nourished, but the skin was pale and lemon-tinted. She was dyspnoeic on slight exertion, the tongue pale and glazed, the lips blanched, and the teeth and gums septic. The liver was palpable three fingerbreadths below the costal margin, and was tender. The spleen was palpable two fingerbreadths below the costal margin, and was also tender. The blood picture (Table II) was that of a severe pernicious anaemia with a polymorph leucocytosis. A fractional test meal done on admission showed an absence of free hydrochloric acid in the stomach. The temperature was 101.2° F. On October 2nd daily injections of 5 c.cm. of hepatex P.A.F., intravenously, were commenced. Within three days the appearance of the patient had altered. She stated that she felt much better, and the spleen and liver were smaller and less tender. By October 5th the temperature was normal, and remained so while she was in hospital. The injections were continued for ten days, by which time the red blood cells had risen from 775,000 to 2,212,000 per c.mm., and the spleen and liver had become normal in size. Liver extract (hepatex) orally in dosage equivalent to 172 grams of fresh liver daily, and 1 drachm of dilute hydrochloric acid three times daily, were commenced, and on November 2nd she was discharged at her own request. The red blood cells at the time of discharge had risen to 3,000,000 per c.mm., but the colour index was still just above 1.

Since discharge she has taken desiccated hog's stomach (Benger's), 10 grams daily, and on December 7th the red blood cells were 4,387,000 per c.mm., and the colour index 0.92. She stated that she felt well and could do her own housework easily.

It is of interest that the septic condition rapidly subsided with the treatment, and it seems not improbable that here the sepsis was merely secondary to the pernicious anaemia. In those cases which do not respond the opposite may possibly hold good, but the relation of the sepsis to the anaemia will generally be difficult to determine. With the subsidence of the sepsis here, the leucocytic picture was converted from one atypical of pernicious anaemia to one typical of it, the Arneth becoming right-handed, with a polymorph leucopenia in place of a leucocytosis. The Arneth count subsequently became normal, and the following three counts are given to show the changes in detail. (Cooke's¹¹ technique was used.)

Oct. 1st.—Arneth count: 27, 30, 26, 12, 5—238 lobes per 100.

Oct. 9th.—Arneth count: 6, 12, 44, 28, 8, 2—314 lobes per 100.

Dec. 7th.—Arneth count: 8, 34, 46, 10, 2—264 lobes per 100.

The polymorph leucopenia in pernicious anaemia is not due to the inability of the bone marrow to react to stimuli. It is of interest, therefore, in view of the work of Ponder and others,^{12 13} who showed that the subcutaneous injection into animals of a wide variety of substances produced an Arneth shift to the left by increasing the output of polymorphs, that in this case the intravenous injections of a potent liver extract were followed by no such effect, although the first count showed the capacity of the bone marrow to react.

No conclusions are to be drawn as to the probable effect of such treatment in other similarly septic cases, but there is no doubt that the method is a very effective one, the response being obtained much more rapidly than with the oral route. The treatment would appear to be somewhat costly, but when the more rapid response and earlier return of the patient to normal is considered, and the cost of maintenance in hospital is taken into account, this is not necessarily so. One of the above cases was discharged from hospital thirty-one days after commencing intravenous treatment. Owing to the great variation in dosage required by individual cases, however, exact comparison of the cost of the oral and parenteral methods of treatment is impracticable, except with large groups of cases.

SUMMARY

Two cases of pernicious anaemia treated intravenously with liver extract are described.

Both responded rapidly, although one had previously failed to respond to oral treatment owing to vomiting, while the other was complicated by sepsis.

We are indebted to Dr. Franklyn for the radiological report quoted.

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THE RADIOGRAPHIC DISSECTION OF CHRONIC RHEUMATIC ARTHRITIS*

BY

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The following is a brief outline of the radiological investigation upon which I am at present engaged at the British Red Cross Clinic for Rheumatic Diseases in London. The objects in view are to simplify the classification and identification of rheumatic arthritic conditions by a radiographic dissection. If it is realized that a radiograph will depict pathological changes or processes in terms of shadows, it is obvious that it is only necessary to interpret these properly for a correct diagnosis to be reached.

In 1907 Dr. Strangeways carried out some important and painstaking research in this complex subject. Though it covered the clinical, radiographic, and morbid-histological aspects, and though many specimens of arthritis were dissected, his final deductions were inconclusive. He even remarks that it was not possible at that time to distinguish between the various types of rheumatic arthritis. This statement might have been true twenty-four years ago; I do not consider it will stand to-day. Two reasons why fuller value was not obtained from his radiographic examination in those days were the inability, owing to inefficient x-ray apparatus and technique, to detect the early and slight diminution in bone calcium and other minute alterations in bone construction, and the fact that the clinical diagnosis was often regarded as infallibly correct.

TECHNIQUE

The technique which I have adopted at the Rheumatism Clinic, and which I consider essential to the investigation and identification of chronic rheumatic arthritis, is as follows. A "standard" radiograph of the hand is taken of every case accepted for treatment. "Standard" refers to the conditions under which the radiograph is taken. The hand, for instance, has been taken to be of standard thickness and density in the adult male and female, and is therefore used as the standard tissue. One particular wave-length and a definite time of exposure is decided upon, while a set distance of tube from film and a uniform time and temperature for development will ensure all these radiographs of the hand being taken under uniform

* The substance of a paper read at the Third International Radiological Congress, held in Paris in July, 1931.

conditions. There is another reason why the hand has been chosen for the purpose of this investigation. I have found that the earliest indications of arthritic changes in many cases must be looked for in the bones of the hand, irrespective of the existence of local symptoms. In other words, the radiograph of the hand will frequently supply the key to the type of arthritis that may have attacked a major joint, the *x*-ray examination of which so often proves inconclusive.

The terms "osteoporosis," "osteosclerosis," and "disturbance of bone density balance" (B.D.B.) need some explanation. Osteoporosis is denoted radiographically by an increased transparency of the bones. This may be localized or general. Localized osteoporosis indicates an active infective process, and is seen in such conditions as active tuberculous caries or osteomyelitis. On the disease becoming chronic, this is replaced by a localized osteosclerosis, indicative of a healing process. Radiographically this is shown by an increase in the normal bone density. Disuse or paralysis also gives rise to a type of osteoporosis, but this does not concern us here. General osteoporosis is of considerable diagnostic importance, especially in the study of chronic rheumatism. The loss of bone calcium may be attributed to various factors. Senility, rickets, osteomalacia, etc., are examples of deficiency causes, while hyperthyroidism, hyperparathyroidism, and rheumatoid arthritis are examples of metabolic disturbances. Normally there appears to be a constant ebb and flow of bone calcium. Now to be in a position to appreciate the very early ebbing of the calcium tide—and it is this early evidence of disease that is so valuable—not only must a standard method of radiographic technique be adopted, but it is essential to be familiar with the normal bone density and with those slight deviations from the normal which are of no pathological significance. This necessitates considerable experience, and incidentally offers a field for further work.

Bone density balance may be an unfamiliar term. The radiographic dissection of any of the long bones of the hand, metacarpals especially, will show a definite relation between the density of the cortex, medulla, and cancellous ends of the bone. The density of the normal cortex is three times that of the cancellous bone. This relationship of balance should remain unaltered even in extreme cases of general osteoporosis. In Paget's disease the disturbance is such that there is no distinction between the three bone components; in other words, the whole bone is of equal density, but denser than normal. In other cases the reverse is found—that is, the whole bone may be more transparent than normal, and no difference can be detected in the density of the cortex, medulla, or cancellous bone. I am not prepared at present to say what is the significance of this process, but I consider it of metabolic origin. B.D.B. should be distinguished from general osteoporosis.

It should be realized that the description given in this paper is limited to the radiographic examination of the hands only, except where otherwise stated, also that these notes are but an indication of the lines of investigation on which I am at present engaged.

RHEUMATOID ARTHRITIS

The characteristic change noted in this group is the general osteoporosis, or loss of bone calcium, noticeable throughout the whole skeleton, if the disease is active—that is, progressive—and occurring in conjunction with symptoms of arthritis. The fact that a similar loss of bone calcium is noted in such diseases as hyperthyroidism, hyperparathyroidism, etc., suggests that the cause of rheumatoid arthritis is of the same nature—that is, some disturbance of metabolism. There is no difficulty in detecting this general osteoporosis in the advanced case,

but it is in the early stages that correct diagnosis is so important. An early ebb of the calcium "tide" can only be ascertained with accuracy by the use of the "standard" hand radiograph, combined with a wide knowledge of normal bone density variations. This "ebb and flow" of bone calcium may, in addition, be utilized as an indication whether the disease is progressive or quiescent, while the degree of activity in a particular case of rheumatoid arthritis can also be gauged by the bone density. In many advanced cases the radiographic evidence shows that the disease has become quite dormant.

Evidence of the first stage of active rheumatoid arthritis is a general osteoporosis. The second stage is the additional loss of cartilage of several of the minor joints and possibly of the wrist. The third degree shows erosion of articular bone under the cartilage, generally with subluxation and disorganization, and bony or fibrous ankylosis. The disease may become arrested at any of these stages, and subluxation without any alteration in the articular bone can occur.

OSTEO-ARTHRITIS

This is essentially a degenerative condition, unlike rheumatoid arthritis, which we have seen to be an inflammatory process. Hence the fact that ankylosis is more frequent in rheumatoid arthritis than with osteo-arthritis.

The outstanding feature of a true osteo-arthritis is the formation of osteophytes—bony spurs growing from the edges of the joints. The pathological process here is one of bone increase, the reverse to that which is met with in rheumatoid arthritis and gout, where the actual amount of bony tissue is decreased. Incidentally, I have come to the conclusion that there are two types of osteo-arthritis—apart from cases of spondylitis deformans: one where the hands alone are involved, the second where clinically only a major joint is affected, but where radiographic evidence of osteo-arthritis is also to be found in the hand. These, to my mind, are the only true types of hypertrophic arthritis. If a major joint is arthritic and no evidence of new bone in the form of osteophytes is detected in the hands, then it is probably an infective and not a true osteo-arthritic joint. Speaking broadly, every case having arthritic symptoms referable to the hip is consistently labelled clinically as osteo-arthritic; even a Charcot's joint and Paget's disease may be included and treated as an arthritic of this group.

To return to the examination of the hand, the earliest indication that the patient has an osteo-arthritic diathesis is the formation of minute "thornlike" osteophytes growing from the edge of the articular surfaces of the minor joints of the hand. In addition, it is not unusual to find minute opaque bodies deposited in the substance of the joint capsule itself, quite unattached to the bone. I have called these "periarticular ossicles." What these opaque bodies are, how they are formed, or of what they are composed, is yet undecided. The terminal joints of the first and second fingers are the most usually attacked, and as the disease progresses the joint surfaces soon become dentate—that is, very irregular—and the joint space becomes obliterated. In most cases, however, quite good movement will still be possible. This dentate form of joint disorganization is peculiar to the fingers of this group, and is never seen in the major joints, however advanced the disease. Tailors and seamstresses are very prone to it, and thus suggest trauma as a possible causal factor. Clinically, there may be certain difficulties in differential diagnosis from gout. Ankylosis and subluxation are but rarely met with in this condition. Cavitation, so frequently noted in the articular ends of the bones of major joints where osteo-arthritis is present, is not found in the minor joints. The cause of this condition is at

present unexplained. Hypertrophic spondylitis deformans with the formation of osteophytes around the bodies of the vertebrae, yet another form of osteo-arthritis, will not be dealt with here.

The different types which, for the present, may be included in the osteo-arthritic group are as follows: (1) single major joint (possibly infective); (2) several major joints (rare); (3) major and several minor joints (hands); (4) minor joints (hands) alone involved; (5) spondylitis deformans; (6) osteochondritis dissecans.

The most tragic of cases treated at the clinic are the young patients crippled by spondylitis deformans, or the so-called general infective arthritic cases. To my mind this type of arthritis requires separate study and interpretation. It is interesting, however, to note that most of these unfortunate patients have, at the age of 20, the bones of a man of 50; their costal cartilages show extensive calcification, while other senile degenerative changes are present, suggesting that the disease has some metabolic basis. Another interesting observation I have made is that many of these spondylitis deformans cases (90 per cent.) show evidence of a chronic infective condition, or even abscess formation in the sacro-iliac joints.

GOUT

The feature in "uratosi," or "osteo-arthritis urica" of the Germans, is the deposit of sodium urate crystals in the articular ends of the minor joints of the hand and wrist; occasionally in the joint of the big toe.

Radiographically, these deposits are indicated by well-defined punched-out areas in the bone. Although these are usually to be found in the superficial surface of articular bone—that is, immediately under the cartilage—localized defects are occasionally situated in the actual bone substance. These small cavities may contain crystals during the active stage of the disease, later to be replaced by granulation tissue, while in some cases they are just empty spaces in the bone. There is reason to believe that the cavities noted in the head and neck of the femur, in many of the so-called osteo-arthritic hips, may be of gouty origin. I have seen one case where these gouty cavities in the bone have been replaced by normal bone, either as the result of the attack quieting down, or as a response to treatment. Further investigation on these lines might form a valuable indication as to the effect of treatment.

The various stages of the disease, as indicated in the hand, are as follows. The very early cases show no articular changes. Other changes are a single punched-out area at the base or head of the bones making up a minor joint; or, occasionally, a small group of transparent spots, frequently in the base of the first metacarpal; or involvement of the bones and joints of the wrists, producing characteristic "mottling" of the carpals. As the later stages of the disease are approached, the disorganization of joints and the difficulty in differential diagnosis become greater. A loss of cartilage occurs in joints showing gouty deposits. Irregularity and erosion of the articular bone follows, and, finally, subluxation, with almost complete destruction of the articular bone.

The presence of general osteoporosis or a disturbance of B.D.B. in rheumatoid arthritis serves to distinguish this condition from gout, in which both are absent.

A number of cases, usually under the age of 30, come to the clinic labelled rheumatoid arthritis, but prove radiographically to have characteristic gouty deposits, giving, in fact, the identical radiographic picture of those cases of gout where the clinical and radiographic diagnoses are in agreement. This indicates that gout in the early decades of life is not such a rare occurrence as is commonly thought. Recent investigations lead me to think that Still's disease in children belongs to this group.

When gout attacks a major joint there are no radiographic changes of diagnostic value.

It is in these cases, where a major joint is attacked, that the radiographic examination of a hand is so valuable, for small urate deposits are detected in the hands in nearly all cases of true gout, even though the disease has primarily attacked a major joint. Clinically, there appears to be some difficulty in differentiating between osteo-arthritis, gout, and the late stages of some types of rheumatoid arthritis, when these diseases attack the hand. Radiographically, it is comparatively simple to determine to which group the particular arthritis belongs. It is possible to get two types of arthritis in one and the same patient. Infective arthritis is not included in this paper.

I consider that eventually all chronic arthritic cases will be classified according to the changes seen radiographically. A radiograph depicts pathology in terms of shadows, and a correct interpretation of this pathological process must give us a much more reliable foundation for our diagnosis than is at present afforded by clinical methods.

FOREIGN BODIES IN THE OESOPHAGUS*

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It has been my privilege between the years 1920 and 1930 to deal with sixty-seven cases of foreign bodies impacted in the oesophagus. During this period, however, only two verified cases of foreign bodies in the lower air passages have been admitted. According to American journals cases are frequent in that country; the habit of eating pea-nuts is said to be largely responsible. It would therefore be interesting to have the experience of British endoscopists as to the relative frequency of foreign bodies in the food and lower air passages.

As there still seems to be some doubt with regard to the urgency or appropriate treatment to be adopted when a foreign body is lodged in the oesophagus, a review of the sixty-seven cases which I have seen may be of value. The ages of the patients varied from 11 months to 62 years, while the foreign bodies consisted of thirty-nine coins, fourteen meat bones, one denture, three pins, and various charms, whistles, buttons, and badges. In fifty-eight cases the foreign body was successfully removed by endoscopic means; in seven it was ultimately passed by the rectum; in one endoscopic removal was only partially successful, the patient vomiting the rest of the fragment; the remaining case ended fatally, giving a mortality rate of 1.4 per cent.

LEVEL OF IMPACTION

Anatomically the oesophagus is constricted at four points: at its upper end on a level with the sixth cervical vertebra, where its orifice is strongly guarded by the powerful contraction of the crico-pharyngeus or inferior pharyngeal constrictor muscle, and supported anteriorly by the resistant posterior surface of the cricoid cartilage; in the thoracic portion by the arch of the aorta and the left bronchus at the level of the fourth and fifth dorsal vertebrae respectively; and, finally, on a level with the ninth or tenth dorsal vertebra the lumen narrows as it passes through the crus of the diaphragm to continue in its intra-abdominal course.

Although anatomically the oesophageal lumen is slightly constricted by the aorta and left bronchus, it is rarely, in my experience, that impaction occurs at these levels. This, no doubt, is due to the transmitted respiratory expansion and contraction of the thoracic

* A university post-graduate lecture delivered at Ancoats Hospital.