the salinity of the ocean by emptying the bladder into it.

With circulatory failure the drug *par excellence* is adrenaline. It augments the heart's contraction, constricts blood vessels, and raises blood pressure: 5 to 10 minims can be injected every four hours, increasing, if necessary, to two-hourly. Pituitrin has no action upon the heart, but stimulates contraction of the smaller arterioles and capillaries. It can be used to augment the action of adrenaline—1 c.cm. every twelve hours, or not more often than every six hours. With both these drugs the point may have been reached when toxic action upon the capillaries has advanced so far as to make them incapable of response. They should be employed at the first sign of failure, and it must be recognized that with grave toxæmia we may be wholly powerless to combat circulatory failure.

Digitalis and Alcohol

The use of digitalis in pneumonia has been the subject of much controversy. It was for long out of fashion, and its revival is due to the advocacy in America of its early use in full doses with the idea that if the heart was digitalized early its failure might be prevented. This was due to a misconception of the nature of circulatory failure. Digitalis has been used to slow the heart, and also with the vague idea that it is a cardiac tonic and therefore must be of value in heart failure. But there is abundant clinical evidence that digitalis does not slow the heart in pneumonia. Its reputation depends almost entirely upon its power of depressing the function of the conducting tissues, a very desirable property in auricular fibrillation but surely not desirable in pneumonia, where we should aim at preserving the normal functions of the heart. Doubt has recently been expressed in America upon the value of digitalization in pneumonia, and Niles and Wyckoff made a controlled study. Digitalis was given to alternate cases over a period of two years. The control and treated cases were observed in exactly the same way. Electrocardiograms were taken every day during the febrile period. Of 404 patients who did not receive digitalis 136 died, a mortality of 33.7 per cent. Of 338 who were given digitalis 140 died, a mortality of 41.4 per cent., showing a difference of 7.7 per cent. In other words, for every 100 patients in the control group who died there were 122 deaths in the digitalis-treated group. A surprising result was that in twenty-three cases with auricular fibrillation or flutter the mortality was again higher in those receiving digitalis.

Alcohol has probably for long been the most used of all drugs in pneumonia. While it still has its supporters, opposition appears to be growing. In the early stages it may by its sedative action allay anxiety and promote sleep, but morphine will do this more effectively. The argument that it is a source of energy has not much weight when so easily assimilable a food as glucose is available. But the chief discussion is concerning its use in circulatory failure. Its reputation as a cardiac stimulant probably arose from its familiar use as a remedy for fainting. The girl who fainted in church was carried out into the porch and given brandy by the churchwardens. The effect on the circulation is then due to reflex action from its irritant effect upon the upper part of the alimentary canal. But this action is fleeting, and it does not follow that the same effect will be produced in gradual circulatory failure in acute fevers. When prescribed in pneumonia in the usual way of so many ounces of brandy every four hours or so it is its action after absorption which must be considered. Experiments on animals and man show that it has no direct action on the heart, but it causes some redistribution of blood. There is dilatation of peripheral blood vessels, flushing of

the skin, and therefore a smaller supply for the internal organs. Alcohol is therefore likely to accentuate the peripheral circulatory failure. There is no doubt that much of the delirium and excitement attributed to pneumonia was actually produced by the alcohol given for treatment, and in my early days as a physician it was not uncommon to see alcohol urged for the treatment of active delirium which was entirely the result of the alcohol the patient had already received. With the smaller doses now used severe delirium is less often met with.

Strychnine was frequently prescribed in the past, but it is rather out of favour at present. It also has no direct action upon the heart, but is a central vasomotor and respiratory stimulant. It fails to act in toxic depression of the centre or in cases of peripheral paralysis of the vessels. Many other drugs have been advocated for their action upon the circulation, but mostly with the idea that the heart was primarily at fault. They may have some value in certain cases, but I have not found one which is of real value in saving life in serious circulatory failure.

It would seem that critical examination is depriving us of several time-honoured remedies, but we have the consolation that if our faith in certain remedies has proved false yet our means of preventing serious symptoms are steadily improving, and we are in sight of a truly rational treatment of a disease which takes a heavy toll at all ages, of the strong as well as of the weak.

SOME NOTES ON THE DIAGNOSIS OF BONE TUMOURS*

BY

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In the small space of time at my disposal it is impossible to deal with the radiographic aspect of all the different types of tumours of bones and to discuss the various classifications. These can be found fully described in numerous books, monographs, and magazines—their symptoms, signs, x-ray features, sites of predilection, prognosis, etc.

It is my intention to discuss and to illustrate certain pitfalls, and, above all, to emphasize the need for care in arriving at the diagnosis, especially as to the type of tumour, at as early a stage as possible, because the early differentiation is of great importance from the aspect of correct treatment. Mistakes may arise in several ways—from want of care in inspecting the skiagrams, from not making use of available clinical history and pathological findings, as well as from want of knowledge and experience. It is to be remembered that the x-ray findings are only one of the means of arriving at a diagnosis, though probably the most important means at present available. Signs and symptoms do not concern us at present, but I should like to mention the great importance of a careful radiographic examination of the chest before any mutilating operation is decided upon.

We are all *au fait* with the typical radiographic pictures of the main types of bone tumours—of osteoma, enchondroma, the variations in cartilaginous and bone development allied to the tumours (such as Ollier's disease, hereditary deforming chondrodysplasia), bone cyst and fibrocystic variations, of osteogenic sarcoma, Ewing's tumour, haemangioma, giant-celled tumour, etc.; but all too frequently do we hear of errors in diagnosis in the case of bone tumours, sometimes, I regret to say, from want of care in examining the skiagrams and want of appreciation of the importance of slight or fine changes.

* Read in opening a discussion in the Section of Radiology at the Annual Meeting of the British Medical Association, Melbourne, 1935.

Aids to Radiological Diagnosis

Before passing on to the discussion of certain difficulties or pitfalls in diagnosis, let me emphasize the importance of a careful history. A history may at times be almost pathognomonic—for example, in the case of secondary neuroblastomata. The history should be forwarded by the clinician. Failing this the radiologist should not hesitate to ask for any clinical details which he may consider of value to help him to arrive at the correct diagnosis. In this the radiologists have a parallel with the pathologists, for nowadays many pathologists will not express an opinion without a history of the case.

The radiologists, as a body, should insist on having any available clinical findings. A patient is referred to the radiologist not merely for a radiograph or radiographs, but for an opinion, and anything that will be of use to the latter in arriving at a correct interpretation should be made available to him. Similarly, the radiologist is entitled to have, for his information, details of any pathological examination that has been made—the Wassermann reaction, the Casoni (especially in this country), the blood count, and the blood picture. If these have not been made the radiologist may be forced into giving a differential diagnosis, stating that certain pathological tests may be required to differentiate. Again, he may require a much more extensive x -ray examination than that which has been requested, and this he should be entitled to make. To give a simple illustration: he may suspect that a single localized transradiant area in one bone may be merely one of many such areas widely distributed—for example, in osteitis fibrosa, in certain types of lipoid histiocytosis, etc.

At times it may be essential to request time for progress skiagrams—for example, in cases of myositis ossificans—though this should naturally be avoided as far as possible for fear that the delay may jeopardize the patient's chances. In other cases it may be of advantage to advise a diagnostic application of x rays of high voltage—for example, in distinguishing between osteomyelitis and Ewing's tumour, and between lymphadenoma of bones and osteogenic sarcoma.

To emphasize these points let me quote the following two cases, illustrating how simply errors may occur.

1. At one of the general hospitals in Sydney a child, aged 20 months, was referred to the x -ray department for investigation. No changes were detected in the skull, but changes indicative of secondary neuroblastomata were observed in the long bones, especially of the inferior extremities, and such a diagnosis was made. Reference to the history showed the almost pathognomonic feature: "the child was unable to use its legs." The blood count showed a very low red cell figure (2,670,000). A hopeless prognosis was given. The child was removed from hospital, taken to see another physician, and referred to another radiologist, who, I understand, reported that no bone lesion was present. This child died a couple of months later. This error probably arose from the physician requesting a radiographic examination of the skull alone (and in this case the widening of the sutures and worm-eaten appearance, typical, though not universal, of this condition, were not present), or from a lack of care on the radiologist's part in not x -raying the limbs as well as the skull.

2. The following case illustrates the need for the most careful examination of the finer bone changes, changes that may be best seen by the use of a good magnifying glass; it is that of a man who was referred to the x -ray department of a general hospital in Sydney because of a swollen and inflamed finger. The skiagram showed widespread osteoporosis in the proximal phalanx of the middle finger, and a diagnosis of osteomyelitis was made. This man died in another Sydney hospital, where a necropsy was performed and widespread metastases typical of Ewing's tumour were found. This example illustrates how easily these two conditions may be confused, and, indeed, it is often impossible to differentiate between them radiographically; but it also demonstrates the value of using a magnifying glass, because in this patient's

skiagrams there could be seen with it a suggestion of a fine periosteal deposit, arranged perpendicularly to the shaft; and this would have warned the radiologist that he could not exclude neoplasm.

Classification

It is with the object of lessening the number of errors that the following notes are made. As I have said before, I shall not discuss individually the types of bone tumours usually encountered, but shall pass on to some of the more unusual bone tumours, in which diagnosis may be difficult, especially to the radiologist who has not had a wide experience in bone work. In doing this I cannot follow any definite classification, as I shall be referring both to primary and to secondary growths. For ease of discussion I shall put them into four groups, according to the part of the bone mainly involved, as below:

- A. The changes are mainly periosteal, or involve especially the surface of the cortex.
- B. The involvement is mainly cortical.
- C. The lesion is mainly central.
- D. There is composite involvement.

Group A: Periosteal Tumours

In the first group—that affecting especially the periosteum and the more superficial layer of the cortex—I shall briefly discuss: (1) secondaries from primary bronchogenic carcinoma; (2) the extraperiosteal fibrosarcoma; (3) secondary neuroblastoma, which may be, in its early stages, mainly periosteal, though usually it is not encountered until it is generalized throughout the substance of the bone; and (4) the lacework type of specific periostitis.

SECONDARIES FROM BRONCHOGENIC CARCINOMA

It now seems quite definite that there are two types of lesion included in the term "hypertrophic pulmonary osteoarthropathy": a true osteoarthropathy, seen in bronchiectasis, etc., and a bastard type, malignant in nature, that is seen in cases with a primary lung cancer. The latter type has, in addition to its periosteal deposit, a cortical destruction, often very superficial, especially in the early stages. It occurs usually towards the ends of the shafts. The x -ray picture is typical. It is not, however, to this widespread type of metastatic bone involvement that I wish to refer, but to the single bone metastasis that may occur in bronchogenic carcinoma. A secondary arising from this type of primary tumour may occur in a single bone, affecting a somewhat localized area of the cortex, often not at the end of the shaft, with slight to moderate cortical erosion, and with very definite periosteal reaction, usually arranged in a curiously loculated way, slightly suggestive of the type of arrangement seen in benign cavernous haemangioma, though the bony tissue within the mass is much less in quantity. It is not unlike the soap-bubble appearance seen at times in secondary hypernephromata. When such cortical appearance is seen secondary hypernephroma and secondaries from primary bronchogenic carcinoma should be remembered. I have seen it most frequently in the tibia, but also in the femur. It is usually diagnosed by the radiologist as osteogenic sarcoma, to which it bears a close resemblance.

EXTRAPERIOSTEAL FIBROSARCOMA

This lesion is a very rare tumour, the most benign of all sarcomata, its malignancy being almost of a local character. It is important to recognize it, with its low-grade malignancy, in order to avoid an unnecessary amputation. Local removal may suffice for its cure. It is characterized by a pressure deformity on the adjacent bone, without erosion. [A skiagram was shown (taken in 1924) of a young man on whom local removal was per-

formed: section by the pathologist showed a fibrosarcoma of low-grade malignancy. Some deep irradiation was also carried out. Dr. Sear stated that there was still no evidence of any recurrence, either local or general.]

SECONDARY NEUROBLASTOMATA

This is another lesion which may cause trouble and worry in diagnosis. The classical picture, as described by Henle, both of the skull and of the long bones, offers no great difficulty in diagnosis (except from chloroma), but in cases where early involvement is discovered the only sign may be some early or slight elevation of the periosteum, sometimes associated with the "lipping" encountered at times in sarcoma. It is a lesion of infancy, and is always to be remembered in making a diagnosis in a child with unusual periosteal changes. The blood count usually shows a great decrease in the red cells, and this is suggestive of secondary neoplasm; the history of the child "going off its legs" is almost invariably present, and cannot be too highly emphasized.

SYPHILITIC PERIOSTITIS

The fourth member of this group to which I shall refer is the lacework type of syphilitic periostitis. Syphilis in bones may assume many forms. It is usually associated with marked osteosclerosis; it often affects the cortex principally, but in addition to the usual forms one may see occasionally a curious overgrowth from the periosteum, to which the description "lacework" has been applied. Such periosteal reaction may be not unlike that of sarcoma.

[Dr. Sear showed the skiagram of a young woman of 20 years, demonstrating such an appearance. The diagnosis of luetic periostitis was confirmed by the ready response to anti-specific treatment.]

Group B: Cortical Tumours

Of the lesions involving especially the cortex the conditions causing difficulties in diagnosis to which I shall refer are: (1) hydatid, (2) lymphadenoma, and (3) certain secondaries, such as hypernephroma.

THE CORTICAL HYDATID

In Australia it is to be remembered that the incidence of hydatids in bones is relatively high as compared with that in other countries. Hydatid in bones may assume one of two main forms—the cortical and the central. It is the cortical type that calls for discussion in this section. Usually there is erosion, with more or less bone production; sometimes bone production may be almost absent. The erosion and the bone production present a picture at times identical with that of osteogenic sarcoma, and in quite a number of cases the differentiation between sarcoma and hydatid is impossible radiographically. The value of the blood picture, with its eosinophilia, and of the Casoni test, is at once apparent. At odd times the diagnosis of hydatid can be made with a considerable degree of certainty by the skiagrams, as one may be able to trace the circular shadow of the calcified or calcifying wall of the cyst, extending into the soft tissues. This is unusual. As a rule the pathologist's aid is indispensable.

LYMPHADENOMA

Lymphadenoma of the bones is, I am sure, of much greater frequency than is generally recognized. I have seen quite a number of examples, the bone most frequently involved being, in my experience, the sternum. This is contrary to statistics, which place the vertebra as the most common site among bones involved. I have also seen the lesion in the spine, pelvis, skull, ribs, and femur. It is characterized by erosion and bone production, either of which may predominate, though usually bone destruction

is the more obvious feature. Its ready local response to x-ray treatment is an important diagnostic feature. At times the radiographic appearance may be very suggestive, at other times it is quite impossible to make the diagnosis on the radiographs of a single part—possibly the x-ray examination of the thorax may clear up a doubtful diagnosis, though in several of my cases there has been no gross involvement of the mediastinum.

The first patient I remember seeing with this condition was in 1915. The sternum was the site of the original bony mass, and I made the diagnosis of sarcoma. The mass completely disappeared under x-ray treatment (at about 100 kV). Later other masses formed in the iliac bones, which again readily responded. The patient died later, the clinical diagnosis being lymphadenoma. No post-mortem examination was made.

SECONDARY TUMOURS: HYPERNEPHROMA

Again, it is to be remembered that certain tumours give rise to secondaries in bones, and that at times only a single bone may be involved. Such a localized secondary may present an appearance simulating osteogenic sarcoma of the osteolytic type. More than once I have seen such secondaries diagnosed as sarcoma. This is especially the case with secondaries from hypernephromata. These are not uncommon, and their secondaries may affect a single bone or several bones; but each area is localized. It is the symptoms of the secondaries that call attention to the lesion, not the primary tumour itself. The secondaries from hypernephromata are commonest about the sixth decade, and occur much more frequently in men than in women. Hence, before making a diagnosis of osteogenic sarcoma in a patient of advanced years—especially a male—the possibility of such a secondary should be considered.

The secondaries of a hypernephroma may occur as a central lesion or as a cortical lesion. Both types may occur in the long bones, though possibly the former are more frequent; in flat bones the cortical type occurs more frequently. The appearance of such metastases has been likened to soap bubbles; this is especially the case where the metastases occur in the flat bones, though it may also be seen in the cortical lesions in the long bones. [Dr. Sear showed a film of a hypernephroma on the left side; the large mass was apparent, displacing the kidney upwards and causing hypernephrosis and deformity of the renal pelvis. It showed secondaries in the spine and in both innominate bones, the secondary on the right side presenting the typical soap-bubble effect. The mass displaced the bladder towards the left.]

Finally, before leaving this section, that of cortical involvement, let me emphasize the fact that tuberculous lesions of bones may, in rare cases, be extremely difficult to differentiate.

Group C: Central Tumours

The four main lesions likely to cause error in diagnosis in the third group, that of central involvement, are: (1) hydatid, the central type; (2) lipid histiocytosis, the generalized, massive type; (3) central cartilaginous masses and tumours; and (4) secondaries from hypernephroma.

THE CENTRAL HYDATID

Reference to the second group of bone lesions in this article will show that I have already mentioned the two main forms that hydatids of bones may assume—the cortical, already discussed, and the central. The central type of hydatid extends up and down the medullary cavity, along the line of least resistance, and simulates bone cyst. The presence of various bulges and erosions may suggest that the condition is one of hydatid, but this is unusual. The differentiation from bone cyst may be impossible on radiographic evidence alone. The possibility of hydatid being present should be remembered and should suggest pathological assistance.

LIPOID HISTIOCYTOSIS

This is another lesion which may cause difficulty in diagnosis. The most classical appearances of lipoid histiocytosis are those described by Schüller as the geographical skull, and by Gaucher as of the long bones, with Fisher's sign, etc. Lipoid histiocytosis may, however, assume other forms in bones. I have seen Schüller's disease of the skull and Gaucher's disease combined. There is the type of bone lesion occurring in the latter described by Junghagen, by Welt, Rosenthal, and Oppenheimer, etc., with massive joint involvement, to which I shall refer later. Again, in addition to the large transradiant defects in the skull, as in Schüller's disease, one may also see similar large transradiant areas, simulating cysts, in other bones, such as the case described by Svenningsen. [Dr. Sear showed the skiagram of a tibia which suggested at first sight a fibrocystic area; the skiagrams of the pelvis showed somewhat similar areas, the skiagram of the skull, however, presenting the typical picture of xanthoma. In this case the possibility of a generalized massive lipoid histiocytosis was suggested on the x-ray films, and this was verified by biopsy in the tibial lesion. The skiagram of the tibia alone could, it was stated, easily lead to a mistaken diagnosis.]

CENTRAL CARTILAGINOUS MASSES AND TUMOURS

These constitute the third condition in this group dealing with central bone involvement. Chondrosarcoma and myxochondrosarcoma may simulate cystic lesions in bones. A somewhat similar appearance involving a much greater length of the bone is occasionally met with, and it may cause much worry in diagnosis. It is to be noted that true central chondromata of the long bones are very rare. Copeland and Geschickter state:

"It is doubtful whether such diagnosis is justified on the basis of the roentgenogram alone. In nearly 2,000 tumours of the bone there are but five well-established cases, and in these the resemblance is so close to malignancy in the x-ray films, and the tendency for the lesions to recur and to be cured only by radical operation is so great, that there is little practical harm in classing these tumours as forms of chondrosarcoma, although those not experienced may be led into an erroneous diagnosis of cyst of the bone. Nevertheless, from a scientific standpoint, the possibility of the occurrence of a true central chondroma in the long bones must be conceded. The only distinctive roentgen features are the tendency to expand the bone, the marking of the transradiant areas by lines and particles of calcification, which produce a distinctly multilocular effect, and the involvement of the periosteal region by peculiar roughened areas escaping beyond the cortex."

Hypernephroma metastases have already been discussed in Group B, and need not be mentioned again. The time at my disposal precludes me from referring in any detail to the extremely rare tumours in the shaft of bones, such as adamantinoma of the shaft of a long bone—for example, the tibia.

Group D: Composite Tumours

Finally, in dealing with the pitfalls in the bone lesions where the whole structure of the bone is involved, I shall discuss these according to the following table.

Diagnosis of Composite Bone Involvement

Lesion.	Lesion to be Excluded.
1. Ewing's tumour	(a) Osteomyelitis. (b) Syphilis. (c) Tuberculosis. (d) Garré's sclerosing non-suppurative osteomyelitis. (e) Engelmann's disease.
2. Paget's disease	(a) Supervention of sarcoma on same. (b) Prostatic secondaries. (c) "Ivory" vertebra.
3. Lipoid histiocytosis (Gaucher's with massive destruction)	(a) Tuberculosis. (b) Malignant metastases.
4. Secondary neuroblastoma	(a) Osteomyelitis. (b) Chloroma.

EWING'S TUMOUR

Ever since it was first described, Ewing's tumour has been a source of the greatest worry to the radiologist. The difficulty in diagnosis is beautifully exemplified by the case quoted by Kolodny (*Surgery, Gynecology and Obstetrics*, April, 1927), the mistake affecting not only the radiologist, but also the surgeon and the pathologist. While the pathological diagnosis of this tumour may be difficult, its differentiation from osteomyelitis may be impossible radiographically. Clinically, each condition may show the same signs and symptoms. The reaction to deep irradiation may be of value in differentiating between these two lesions. Progress skiagrams usually make the diagnosis definite, but one hesitates to suggest such delay. It has always seemed to me that culture at the exploratory incision should give much help—a sterile result on culture should suggest that the case may be one of Ewing's tumour in such doubtful cases. I speak here as a radiologist, not as a pathologist. I do not know the consensus of opinion among pathologists on this point. I am aware of the objection to such incision, but it may possibly settle the diagnosis in a doubtful lesion.

It is to be noted that in the skiagrams of a very early stage of Ewing's tumour there may be no obvious bone destruction, but only some increased density of the affected area. For this reason one has to exclude the possibility of Garré's sclerosing non-suppurative osteomyelitis. This lesion leads to expansion and very marked osteosclerosis of the part of the bone affected. It is characterized by the absence of pus and sinus formation, and is usually ushered in by fever and pain—an acute onset. There is leucocytosis. The infiltration of the soft tissues subsides, leaving only the widening and expansion of the bone, with osteosclerosis. The onset is different from a syphilitic lesion, with which it might be confused. The extent of the bone involvement is usually greater than that in sarcoma, and the thickening is more symmetrical and denser. The skiagram of a single bone of a patient affected with "osteopathia hyperostotica sclerotisans multiplex infantilis" (Engelmann's disease) might be mistaken for this lesion. I shall not, owing to the time at my disposal, refer to tuberculosis and syphilis of the long bones.

PAGET'S DISEASE

Passing now to osteitis deformans, this dystrophy is of great frequency in this country, and its diagnosis is usually obvious. Occasionally it may be difficult to differentiate it from prostatic secondaries, but usually the diagnosis presents no great problems to one who has seen a large number of patients with osteitis deformans. Much more difficult, however, may be the detection of early sarcoma when it supervenes on a bone affected with Paget's disease. Any slight periosteal or cortical erosion should be carefully looked for. Well-established sarcoma on Paget's disease presents the usual features of sarcoma, but I shall show skiagrams to illustrate how difficult such diagnosis may be. They are those of the bones about the knee-joint, with changes typical of Paget's disease. [Dr. Sear showed skiagrams of a man who died some ten weeks after the photographs were taken. Changes could be seen due to the supervention of osteogenic sarcoma in a very early stage.]

It has been held in America that some 14 per cent. of patients with Paget's disease develop osteogenic sarcoma; in Germany this figure has been put down at 5 per cent.; in Australia, where osteitis deformans is so very common, I do not think that the figure is more than 2 per cent. I have seen only nine cases of sarcoma supervening on Paget's disease, whereas I have seen several hundreds of patients with Paget's disease. The "ivory" vertebra, due to metastases, may occur in prostatic secondaries, but it may also be met with in secondaries from other carci-

nomata—for example, from a cancer of the breast. The diagnosis is usually obvious.

GAUCHER'S DISEASE

When Gaucher's disease with massive destruction affects the long bones it usually causes thinning of the cortex and a looser type of trabeculation—a somewhat worm-eaten appearance. It also is associated with expansion of certain bones, especially the femora (Fisher's sign). But Gaucher's disease of the long bones may cause massive destruction in the long bones, especially at the ends of the diaphyses; and this is the type to which I am now referring. It involves especially the ends of the diaphyses; and, as has been pointed out, the skiagrams of a single part may lead to the condition being diagnosed as a tuberculous lesion. The widespread character of the lesion should at once disprove this. The possibility of metastases has to be excluded. In a case of mine we watched areas develop in the skull which are very suggestive of lipoid histiocytosis, and it is difficult to see what primary tumour could give such secondary metastases in the skull.

SECONDARY NEUROBLASTOMA

I have already mentioned the early secondaries of neuroblastoma as a possible error in the diagnosis of lesions affecting especially the periosteum. In a patient in whom such secondary invasion is well established one also hears of errors in diagnosis—for example, I heard recently of such a case being regarded in a London hospital as an example of osteomyelitis. The worm-eaten appearance of the long bones and the periosteal reaction, with, later, the formation of larger transradiant areas, are usually diagnostic. The skull changes may clinch the diagnosis, as, if present, they are typical; but, as mentioned before, they need not be present, and yet the picture of the long bones may be quite diagnostic.

Conclusion

These few notes have been put together in the hope that they may be of some value in establishing the diagnosis by suggesting possibilities that have to be considered and excluded. I have confined my attention to the general skeleton; space and time prevent me from discussing corresponding conditions in the skull.

We have received the programme of the third International Congress of Comparative Pathology, which is to be held in Athens from April 15th to 18th under the presidency of Dr. W. Bensis, professor of medicine in the University of Athens. The topics to be dealt with have been chosen from the fields of human, animal, and vegetable pathology, with special reference to their interrelationships. Thus in the first of these there will be discussions on the echinococcoses, the nephroses and amyloses, leishmaniasis, spirochaetoses, and avitaminoses, with consideration of their influence on the digestive functions. The veterinary sides of these questions will also be discussed, and the manifestations of immunity in the vegetable kingdom will be specially reviewed. Professor S. Adler of Palestine and Lieut.-Colonel H. E. Shortt, I.M.S., will speak on the leishmaniasis; the director of the Imperial Mycological Institute will report on the nature of immunity from disease in plants; Dr. K. Smith and Dr. R. N. Salaman of Cambridge will deal with plant virus diseases; the head of the botanical department at Rothamsted will describe the resistance of plants to poisons; and Professor F. T. Brooks of Cambridge will read a paper on the resistance of trees to certain fungi. Several excursions in Greece have been arranged in connexion with this congress, further particulars of which may be obtained from the general secretary, Professor A. Codounis, Club Universitaire, 15, Rue Hippocrate, Athens.

PHYSIOTHERAPY IN THE TREATMENT OF INJURIES IN GENERAL AND ORTHOPAEDIC PRACTICE*

BY

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The word physiotherapy should, from its derivation, mean "curing by natural means." It is a loose term—introduced by whom and when I cannot tell—meaning as yet nothing to the layman, and of too recent origin to have found its way into non-medical dictionaries. In our medical jargon it has come to denote, in addition to massage, such subjects as heat, electricity, hydrotherapy (now taught in the massage curriculum), and practised in the public hospitals and in private work by the modern masseuse.

It has become the prevailing mode with many of us to adopt a somewhat scornful attitude towards physiotherapy, taking its help for granted, and yielding it faint praise in return. This is a reaction from the boom years. In the military hospitals, during and after the war, physiotherapy reached its zenith. No equipment was then too elaborate or too costly, and there was a large body of ardent young masseuses at the service of these institutions. The large hall, the shining wood, the ladders against the wall, the capstan wheels, the weights, the pulleys, the wooden horses, the stationary bicycles, the smell and sight of electric sparks, the baths (hot and cold), whirling and bubbling—where are they now?

In spite of the army of motor-made and machine-made civilian cripples of the present day, there seems to be no strong survival of those temples of physiotherapy. Memories of them still exist in the minds of those who saw them, and when fractures are ugly and function is poor the idea then comes that attendance at one of these places might have saved all this. They have not been perpetuated because they did not achieve as much as was expected of them—and this, because they assumed the wheels, the pulleys, and the sparks could of themselves cure.

Another cause of some of the scorn is the tendency evident to those who see the inside working, to treat the massage department as a sort of dumping-ground for the rubbish of both medical and surgical practice. The vague prescription of "massage," or "radiant heat and massage," seems to engender a vague hope of cure. For the patient the warmth, the rubbing, the social atmosphere, all tend to make the situation pleasant. He likes it and comes again, and keeps on coming until he is a confirmed invalid.

Physiotherapy in the Past

In this attempt at evaluation one is forced to seek fundamentals. The search leads to H. O. Thomas—as most things orthopaedic do.

As a disciple of Thomas, I believe in the restoring of parts impaired by injury by three methods. (1) *A period of rest*: in adequate splints, uninterrupted, enforced, and prolonged until the inflammatory process of repair is nearly complete. This process involved the vascular capillarized granulation tissue being slowly converted into avascular scar tissue—and, in the case of bone, for lime to be deposited in the scar tissue—a process taking typically three weeks, but in bones and joints longer.

* Read in opening a discussion in the Section of Orthopaedics at the Annual Meeting of the British Medical Association, Melbourne, 1935.