STRESS FRACTURES OF THE FEMORAL NECK IN YOUNG ADULTS

A REPORT OF SEVEN CASES

DIMITRIS-STILIANOS KALTAS

From the Military Hospital, Thessaloniki, Greece

Seven patients with stress fractures of the femoral neck were treated at the Military Hospital of Thessaloniki, Greece between 1972 and 1976. Their average age was 22 years. Stress fractures of the femoral neck are not as common as stress fractures of the metatarsals or tibia and other bones. Intense muscular activity was the main cause of these stress fractures which were only classed as such in the absence of any injury. Pain and stiffness around the hip were reported by all seven patients before admission. Results of laboratory investigations of the patients' alkaline phosphatase and serum calcium levels were normal. One patient received surgical treatment and the other patients were treated conservatively. Healing was uneventful in all.

Stress fractures, also known as march fractures or fatigue fractures, have been described by many authors. The first clinical description was made by a German military surgeon in 1855 (Stechow 1897). However, reports of stress fractures of the femoral neck, are rare (Ernst 1964; Blickenstaff and Morris 1966; Devas 1975) and the first recorded case was not described until 1905 by Blecher (1905). Before 1964 there were 38 reports of stress fracture of the femoral neck, but each report described no more than four patients. A single case report of a stress fracture of the femoral neck in a patient with open capital femoral epiphyses was reported by Wolfgang in 1977. This was followed two years later by a report by Freeman, Todd and Pirie (1974) of a stress fracture of the femur in a child. The incidence of stress fractures of metatarsal bones, the fibula, tibia and calcaneus is much higher than that for stress fractures of the femoral neck. Since the first stress fracture of the femoral neck was reported in 1905 no more than 133 cases have been reported (Wolfgang 1977). This low number is probably due to the rarity of the condition, the difficulty in diagnosis and the resulting error in treatment.

The term stress fracture describes fractures which occur in normal bone of healthy individuals. The absence of a history of injury is the most important factor in the diagnosis. The association between muscle stress and bone fracture was previously reported by Devas (1961, 1965, 1975), Johnson et al. (1963), Blickenstaff and Morris (1966) and Baker, Frankel and Burnstein (1972). The diagnosis of a stress fracture may be difficult unless the orthopaedic surgeon bears the possibility of such fractures in mind. Stress fractures are often erroneously diagnosed as malignant neoplasms, osteomyelitis, osteoid osteoma or monoarticular arthritis. The following seven cases encountered in the Military Hospital in Thessaloniki, Greece could therefore be of interest to anyone working in this field.

All seven patients were young recruits undergoing military training. Military service in Greece is compulsory and young men from varying professions have to undergo the same rigorous training regardless of their past occupation. It therefore follows that an individual employed in a job which involves little strenuous physical activity is at greater risk because of the increased strain on the muscle. The normally healthy young man who walks occasionally has to force his musculoskeletal system to adapt rapidly to a radical change in the level of exercise.

A typical day in the life of a young enlisted recruit would normally commence at 6.30 am with breakfast followed by a training programme which varies from day to day but basically consists of a 10 kilometre march carrying a full pack, weighing 15 kilograms, on the back. In addition he would carry a rifle weighing another five to six kilograms. There would be a short stop after five kilometres. Occasionally these marches would be 20 to 25 kilometres under the same conditions. After lunch and a rest of one hour, training commences again with exercises carrying a full pack or speed marching. In the afternoon there is one hour of theory before dinner which is followed by free time.

D.-S. Kaltas, MD, Orthopaedic Registrar, Northwick Park Hospital, Watford Road, Harrow, Middlesex HA1 3UJ, England.

© 1981 British Editorial Society of Bone and Joint Surgery 0301–620X/81/00010033 $2.00

VOL. 63–B, No. 1, 1981
Case reports

Case 1. A 21-year-old recruit was admitted with a diagnosis of an osteolytic lesion of the neck of the left femur. The onset of symptoms had occurred eight weeks previously. The patient complained of increasing pain in the left hip which had radiated to the thigh and to the left knee. The pain was exacerbated by exercise or walking, although no history of trauma or injury was reported. The patient had been resting in bed and was taking analgesics, but the pain became worse as soon as he returned to his everyday activities.

The patient limped and was unable to stand on his left leg. Clinical examination revealed pain at the extremes of movement, especially medial rotation. Percussion of the greater trochanter was also painful. Atrophy of the left quadriceps was noticeable (1.5 centimetres) although the patient was afebrile. Measurements of the patient's alkaline phosphatase and serum calcium levels were found to be normal. Radiographs revealed a stress fracture of the left femoral neck and a dense patch along the left femur. The fracture had already started to heal in a varus position (Fig. 1).

Full investigation of the patient with tomography of the neck of the left femur confirmed the diagnosis of a stress fracture. The patient was treated with skeletal traction using a Steinmann pin placed through the tibial tubercle. Further radiographs showed that callus formation had already started. We therefore decided to continue conservative treatment. Callus formation was slow but uneventful.

Ten weeks after admission the patient began walking on crutches without weight-bearing and was discharged three weeks later. Radiographs at the time of discharge showed satisfactory callus formation (Fig. 2).

Follow-up three months, six months and one year after discharge showed the patient to be asymptomatic and the radiographs showed good healing.

Case 2. A 29-year-old non-commissioned officer was admitted complaining of pain in the right hip which gradually became worse when walking. The symptoms had increased in the three weeks before admission. During this period he had been taking part in long marches. Examination indicated that the pain was present at the extremes of movement in the right hip. Flexion and medial rotation was limited and painful and this pain radiated to the right knee. There was no record of any previous injury to the right hip.

Measurements of the alkaline phosphatase, serum calcium and phosphorus levels were found to be normal. Radiological examination showed extensive osteoporosis of the femur and a fracture of the neck of the femur had developed with a simulated osteolytic lesion (Fig. 3). Radiographs of the chest and the rest of the skeleton were normal.

An excision biopsy was made and no obvious indications of a tumour were recorded at the time of operation nor was there any apparent extension of tumour mass from the muscles. The friability of the cortex was very noticeable. The histological examination did not demonstrate any neoplasm but diffuse osteoporosis and rarefaction of the trabeculae were noted. Conservative treatment of the patient included bed-rest and skeletal traction. Further radiographs showed callus formation and healing of the fracture and the patient was discharged 14 weeks after admission. The follow-up examination two months and four months after discharge showed complete healing of the fracture. At review one year later the leg was found to be satisfactory.

Case 3. A 22-year-old soldier who had served in the army for the previous five months was admitted after rigorous training in the marine commandos. He complained of pain in the right hip which had been present for six weeks. The pain had gradually increased until he was unable to bear weight on the right leg. There was no record of any injury to the right hip.

Physical examination showed that all movements of the hip were limited. A slight swelling of the hip was revealed but there was no tenderness. Pain was elicited by percussion of the greater trochanter. The radiographs indicated a stress fracture and there was a faint haze of new bone formation due to internal callus formation in the neck of the femur.
the right femur (Fig. 4). Further radiographs and tomographs confirmed the initial diagnosis. The results of biochemical analysis were normal and the patient was restricted to complete bed-rest.

Four weeks after admission the patient started to walk on crutches without weight-bearing. Radiographs showed satisfactory callus formation and the patient was discharged two weeks later using crutches. At follow-up two months after discharge there was satisfactory callus formation of the inner edge of the femoral neck. When the patient was reviewed one year later the radiograph showed no fracture line and the results of the clinical examination were normal.

**Case 4.** A 20-year-old soldier complained of pain in the right hip which had lasted for three weeks and which was increased by standing or walking. Flexion and extension of the right hip caused slight pain and there was a slight limitation of movement. The patient had no previous history of injury. Investigation of the alkaline phosphatase and serum calcium levels and of the Wassermann reaction were made and the results found to be normal. Radiographs taken at the time of admission showed no abnormality, but a tentative diagnosis of synovitis of the right hip was made (Fig. 5).

The patient was allowed to walk on crutches with partial weight-bearing, and aspirin was prescribed. He was discharged one week later. Three weeks after discharge radiographs showed a stress fracture of the femoral neck which had commenced healing (Fig. 6). He was treated with skeletal traction using a Steinmann pin through the tibial tubercle. This traction was continued for six weeks. Further radiographs showed satisfactory callus formation and the patient was allowed to walk on crutches without weight-bearing. He was discharged eight weeks later. At follow-up two months after discharge the radiographs showed very good callus formation (Fig. 7). The patient was allowed to walk on crutches with weight-bearing and one year later he was asymptomatic (Fig. 8).

**Case 5.** A 20-year-old soldier who had served in the army for eight months was admitted to the hospital after monoarticular arthritis of the left hip had been diagnosed. He reported pain in his left hip during the two months before examination. This pain increased when walking but improved with rest. There was no previous history of injury to the hip.

There was full movement of the left hip and slight tenderness was revealed in the area of the greater trochanter. A full clinical investigation and a radiological examination showed no abnormalities.
and the patient was discharged three weeks after admission. Five days after commencing everyday activities he developed severe pain in his left hip and was unable to walk. He was therefore readmitted for further investigation which revealed limited movement of the left hip especially during flexion and medial rotation. Alkaline phosphatase and calcium levels were found to be normal, but the radiographs and tomographs showed a stress fracture of the neck of the left femur (Fig. 9). The patient was restricted to complete bed-rest and six weeks after readmission commenced walking on crutches without weight-bearing. Six weeks later he was asymptomatic and the fracture line was no longer visible on the radiographs. The patient was therefore discharged, but did not return for follow-up.

Case 6. A 21-year-old soldier complained of severe pain in his left hip during long marches. He had spent 10 months in the army but apart from the pain felt during the month before admission there was no history of injury. The left hip had become extremely painful and he had difficulty finishing the marches.

The radiographs clearly showed a stress fracture in the upper surface of the left femoral neck (Fig. 10). The patient showed localised tenderness to palpation and slight swelling over the anterior aspect of the left hip. Full flexion of the hip caused pain which radiated to the left groin and the patient was therefore unable to walk or stand.
Laboratory tests revealed normal levels of serum calcium and alkaline phosphatase. The patient was treated with bed-rest and skeletal traction using a Steinmann pin through the tibial tubercle. Radiographs taken in the sixth week showed further healing and callus formation (Fig. 11). Walking on crutches without weight-bearing was permitted. The patient was discharged seven weeks after admission, but declined further follow-up.

Case 7. A 22-year-old recruit who had served in the army for seven months was admitted for investigation. There was no previous history of trauma, but the patient complained of pain in his left hip which gradually increased during training and decreased at night or with rest. Stiffness of the left hip occurred in the mornings during the last month before admission. Examination revealed that all movements of the left hip were painful. The left leg was four centimetres shorter than the right. Biochemical analysis showed that alkaline phosphatase and serum calcium levels were normal. The radiographs confirmed a stress fracture of the left femoral neck (Fig. 12).

A closed reduction using pin and plate fixation was performed (Fig. 13) and the patient was discharged three weeks after admission. The patient was permitted to walk on crutches without bearing weight on the affected limb. Progressive weight-bearing was started three months after discharge. At follow-up six months later the healing was slow but uneventful. The patient was asymptomatic one year after discharge and the pin and plate were removed (Fig. 14).

DISCUSSION

The diagnosis of stress fracture of the femoral neck was indicated by pain in the hip which sometimes radiated to the knee. Examination showed that all seven patients were healthy with no previous history of injury to the hip. The patients complained of pain which had lasted between three to eight weeks before admission and had gradually become so acute that the patients were obliged to stop all activity. Relief of the pain occurred with rest. Physical examination showed localised tenderness over the anterior aspect of the painful hip and sometimes swelling was present. Pain was elicited at the extremes of movement especially during flexion and medial rotation. Full flexion of the hip caused pain which radiated into the groin and sometimes to the knee. Percussion of the area of the greater trochanter was painful. Laboratory tests, including the Wassermann reaction, gave normal results.

Radiographs taken at the time of admission showed no abnormalities although a faint haze was sometimes visible in the neck of the femur before the appearance of the fracture line (Case 3). The stress fracture was not detected radiographically until two to four weeks after the onset of symptoms. Therefore confirmation of the diagnosis may be delayed (Case 4).

The periosteal reaction and the discovery of soft tissue calcification in a young patient (Case 2) with no history of trauma suggested osteogenic sarcoma and a biopsy was therefore performed to exclude this diagnosis. According to Devas (1975) stress fractures can be divided into two radiographical types—distraction fractures and compression fractures (Cases 3 and 5).

The treatment of compression type femoral neck stress fractures was conservative and included bed-rest with skeletal traction where necessary. The surgical treatment involving internal fixation was reserved for the distraction type of stress fractures of the femoral neck.

Cases 1, 2 and 4 were suitable for open reduction and fixation, but as healing had already commenced conservative treatment was preferred.

I would like to thank Colonel Chrisafides MD, Orthopaedic Surgeon in the Medical Corps at the Military Hospital, Thessaloniki, Greece for his kind permission to study his patients.

REFERENCES