INCREASED EPIPHYSIAL DENSITY IN BONE SARCOMA

Report of Two Cases

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This paper reports two cases of bone sarcoma in which a notable radiological feature was markedly increased density of the lower femoral epiphysis.

Case 1—In 1936 Laming Evans showed to the Orthopaedic Section of the Royal Society of Medicine a case titled *Osteochondritis of the Lower End of the Left Femur in a Child aged 5*

FIG. 1

Case 1—Antero-posterior and lateral radiographs showing increased density of the lower femoral epiphysis.

FIG. 2

Case 1—Antero-posterior and lateral radiographs seven months later showing marked subperiosteal new bone and ossification in the tumour surrounding the metaphysis.

Years. A year before the girl had wrenched her left knee and had been laid up for two weeks. Pain and swelling of the joint persisted, and examination revealed effusion, increased warmth, local tenderness over the joint line and impaired flexion. Rest in plaster for three months

was followed by relief of pain and a full range of movement was restored. Radiographs (Fig. 1) showed increased density of the lower femoral epiphysis, which had not returned to normal when further radiographs were taken seven months later. Bone fragments removed from the dense epiphysis showed haemorrhage and fragmentation, with no evidence of tuberculosis or new growth. Culture was sterile.

The subsequent history of this case has been kindly supplied by Dr Campbell Golding, together with the early radiographs and later films taken in 1937 (Fig. 2). These showed that the lower femoral epiphysis remained dense but there was now a clearly marked periosteal reaction in the lower femoral shaft and ossification occurring in a tumour surrounding the metaphysis. The diagnosis was established as that of osteogenic sarcoma. The treatment and ultimate fate of the child are unknown.

Case 2—A boy of three was sent to King's College Hospital in 1963 because he had pain in the left calf for a month. The pain disturbed sleep and made him limp. There was no history of injury. On examination he walked with a "rolling gait" and there was wasting of both thighs and calves. Straight leg raising was up to 80 degrees on both sides. The right knee jerk was absent; the plantar responses were flexor; and cutaneous sensation was normal. The lumbar spine was rigid and when asked to rise from a sitting position on the floor he

FIG. 3

FIG. 4

FIG. 5

Case 2. Figure 3—Radiograph showing collapse of the fourth lumbar vertebra and erosion of anterior surface of fifth lumbar vertebra. Figure 4—Antero-posterior radiograph showing a dense lower femoral epiphysis and sclerosis extending into the diaphysis. There is also a dense zone in the tibia. Figure 5—Lateral radiograph a week later showing a soft-tissue swelling and sun-ray spicules.

attempted to do so by "climbing up himself" with hands on thighs. Rectal examination revealed that the hollow of the sacrum was filled by a hard swelling. Examination of the eyes showed normal fundi. Radiographs showed collapse of the fourth lumbar vertebra, which was of increased density, and erosion of the anterior surface of the fifth lumbar vertebra (Fig. 3).

Skeletal survey was carried out and showed that in the right lower limb the lower femoral epiphysis was dense and that the sclerosis extended up into the diaphysis in a triangular fashion (Fig. 4). There was also a dense zone in the metaphysis of the tibia.

Pathological investigations gave the following results. Haemoglobin 94 per cent; the serum calcium was 11 milligrams per cent; the white blood count was 12,400 per cubic millimetre; serum phosphorus was 2.4 milligrams per cent; the erythrocyte sedimentation rate was 3 millimetres (Westergren); the alkaline phosphatase 24 King-Armstrong units; the Mantoux test was negative; and only a trace of protein was found in the urine.

At operation a hard well defined mass could be felt at the left side of the sacrum, which on incision oozed blue blood. Osteogenic sarcoma was diagnosed from the biopsy.

FIG. 6

FIGS. 6 AND 7

Case 2. Figure 6—Photographs of the necropsy specimen showing the tumour. Figure 7—Section of the femur showing the site of the tumour.

FIG. 7

A radiograph of the left femur a week later showed increased sclerosis, Codman's triangle and ossification in a large soft-tissue tumour (Fig. 5). One week later an abdominal mass could be felt. There was retention of urine, increasing abdominal distension, constipation, hypotonicity of legs, and a large mass behind the left knee. The patient died three months later.

At necropsy a rounded tumour 15 centimetres in diameter extended forwards and upwards from the lower two lumbar vertebrae and first sacral vertebra to fill most of the pelvis (Fig. 6). The tumour was firm but cut easily and showed little evidence of new bone formation or calcification. At the lower end of the right femur there was a tumour which appeared to arise from the metaphysis and to involve the diaphysis and epiphysis (Fig. 7). Sections from both tumours showed osteogenic sarcoma. The pelvic tumour consisted of a cellular matrix with little evidence of new bone formation. The tumour of the femur had breached the epiphysal plate, and tumour cells were present throughout the epiphysis, especially beneath the articular

cartilage (Fig. 8). In the epiphysis and elsewhere there were areas of irregular ossification with imperfectly formed bone and deposits of calcium. Thin-walled vessels, present throughout the tumour, were patent and no vascular lesion was found which would account for the necrotic tumour tissue which was present. In the upper lobe of the left lung there was a solitary metastasis consisting of a pleomorphic cellular matrix and irregular fragments of bone and cartilage. The only other significant finding was pyonephrosis.

FIG. 8

Case 2—Photomicrograph showing invasion of the epiphyseal plate (*left*) by tumour (*right*). (Haematoxylin and eosin, $\times 160$.)

COMMENT

The radiographs of the lower femoral epiphyses in these two cases bear a marked similarity.

In Case 1 the increased density was known to have been present for over a year before the sarcoma was discovered. In Case 2 it is not known for how long it had been present and the femoral tumour was only discovered by routine skeletal survey. These two cases raise several points of interest.

Epiphyseal sclerosis—Increased density in the lower femoral epiphysis is rare. In describing the vascular supply of the distal end of the femur, Rogers and Gladstone (1950) said it is abundant and they had not found evidence of ischaemic necrosis after fracture of the distal end of the bone. Brashear (1963) produced retardation of growth and temporary necrosis in the lower femoral epiphysis of young rats by destruction of the epiphyseal blood supply.

Histological examination of the specimen from Case 2 revealed no evidence of vascular obliteration and it seems reasonable to attribute the radiological appearance to direct invasion of the epiphysis by tumour cells.

A similar case is quoted by Moseley and Bass (1956) of a girl of five in whom multiple sclerosing tumours were present in the metaphyses of the long bones which invaded the epiphyses.

Multiple sarcomata—Excluding the multiple sarcomata of Paget's disease, reports of multiple bone sarcomata are rare. Willis (1952) quoted eleven cases. Finlayson (1953) described a case in a girl of twelve who had a sarcoma in the left ulna, and who later developed similar tumours in many other bones. She died seventeen months later and at necropsy both lungs were found to contain metastases. He quoted a case of Silverman's (1936) in which multiple sarcomata developed simultaneously.

Finlayson expressed the view that while possibly some tumours are of multifocal origin, the more usual explanation is a primary tumour with metastases in bone.

It would seem that in Case 2 the primary tumour was in the vertebra and that metastases occurred in the femur, tibia and lungs.

SUMMARY

1. Two cases are described in which increased density of the lower femoral epiphysis was due to sarcoma.
2. In one of these, multiple sarcomata were present.

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REFERENCES

- BRASHEAR, H. R. (1963): Epiphyseal Avascular Necrosis and Its Relation to Longitudinal Bone Growth. *Journal of Bone and Joint Surgery*, **45-A**, 1423.
- EVANS, E. Laming (1936): Osteochondritis of the Lower End of the Left Femur in a Child aged 5 Years. *Proceedings of the Royal Society of Medicine*, **29**, 1665.
- FINLAYSON, R. (1953): Osteogenic Sarcoma with Multiple Skeletal Tumours. *Journal of Pathology and Bacteriology*, **66**, 223.
- MOSELEY, J. E., and BASS, M. H. (1956): Sclerosing Osteogenic Sarcomatosis; A Radiologic Entity. *Radiology*, **66**, 41.
- ROGERS, W. M., and GLADSTONE, H. (1950): Vascular Foramina and Arterial Supply of the Distal End of the Femur. *Journal of Bone and Joint Surgery*, **32-A**, 867.
- SILVERMAN, G. (1936): Multiple Osteogenic Sarcoma. *Archives of Pathology*, **21**, 88.
- WILLIS, R. A. (1952): *The Spread of Tumours in the Human Body*. Second edition, p. 234. London: Butterworth & Co. (Publishers) Ltd.