area with deformities of the knee, ankle and subtalar joints should alert the clinician to the possibility of stress fractures.

Haider and Storey (1962) considered generalised osteoporosis to be the main factor in the pathogenesis of stress fractures. Bone loss in patients with rheumatoid arthritis tends to be more pronounced in the region of an inflamed joint and most authors agree that the severity of osteoporosis is related to the duration of arthritis (Soila 1958; Kennedy et al. 1975a). Osteoporosis is more severe in postmenopausal women (Saville and Kharmosch 1967) and it can be aggravated by treatment with corticosteroids (Boland and Headley 1950; Kennedy et al. 1975b). Current research suggests that the loss of bone in rheumatoid arthritis results not only from immobility and disuse but also the disease process (Kennedy et al. 1975b). Dietary deficiency of vitamin D may be involved in skeletal rarefaction in the elderly (Exton-Smith, Hodkinson and Stanton 1966) and in rheumatoid patients with stress fractures (Maddison and Bacon 1974). Exposure to ultraviolet light may be significantly altered by variations in latitude, seasons and the mobility of the patient. Extensive investigations are often needed to make the diagnosis of osteomalacia and are recommended for patients with rheumatoid arthritis and fractures, as dietary deficiencies are not the only cause (O'Driscoll and O'Driscoll 1980).

We have found evidence for all these factors in our patients. All 13 patients had severe longstanding rheumatoid arthritis and most were elderly women who had received large doses of corticosteroids. They had generalised and juxta-articular osteoporosis which in some patients may have been caused by a deficiency of vitamin D, and relative immobility. Seasonal variation in sunlight may have tipped a precarious balance of vitamin D as shown by the higher incidence of fractures in the winter in our group of patients.

Devas (1975) has attributed the cause of stress fractures of the uppermost third of the tibia in fit young adults to bowing of the bone produced by use of the powerful tibial muscles. Stress fractures of the fibula alone occur most commonly just above the malleolus where the greatest bend occurs with normal movement. Reynolds (1972) postulated that varus or valgus deformities of the knee so alter the loading of the tibia that normal walking can cause stress fractures.

A striking feature in our group of patients was the presence of deformities of the knee, ankle and subtalar joint on the side of the fracture. Eleven of our patients had valgus deformities of the knee which, when bilateral, were more severe on the side of the fracture. This was associated with minor instability and flexion deformities in all patients. Except for the one patient with a varus deformity, ankle and subtalar deformities were present in the form of stiffness and valgus. Under these circumstances weight-bearing would cause the tibia and fibula to bow inwards in a convex fashion. Eventually this stress on the long bones exceeds a fatigue limit which results in fracture at a similar site to that found for fractures in healthy adults.

Prevention of the stress fractures involves correction of the joint deformities and an awareness of any metabolic and dietary deficiencies of vitamin D. Early recognition of clinical features prevents further weight-bearing and any further displacement of the fracture. The patients most likely to develop stress fractures are elderly women who have severe, steroid-dependent rheumatoid arthritis with marked steroid-dependent rheumatoid arthritis and valgus deformities of the knees and subtalar joints.

We thank Mr E. L. Trickey, Dr A. C. Boyle, Dr S. T. D. Mattingly and Dr Mary Corbett for permission to study their patients. Also Mr M. B. Devas and Mr T. C. B. Stamp for their help and advice in the preparation of this report and Miss G. Reilly for secretarial assistance.
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