FAMILIAL HYPERPLASTIC CALLUS FORMATION

Case Followed for Twenty Years

Gwen Hilton, London, England

Director of the Radiotherapy Department, University College Hospital

The case here recorded was first described (Hilton 1934) under the title "Familial Chondrodystrophy with Rheostosis Treated by X-ray Therapy." It is thought appropriate, in giving this up-to-date further account of the progress of the case, to substitute the description "hyperplastic callus," because the main features of the present case conform with those observed in hyperplastic callus formation in osteogenesis imperfecta. The present account records the progress of the patient over a period of twenty years.

CASE REPORT

Résumé of details previously recorded—A girl aged ten attended in 1932 with bilateral tumours of the thighs. The lower end of the left femur had become painful three weeks before, and soon after this a swelling had appeared. The only relevant history was of a fracture of the ankle at the age of nine but there had been no other fractures. The child was small and in poor condition, and the temperature was raised to 103 degrees Fahrenheit. The left thigh presented a large, hard, non-pulsatile swelling extending from the medial condyle upwards for three inches. Its most prominent part was tender. The right thigh showed a similar swelling beginning two inches above the medial condyle, rising sharply from the bone and extending upwards for a further two inches. Figure 1 illustrates the condition found on radiological examination of the left femur at that time. There is a mass of irregular ossification close to the medial surface of the lower end of the femur and, extending upwards from it, a soft-tissue shadow. The mid-part of the shaft of the femur is marked by hyperostosis. There is no evidence of any fracture, nor does the general appearance of the bone suggest osteogenesis imperfecta. Radiographs of the right femur showed similar changes. Examination of the rest of the skeleton revealed hyperostotic ridges on both humeri, the forearm bones, the left fibula and some of the metacarpals and metatarsals. The forearm bones showed distortion of shape, and the head of each radius was dislocated forwards and upwards.

A biopsy was performed on the left femur. Figure 2 illustrates the histological appearance. The central part of the section shows very cellular chondroid tissue and in the lower part there is chondro-osteoid tissue. Subsequently, the swelling increased in size, and Figure 3 illustrates the appearance between two and three months after the onset of symptoms.

Family history (in 1934)—The father was said to be normal but there had been no opportunity of examining him. The mother, aged thirty-one, was small and under-developed but otherwise healthy. The radiograph of her femur revealed a hyperostotic ridge and her forearms showed dislocations of the upper ends of the radii as in the daughter. One brother, aged two, had been examined radiologically and found normal. One maternal aunt, aged thirty-six, resembled the patient's mother in having a hyperostotic ridge along the femur and dislocation of the head of the radius. The second maternal aunt, aged twenty-four, who was severely deformed, was found to have changes in the bones like those in the patient but of a more pronounced character. The long bones were bowed and expanded, the cortices were thin, and numerous hyperostotic ridges were present.
Figure 1—The left femur three weeks after the onset of symptoms in 1932. Figure 2—Histological section of part of the ossifying callus. There is highly cellular chondroid tissue and in the lower part of the figure some chondro-osteoid tissue.

Figure 3—The left femur between two and three months after the onset of symptoms, showing typical hyperplastic callus now ossified. Figure 4—The left femur eighteen months after the onset of symptoms. The greater part of the ossified callus has now been absorbed but there is a "sleeve" of new bone enclosing the shaft of the femur.

THE JOURNAL OF BONE AND JOINT SURGERY
FIG. 5
The pelvis and upper end of each femur in 1937. There is bilateral protrusio acetabuli and hyperostotic ridges are to be seen on each femur.

FIG. 6
Figure 6—Left forearm in 1943. Note the typical appearance of the upper forearm and elbows with dislocation and distortion of the upper end of the radius. There is a small recent formation of new bone on the medial surface of the ulna. Figure 7—A recent radiograph of the right forearm bones showing hyperostoses on the interosseous borders with ossification of the interosseous membrane and synostosis.
**Treatment**—Treatment by radiotherapy to the lower ends of both femora was undertaken. It appeared to lead to symptomatic improvement, and coincided with definition and hardening of the mass of "callus" and subsidence of pain and tenderness. (Other cases reported in the literature have followed the same cycle of changes without x-ray treatment.)

**Further progress**—Since 1932 there have been many subsequent painful swellings in relation to the cortices of other bones, each accompanied by similar radiographic appearances. One year after the patient was first seen a painful lump developed over the right fibula and ossified. Figure 4 shows the radiographic appearance of the left femur eighteen months after the onset of symptoms. The greater part of the new bone formation has disappeared. The shadow of the shaft of the femur is now enclosed by a sheath of bone resembling periosteal new bone.

![Figure 8](image)

**Fig. 8**

A recent radiograph of the leg bones.

In 1937, five years after the onset, fringes of new bone were found round the lower margin of the pubic ramus and ischial tuberosity. Figure 5 shows distortion of the upper end of each femur and bilateral protrusio acetabuli; hyperostotic ridges are to be seen on each femur.

In 1942 a lump appeared over the right humerus and was shown radiographically as a soft structureless shadow which subsequently became absorbed but for some residual thickening of the humerus. Figure 6 illustrates the radiographic appearance of the left forearm in 1943. The distortion and dislocation of the head of the radius are well shown and there are marked hyperostotic ridges on the interosseous borders of the upper ends of each forearm bone. There is a small recent patch of new bone on the medial side of the upper end of the ulna. Figure 7 is a recent radiograph of the right forearm showing the well marked hyperostotic ridges on the radius and ulna and apparent synostosis of the upper ends of these bones. Figure 8 shows a recent radiograph of the tibiae and fibulae of both legs. There is distortion of the shaft of the radius with marked hyperostotic ridging of the bone and synostosis of the lower ends of the tibia and fibula in each leg. Figure 9 is a photograph of the patient and her mother taken recently.
FAMILIAL HYPERPLASTIC CALLUS FORMATION

DISCUSSION

Battle and Shattock (1908) published in the Proceedings of the Royal Society of Medicine an account of a boy aged four who was brought to St Thomas’s Hospital for a tumour of the left femur. He broke his femur in April 1901. The limb was put in plaster-of-paris; this was removed at the end of three weeks on account of excessive swelling of the thigh, which was said to have reached three times the size of the other one. The femur united and the patient was able to walk. The swelling was said to be diminishing. On examination, the left femur was found to be the seat of a hard fusiform swelling. There was no pain or tenderness and the child appeared to be in good health. A radiographic diagnosis of periosteal sarcoma was made and the affected limb was amputated through the hip joint in November 1901. It is recorded as a remarkable fact that a few months later the boy’s mother developed a tumour of her right femur for which amputation of the thigh was performed in 1903, and it was further recorded that a younger brother of the boy, aged two and a half, was admitted to the Rochester Hospital in 1907 with a fracture of the right femur complicated by the development of an extensive tumour of the thigh. A piece of the growth was removed for microscopic examination, the report being that it consisted of well formed bone with connective tissue and cartilage in process of ossification.

The boy who had first been seen at St Thomas’s Hospital and whose leg had been mistakenly amputated returned in June 1903 on account of a swelling of the femur in the remaining leg. There was no fracture. At the time it was recorded as a sarcoma of the same kind as the original growth on the other femur. When he was later readmitted to Hospital in March 1907, it was reported that he had developed a further tumour, this time on his right shin after a fall. It was noted that the head was large and wide across the frontal region and that the forearms were deformed. Radiographs of the forearm showed hyperostotic ridges on the interosseous borders like those noted in the present case. This remarkable case of Battle appears to be the first recorded instance of hyperplastic callus formation in association with some general bone disorder allied to osteogenesis imperfecta.

More recently, Brailsford (1943) and Fairbank and Baker (1948) have described similar cases. That here recorded was included by Fairbank in his description of eight cases, with the comment that the bony thickenings and recurrent bony swellings were typical of the condition under review but that there was no evidence of osteogenesis imperfecta in the usual sense of the term. Fairbank regards the typical features as: 1) The formation of a large mass of intensely calcified local callus adjacent to the bone affected; 2) the absence sometimes of a recognisable recent fracture; 3) the tendency of the callus, when it ossifies, to be permanent and incorporated into the structure of the affected bone; 4) the formation of bony excrescences or hyperostoses on the shafts of the long bones, particularly on the interosseous borders, a change most likely to affect the radius and ulna; 5) usually stunting and invariably bony deformities; bilateral dislocation of the heads of the radii were noted in three cases out of eight; 6) sclerotics not typically blue but in general the recognised features of osteogenesis imperfecta.

Fig. 9
A recent photograph of the patient and her mother.
imperfecta present, with a history of multiple fractures, many healing without any tendency to hyperplastic callus.

CONCLUSIONS

In osteogenesis imperfecta the formation of callus is usually plentiful and sometimes rather excessive but the excess is absorbed in the normal way as consolidation occurs. In hyperplastic callus formation the amount of callus formed is large, or even enormous; and, once its limits are defined and ossification has occurred, some part of the original swelling remains as a thickening of the bone. "Callus" may form with or without injury and with or without fracture. The interest of the present case lies partly in the fact that there is no history of multiple fractures to indicate classical osteogenesis imperfecta, and partly in the familial incidence which has also been noted in other records. It is important to recognise the true nature of the condition in order to avoid the tragedy of unnecessary amputation. In one of Brailsford's cases the lesion is said to have become malignant but there is no other evidence in the literature that the condition has any relationship to malignancy. The clinical appearance can easily give rise to the suspicion of malignancy, and on histological examination the highly cellular and rapidly growing callus can be confused with a malignant condition. In fact, for the short time in which the bone formation runs riot the behaviour of a malignant neoplasm is closely simulated.

It is thought that the present account may be of interest because of the invariable relief of pain after x-ray treatment of each new lesion, the length of time over which the case has been followed and the resemblance between the radiographic appearances in the patient now and those of her aunt taken twenty years ago.

REFERENCES


Battle, W. H., and Shattock, H. G. (1908): A remarkable Case of Diffuse Cancellous Osteoma of the Femur following a Fracture, in which similar growths afterwards developed in connection with other bones. Proceedings of the Royal Society of Medicine, I, Pt. 3. (Pathological Section, 83).

