15. PAGET'S DISEASE

Synonym—Osteitis Deformans

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This chronic disease is characterised by slowly spreading changes in one or more bones, the changes consisting of decalcification coupled with hyperostosis and with the marrow spaces in the transformed bone occupied, partially or completely, by vascular fibrous tissue. Czerny (1873) suggested the name osteitis deformans, but ever since the publication in 1877 of Paget's paper, in which he described with characteristic lucidity the clinical features of eight cases, his name has been coupled universally with the disease. In 1908 Elmslie collected ninety cases and reviewed the whole subject, and in 1938 Brailsford discussed the changes in 154 cases which he had examined radiologically.

Hereditary and familial influences are evident in some cases. In seven of Elmslie's ninety cases other members of the family were affected. Since that date many instances have been recorded in parents and offspring, and of brothers and sisters. We have twice met with two brothers afflicted with this disease.

Age—The majority of cases are seen between fifty and seventy years of age. Though uncommon before the age of forty, several unquestionable cases have been diagnosed at thirty years. Since in some of these more than one bone was affected, the disease was unlikely to have been a recent development.

Sex—Males are rather more commonly affected than females.

Incidence—Paget's disease is one of the obscure diseases of the skeleton which are relatively common, many cases being discovered incidentally when investigated radiologically for symptoms entirely unconnected with the bone condition. Incidence figures most likely to approach accuracy are obtainable only from radiological departments. Inquiry some ten years ago from the radiologists of the teaching hospitals of London revealed that the average annual number of Paget cases seen at each hospital was approximately fifty.

Distribution—The disease may be confined to one bone, at least for a period of years. The tibia is a common site for a solitary lesion. Sooner or later in most cases several bones are affected: only exceptionally is the disease so widespread as to be almost generalised. Published lists of the bones most commonly affected, in order of frequency, vary, but they all agree in placing the pelvis at the head of the list. It showed changes in 243 cases out of a total of 367 reviewed by Dickson *et al.* (1945). The femur, tibia, lower spine and skull are all common sites. The humerus, clavicle and forearm bones are distinctly less common, while the hand and foot, with the possible exception of the tarsal bones, are seldom affected, a point in which the disease differs from polyostotic fibrous dysplasia. The ribs and the manubrium sterni—occasionally even the whole of the sternum—may be affected. When the skull is involved the facial bones very seldom show changes, an important point of difference from leontiasis ossea. In the tibia the changes spread from the upper end far more commonly than from the lower: the same is true of the femur. Changes may begin at both ends of a bone, but this is excessively uncommon.

The distribution appears to be almost entirely erratic, and shows little if any tendency to be symmetrical. When, however, the pelvis is involved there is a greater chance than otherwise of finding the upper end of one or both femora and the sacrum and lower spine also showing changes.

Etiology—The cause is unknown. The inflammatory hypothesis, making infection responsible, is now generally discarded. There is no endocrine error; the parathyroid glands are normal, and their removal in this disease is useless and unjustifiable. Disorder of mineral metabolism is suggested as the possible cause (Hunter 1948). Injury has been suspected of playing a part in the incidence of the disease in a few cases. In one patient, a man of thirty-seven years with typical Paget changes in a tibia, swelling of this bone had been present ever since an injury at the age of fourteen years.

Signs and symptoms—Though it is agreed that the changes in one or more bones are often no more than an incidental finding, there is considerable variation in the percentage said to have symptoms referable to the osseous lesions. Only 48 per cent. of eighty-two cases studied by Newman (1946) have symptoms closely related to the Paget's disease. He found that only 35 per cent. complained of pain, whereas Hunter (1948) stated that pain, usually in the back of the legs, was present in as many as 80 per cent. We find difficulty in accepting the latter figure if the cases discovered incidentally by the radiologists are included. The pain is of various types, occurs at various times of the day or night, and is provoked by a variety of causes. For instance, pain in a tibia may be worse in bed, or on walking may be concentrated at the limit of the changes in the bones. Headache is common and may be caused or exaggerated by exercise or coughing. Kay *et al.* (1934) found headache severe in eight of thirty-four cases. Spontaneous diminution or complete disappearance of pain may occur. Dickson *et al.* (1945) found backache in 119 cases, headache in sixty-four, and pain in the legs in fifty-eight of the 367 cases studied by them. Swelling and deformity may call attention to the disease when a tibia is involved, and increase in size of the head (necessitating repeated purchase of larger hats) is a frequent cause of complaint when the skull is affected. In a tibial case the overlying skin is often warmer than that on the other side, and occasionally it is even red or oedematous, but only quite exceptionally is tenderness present. An affected tibia is thickened, its anterior margin rounded, and the deformity further increased by antero-lateral bowing. Thickening of other affected bones and increase of their normal curves may be readily felt. When the upper part of the femur is affected signs of coxa vara may be present. Limitation of abduction at the hips may, however, be due to deepening of the socket or osteoarthritis in addition to coxa vara. In an advanced case, with many bones affected, the crouching or "simian" attitude assumed on standing may be suggestive. The large head is held low with the chin thrust forwards, the chest is flattened laterally, the spine is kyphotic and the legs are bowed antero-laterally with the joints slightly flexed. The reduction in stature resulting from deformities may be considerable: in one case (Osler, quoted by Lewin, 1922) the reduction amounted to thirteen inches, and even this was exceeded in a case reported by Hurwitz (1913). Though as a rule the curvature of a bone results in approximation of the ends, apparently authentic cases of lengthening have been observed: Elmslie (1908) stated that "numerous instances" had been recorded. We have seen a tibia which was three-quarters of an inch longer than the opposite normal bone. Another convincing case, with an elongated radius curving round a normal ulna, was published by Vilvandr (Kay *et al.* 1934). Fixed pronation deformity produced in this way was first called attention to by Symonds (1881). Fracture may be the initial occurrence, the bones most often affected being the femur and tibia. Deafness due to otosclerosis—not to pressure on the auditory nerve—is common, but only in those with the skull obviously affected (Jenkins 1923). Interference with vision, by pressure on the optic nerve, occurs much less often. Arterial degeneration is common in the older cases, often with retinal haemorrhages and choroidal changes. Calcareous arteries are frequently found—in as many as 40 per cent. of the cases according to Hunter (1948). We are inclined to doubt the statement that Paget's disease occurs with special frequency in those exhibiting premature senility.

Blood examination—The only constant change is the increase, often to as much as twenty or thirty times the normal, of the alkaline phosphatase, the amount varying roughly with the

severity of the disease. The acid phosphatase is increased only quite exceptionally. The serum calcium is normal in amount and so may be the plasma phosphorus, but this is often high. The excretion of calcium and phosphorus is increased, but the amounts have no relation to the severity of a case. Since the kidneys are taxed, hypercalcaemia may occur late in the course of the disease. Increase in the proportion of basophil and eosinophil cells is reported by Piney (1925). Glycosuria is present in some cases, the pituitary being suspected as possibly responsible.

Radiographic appearances—Excluding the skull, the changes in the bones may be divided into four types: 1) honeycombed or spongy; 2) striated; 3) dense; and 4) grossly cystic. Two or more of these may be found in a case, or even in a single bone. In the tibia, for instance, during the early years of the disease when it is slowly spreading, it is common to find a clear cyst-like appearance at the advancing point and honeycombed changes behind it. Generally speaking the honeycombed appearance is the commonest and most widespread. The next most common type is the striated, in which the trabeculations, standing out boldly, show a greater inclination to be parallel than those in the honeycombed type. Striation may be seen in any bone but more often, perhaps, in the pelvis, sacrum, vertebral bodies and calcaneum. Thurstan Holland (1925) called attention to the appearance of striation in the calcaneum while the bone was still apparently unaffected by the disease, and he regarded it as an early sign of some diagnostic value. The dense type is seen typically in the spine in some cases, the bodies of certain vertebrae showing uniform increased density, with little if any increase in size. If two or more vertebrae are affected they are not necessarily adjacent. It is a curious fact that if a vertebral body is dense, it is as a rule uniformly dense throughout. Apart from the advancing point of the disease seen typically in the tibia, as already mentioned, a grossly cystic appearance is uncommon: we have met with it in the fibula, the diagnosis being impossible until typical Paget changes were discovered in the opposite tibia and other bones. We have seen it also in the radius. Clear areas worthy of being called cystic are occasionally seen in the pelvis. Though there seems to be a preference in some cases for one particular type of change, there is general agreement that in most cases there is a tendency for affected bones to become denser in the course of time. The primary changes in the shaft of a long bone are essentially *in* the cortex, which appears to be partly or completely decalcified: new bone is formed both on the surface under the periosteum and towards the medulla, and later replaces, to a varying extent, the decalcified cortex. The diagnostic value of the pointed extremity of the changes in the shaft of a long bone has been appreciated for many years, attention being called to it, we believe, by the late Professor S. G. Shattock. The ends of the long bones are less commonly affected than the shafts but coarse trabeculation, for instance of a femoral condyle, may be the first sign of disease in the bone. In the pelvis the essential change may be increase in the density of the bone, but in our experience this is much less common than honeycombing. The pelvis may be indented, but this is also exceptional.

In the skull there is thickening of the outer table and irregular increased density. In a typical case the calvaria is considerably thickened, with the surface somewhat ill-defined and the bones coarsely mottled with dense rounded "nigger wool" spots of varying size. The sutures are obliterated. The changes are more likely to be generalised throughout the calvaria than in leontiasis, and are much less likely to involve the maxillae. In some cases clear areas are seen and these may be sufficiently marked to warrant the title of *osteoporosis circumscripta cranii*. Of forty-seven cases of this latter condition, thirty-two had Paget's disease in addition, and in eighteen of these both conditions were present in the skull (Kasabach and Gutman 1937). These authors suggested there was justification for regarding osteoporosis circumscripta as either an atypical form of Paget's disease or a precursor of it. There is no general agreement, however, as to the cause and nature of osteoporosis circumscripta: possibly it should be regarded as a clinical feature rather than as a clinical entity. Windholz (1945) suggests that it results from circulatory disturbance at the base of the skull caused by a variety of conditions.

There is no constant change in the pituitary fossa. The pineal gland may be calcified (Brailsford 1938).

The normal curve of an affected long bone is increased, and the deformity is accentuated by thickening on the convex side of the curve. Coxa vara may occur but this is often more apparent than real, the deformity as a rule occurring in the shaft of the bone. Arthritic lipping of the vertebral bodies is naturally common at the age at which Paget's disease is most frequently seen. According to Snapper (1949) the Paget changes begin in the lipping and spread to the body.

Fractures, if present, are abrupt, more or less transverse, and are seldom comminuted. Decalcification of the fragments in the region of the fracture may be so rapid and coarse that the presence of a malignant growth may be suspected. Multiple partial fractures are occasionally seen on the convex side of a curved bone (see below). Collapse of a vertebral body may occur but is uncommon.

Progress—In an individual long bone the changes steadily progress till the whole shaft is involved. Deformities also steadily increase for a time, but not indefinitely. The skull, when affected, gradually increases in size. Low diastolic pressure and cardiac failure are not infrequent in the later stages.

Complications—Fractures are not uncommon, and may occur with greater ease than normal, but it is doubtful whether they occur with much greater frequency than is usual in those of advanced age. Common sites are the upper third of the femoral shaft and the tibia a little below the head. Less common sites are the humerus, lower third of tibia, patella and pelvis. Pain after a fracture may be less than usual. Union takes place readily, but a fracture in the upper third of the tibia, often a horizontal crack with no displacement, produces minimal callus and may be slow in disappearing. Incomplete fractures sometimes occur and several may be seen in a single bone, but only in quite exceptional cases (Roberts and Cohen 1925, Allen and John 1937, Brailsford 1938, Dickson *et al.* 1945). The femur and tibia are the bones affected in this way: healing takes place with a minimum of callus. A partial fracture may become complete. Paraplegia due to hyperostosis of one or more vertebrae is very uncommon but certainly occurs. Urinary calculus was present in twenty-two of 367 cases (Dickson *et al.* 1945).

Sarcoma is a well-known complication of an advanced case, but we believe that the incidence has often been much exaggerated since the days of Paget. The frequency has been variously given as 2.4 per cent. (Newman 1946) up to 11 per cent. (Bird 1927). Dickson *et al.*, however, in their 367 cases found only three with sarcoma. Inquiry in 1938 from a dozen leading radiologists in London, many of whom were seeing a fresh case of Paget's disease almost every week, revealed that the number of cases with sarcoma seen by any single man in his life varied from one to five. There was one exception, a radiologist concerned, we believe, more with therapy than diagnosis, who regarded sarcomas as by no means a rarity. The fact that Platt (1947) had dealt with twelve cases of sarcoma occurring in Paget bones should be regarded as an indication of his reputation for exceptional knowledge and experience of bone tumours rather than as a true indication of the frequency of this complication. One of Platt's cases had multiple tumours of the skull: other similar cases have been reported. In patients over fifty years of age with sarcoma of the bone, a considerable proportion—28 per cent. according to Coley and Sharp (1931)—have Paget's disease in addition, both affecting the same bone. This complication is distinctly more common in males, and is seen most often when they are approaching the age of sixty, whereas the average age of all bone sarcomas is twenty-three years (Bird 1927). The new growth occurs only in a bone showing Paget changes, usually in a lesion of the osteolytic rather than the sclerotic type (Sear 1949). The simultaneous occurrence of sarcoma in more than one bone has been reported in several cases (Albertini 1928, Gerstel and Janker 1933, Davie and Cooke 1937). Of seventy-six collected cases of sarcoma complicating Paget's disease, twenty-six showed multiple bone involvement

(Summey and Pressly 1946). It is said that the multiple tumours in these cases are found only in bones affected by Paget's disease, and occur with far greater frequency than metastases to bone from osteogenic sarcomas generally. Sear (1949) reported the case of a man of forty-seven years with a metastasis in a normal rib. The bones affected, in order of frequency, in the forty-nine cases of Paget sarcoma studied by Davie and Cooke, were: the humerus, femur, skull, tibia and scapula; the radius, clavicle, pelvis and a vertebra were the site only of solitary tumours. Fracture may be the first indication of the presence of the neoplasm. In most cases the tumour is of the osteogenic type, but it may be a fibro- or chondro-sarcoma (Willis 1948). In three cases a malignant osteoclastoma was found (Russell 1949). In two cases reported by Davie and Cooke the oxyphil-cell content of the parathyroids was reduced.

Multiple myeloma co-existing with Paget's disease has been reported (Reich and Brodsky 1948). In one patient known to us, a man of fifty-three years, neurofibromatosis, Paget's disease and sarcoma of the pelvis were all present.

Pathology—Macroscopically a bone affected with Paget's disease is irregularly thickened, its surface markings and borders are obliterated, and the normal dense corticalis is replaced by spongy bone which is covered with red streaks and dots and is obviously abnormally vascular (Hunter 1948). On section much of the original bone is found to be replaced by newly formed spongy bone, the spaces in which may be filled with fibrous tissue. This fibrous tissue is less dense and more myxomatous-looking than that found in "osteitis fibrosa," while it is often extremely vascular. Resorption is less marked and the formation of new bone more marked than in von Recklinghausen's disease. There is a more even distribution of the new trabeculae, with no large areas of fibrosis (Knaggs 1925). Where absorption is taking place osteoclasts are abundant, but anything worthy of the name of osteoclastoma is seldom found. The new bone consists of very irregular lamellae closely applied to remnants of the old bone. The curvilinear cement lines stain deeply and are responsible for the typical mosaic appearance. Woven bone is exceptional. Calcium spheroids may be seen (Eden 1939). There are no cysts. In the skull there is thickening, irregular density and increased vascularity: the foramina may be reduced in size. The foramen magnum and the posterior fossa may be distorted. The thyroid has been reduced in size and the colloid found to be scanty in several cases. The parathyroids are not hypertrophied.

Diagnosis—The difficulties vary with the particular part involved. When several bones show changes the diagnosis should be easy. When only one bone or the skull alone is affected, care may be required. As regards the skull, a diagnosis of leontiasis is favoured by the localisation of the thickening to only part of the calvaria, by obvious involvement of the facial bones on at least one side, and by the absence of the gross type of mottling with woolly circular spots of dense bone so typical of Paget's disease. A meningioma may be associated with considerable hyperostosis of part of the calvaria (Rowbotham 1939). With the pelvis involved, particularly when the changes are of the dense type, secondary carcinomatosis from the breast or stomach, and particularly from the prostate in an elderly male, has to be excluded. Though metastatic infiltration of the pelvis may be associated with little if any thickening of the bones, distortion of the surface certainly may occur. In the case of a prostatic growth the abnormal amount of acid phosphatase in the blood may be conclusive. Fluorosis can produce marked increase in density, but more uniformly than that usually produced by Paget's disease. A dense vertebra can result from metastases from a carcinoma of the breast, and also may be seen in Hodgkins' disease (Dresser and Spencer 1936). In the case of a long bone, changes due to polyostotic fibrous dysplasia have to be excluded, particularly in the early stages, or when the Paget lesion is unusually cystic. In most cases one or more other bones will show changes typical of Paget's disease. Chronic infection may also give rise to difficulty in exceptional cases: syphilis is not likely to complicate matters in Britain nowadays. When hyperparathyroidism produces changes in the bones these are generalised, which is never so in Paget's disease. In Paget the honeycombing of a bone

is accompanied by new bone formation on the surface, whereas in hyperparathyroidism, if a bone is enlarged, the cortex is distended from within and reduced in thickness. In this condition the calvaria is decalcified and finely mottled, and shows little if any thickening.

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CASE 8—PAGET'S DISEASE

(Figs. 27 to 30.) Male, aged fifty years. First noticed head increasing in circumference at age of thirty-four years. Since that date the femora, tibiae, humeri, right clavicle, right ulna and, to a less extent, the radius have become thickened. Now complaining of shortness of breath and "tumour of the stomach." Head enormous, suggestive of hydrocephalus. Has marked kyphosis and much thickening of some ribs. Bones of both upper and lower limbs bowed. His liver, pushed forwards and downwards, forms the "tumour" complained of. Mitral regurgitation. Arterio-sclerosis. Blood examination normal. Wassermann negative. Advanced changes typical of Paget's disease in the skull, most of the major long bones, pelvis and ribs. (Under Sir Cecil Wakeley.)

FIG. 27

FIG. 28

Case 8—Figure 27, skull showing gross increase in thickness—one and five-eighths inches in an unreduced radiograph—of whole calvaria, but not of base. Fairly typical mottling. Figure 28, right arm showing honeycombed type of disease in humerus and ulna and some atypical change in the radius.

FIG. 29

Case 8—Left side of pelvis and femur, showing advanced changes of mixed honeycombed and striated types, and marked bowing of femur.

FIG. 30

Case 8—Knee joint showing typical changes in all three bones.

CASE 9—PAGET'S DISEASE

(Figs. 31 and 32.) Male, aged sixty-five years. Had rickets in infancy. Fifteen years ago noticed hats were small after a year's wear. Head stopped growing two years ago. Has lost two and a half inches in height. General health good. Head large and lumpy on top. Right clavicle enlarged and right iliac crest thickened. Kypho-scoliosis rather marked, with reduction of mobility. Considerable limitation of movement of hips except flexion. Slight general bowing of legs: no obvious thickening. Skull, pelvis and lower spine show typical changes. Left tibia shows very early disease below the tubercle. Pelvis is deformed. Diagnosed as Paget's disease five years ago.

FIG. 31

FIG. 32

Case 9—Figure 31, left tibia showing very early Paget changes in the region of the tubercle. Note the area of decalcification with a pointed lower extremity *in* the anterior cortex. Figure 32, pelvis and upper femora show Paget changes of various types including increased density. Note pelvis is deformed.

CASE 10—PAGET'S DISEASE

(Fig. 33.) Male, aged forty-two years. Complained of pain in left tibia for past six months. Swelling appeared recently. Slightly irregular swelling, tender at lower end, of subcutaneous surface of upper third of tibia. No other bone lesions discovered. Wassermann negative.

Early Paget's disease suggested as possible diagnosis by the late Sir Watson Cheyne. Sixteen years later further investigations revealed typical changes in the skull, tibiae, femora and other bones. Had suffered little pain during the intervening years.

FIG. 33

Case 10—Left tibia showing early Paget changes with typical pointed lower extremity *in* the cortex, but with unusually uniform density. Compare with Figure 31. Note early Paget changes in the fibula.

CASE 11—PAGET'S DISEASE

(Fig. 34.) Male, aged seventy-three years. Swelling of upper half of tibia for past few years. Typical Paget changes. Remainder of skeleton not investigated radiologically.

FIG. 34

Case 11—Leg showing typical Paget changes in the tibia. Note the pointed lower extremity below and mottled increased density with some honeycombing above, and the calcified arteries. For comparison with the earlier lesions seen in Figures 31 and 33.

CASE 12—PAGET'S DISEASE

(Fig. 35.) Male, aged forty-six years. Complains of headache and bronchitis for past eight months. Frontal headache especially on coughing and on certain movements of head and neck. No pain elsewhere. Slight deafness. No obvious thickening of skull. Nature of disease confirmed by biopsy of skull. Decompression operation had failed to relieve headache. Typical changes seen in films of skull, pelvis, sacrum, lower spine and upper ends of femora.

FIG. 35

Case 12—Pelvis and upper femora, showing mixed changes of the striated and honeycombed types. Vertical striation in lumbar bodies present but not well seen.

CASE 13—PAGET'S DISEASE

(Fig. 36.) Female, aged seventy years. Complained of pain at bottom of back and in knees for past five years. Worse after sitting. Marked kyphosis. Pigeon breast. Atheroma. Deafness. Bowing of femora and tibiae. Typical Paget changes in pelvis, both femora, humeri, radii and ulnae, one tibia and fibula, and the lower dorsal and lumbar vertebrae. One foot shows marked striation without new bone formation except a little on the calcaneum. In the arms increased density and thickening are the chief features: a "cyst" is present in the upper third of one humerus.

FIG. 36

Case 13—Foot showing generalised striation of the bones. No hyperostosis present except on inferior surface of calcaneum.

CASE 14—PAGET'S DISEASE

(Figs. 37 to 39.) Male, aged fifty-two years. Admitted for fracture of left humerus in lower third: had sustained a fracture of the upper third of this bone eleven years previously, at which time the bone was considered to be abnormal. Said to have fractured odontoid process of axis vertebra when thirty-one years of age: this vertebra is now abnormal. Changes in bones of legs noticed for past four years. Wassermann negative. Serum calcium 10.5 milligrammes and plasma phosphorus 3.8 milligrammes per 100 cubic centimetres. B.S.R.—normal. Urine—normal. Typical changes found in skull, both humeri, pelvis and both femora, right tibia and upper third of left fibula. The fibular lesion is unusually cystic in appearance. (Under Mr A. Compton and Dr F. Parkes Weber.)

FIG. 37

Case 14—Typical Paget changes in the lower end of the femur and in the tibia of the right leg, and atypical cystic enlargement of the upper third of the left fibula.

FIG. 38

FIG. 39

Case 14—Figure 38, left humerus showing a recent fracture. Note that the disease has invaded the mid-shaft and the lower extremity of the bone leaving the intermediate portion of the shaft almost unchanged. Figure 39, skull and upper cervical vertebrae showing changes in the axis vertebra as well as in the greater part of the calvaria.

CASE 15—PAGET'S DISEASE

(Fig. 40.) Female, aged fifty-eight years. Fell while attempting to hang curtains. Admitted to hospital with fractured femur which was the seat of Paget changes.

FIG. 40

Case 15—Left femur enlarged by Paget's disease, and with a typical transverse fracture at the usual site.

CASE 16—PAGET'S DISEASE

(Fig. 41.) Female, aged forty-six years. Unusual case with facial bones involved. Operation for dental cyst thirteen years ago. Several subsequent operations on upper jaws. Complains of aching in left maxilla at times. Slightly deaf. Whole skeleton radiographed, but no bone affected other than the skull and superior maxillae. (By courtesy of Sir Frank Colyer.)

FIG. 41

Case 16—Skull showing typical Paget changes and also increased density of the maxillae. Note that the changes in the jaw are completely separate from those in the skull, a point against a diagnosis of leontiasis ossea.

CASE 17—PAGET'S DISEASE and OSTEOPOROSIS CIRCUMSCRIPTA

(Figs. 42 and 43.) Female, aged sixty-six years. Complaining of increasing enlargement of upper part of skull on left side, during past four months. Radiographs showed typical Paget changes in the skull, both ischia, right ilium, and several vertebral bodies. Osteoporosis circumscripta also seen in the skull. Wassermann negative. Serum calcium 10.4 milligrammes per 100 cubic centimetres. Two sisters of this patient also suffered from Paget's disease. (Under Dr H. Rast and Dr F. Parkes Weber.) (British Medical Journal, 1937; 1, 918.)

FIG. 42

FIG. 43

Case 17—In Figure 42, the skull shows somewhat irregular but considerable thickening with typical coarse mottling and a sharply defined area of decalcification in the frontal region—osteoporosis circumscripta. In Figure 43, the spine shows increased density of certain vertebral bodies. Note irregular distribution of changes and fairly uniform density of the bodies affected.

CASE 18—PAGET'S DISEASE complicated by SARCOMA

(Figs. 44 to 46.) Female, aged seventy-six years. Gradual onset of pain in left groin during past four months, not affected by rest or exercise. Pain much aggravated by a recent fall. All movements of left hip limited by severe pain. Indefinite swelling in left groin; skin temperature raised; veins prominent; femoral artery pushed forwards by the swelling. Alkaline phosphatase in blood raised. No evidence of Paget's disease in any bone except the pelvis. Radiograph of chest shows left ventricular enlargement but no sign of metastases. Treated with Coley's fluid and X-ray therapy without benefit. Swelling increased. Numerous metastases appeared in the lungs, with left pleural effusion, and she died four months after first examination. Microscopic section confirmed the diagnosis of Paget's disease, and showed the growth to be a chondrosarcoma. (Under Mr S. A. Jenkins.)

FIG. 44

Case 18—Pelvis and hips showing irregular increased density of left side of pelvis with signs of sarcomatous growth in the ilium.

FIG. 45 **FIG. 46**

Case 18—Figure 45, a microscopic section of fragment from the pelvis, shows the typical mosaic structure of the bone, and the marrow spaces filled with loose myxomatous fibrous tissues ($\times 50$). Figure 46 is a microscopic section from the tumour area showing the chondrosarcomatous nature of the pelvic growth ($\times 50$).