AN ADDRESS ON THE PATHOLOGY AND TREATMENT OF OSTITIS.¹

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GENTLEMEN,—I need hardly remark that the British Medical Association was founded for the "promotion of medical and the allied sciences, and the maintenance of the honour and interests of the medical profession;" it devolves upon me, therefore, as your president for the ensuing year, to endeavour to promote these interests to the best of my ability. I shall have something to say on what may be called the social side of the question during the evening; at present, I wish to direct your attention to matters connected with the first part of our programme, which refers to medical science. With this object in view, I have selected the subject of Ostitis for our consideration, because the various forms of diseases of bone comprised under this term are of considerable importance, for cases of the kind are constantly under our care; but there is a difference of opinion among surgeons as to their nature and treatment. I have consequently drawn up a short account of the views I entertain on this subject. This paper will be placed in the hands of our editor for publication in the JOURNAL of the Association, and will thus form a basis for further discussion. Those gentlemen who take an interest in the matter will have an opportunity, during the next few months, to think it over; and I should hope that, at some of our district meetings, the views I have put forward will, together with cases and preparations, be fully considered. I am convinced that criticisms of definite opinions carried out in this way must tend to confirm what is sound, or correct what may be erroneous in the ideas advanced; and so we may hope to promote the interests of medical science to some extent. It is almost unnecessary for me to add that, in making this proposal, I do not wish to restrict the range of our discussion of medical or surgical subjects; on the contrary, I trust that, during the ensuing year, we may have many interesting and important papers brought under our notice at the meetings of our various district Branches.

Until the age of from 21 to 24, the epiphyses of the long bones are separated from the shafts (diaphyses) by a disc of cartilage. Bones increase in length by the growth of osseous tissue formed from cells situated principally on the distal side of this cartilage. The consequence is, the more rapid the growth the greater the activity of the tissues, or, in other words, the vascularity of this portion of the bone. Further, the blood-supply of the epiphysis is, to a great extent, independent of the diaphysis, so that we may remove the diaphysis of one of the long bones, leaving its epiphysis, which will continue to live and grow. In the same way, the epiphysis may be destroyed, and the diaphysis continue to live. Lastly, the disc of cartilage situated between the diaphysis and the epiphysis is continued, on the one hand, with the deep layers of the periosteum; and, on the other, with the synovial membrane; it is from cells derived from this cartilage, therefore, that the bones grow in diameter; and, from the same cells, the bony outgrowths commonly seen in arthritis deformans, and some other chronic affections of the synovial membranes, are produced.

The medulla of bone consists of a reticulum of adenoid tissue, the interstices of which are partly occupied by fat-cells. Enclosed among the fibres of this tissue there are numerous large nucleated brood-cells, which produce an immense number of round cells; these are subsequently elaborated into red blood-corpuscles. Portions of free protoplasm are also found scattered throughout the adenoid tissue, and in its interstices there are spaces through which the round cells pass into the general circulation. In addition to these channels, the adenoid tissue is permeated by blood-vessels. Lastly, lining the walls of the trabeculae of the bones, and also the Haversian and medullary canals, there are a number of nucleated cells which are the descendants of the temporary cartilage-cells from which the bone was originally formed. It is from these cells, which are precisely similar in appear-

ance and in function to those found in the deep layer of the periosteum, that the trabecular structure of a bone grows, and is repaired. The trabeculae of a portion of bone, under certain conditions, may assume a worm-eaten porous appearance; this depends upon imperfect action of the cells which line the trabeculae. Should these cells, from any cause, cease to do their work, the bone during the natural process of disintegration remains unrepaired, and so presents the rotten worm-eaten appearance above referred to. The process leading to this condition is known as "rarefying ostitis." No doubt, the bone-corpuscles contained in the trabeculae assist in producing this result, for they were originally formed from the cells lining the trabeculae, and any cause affecting the one set of cells probably influences the others. On the other hand, supposing that the cells which line not only the trabeculae of the bone, but also the Haversian canals, and the deep layer of the periosteum, multiply considerably, so as to fill these cavities; and that these cells subsequently secrete a large quantity of bone-earth into the part, such a bone grows exceedingly dense and heavy; this process is known as "condensing ostitis;" and a bone so affected is said to be sclerosed.

TRAUMATIC OSTIITIS.—If the periosteum and soft parts be reflected back, and a portion of bone be thus exposed and removed, we notice, after a few days, that florid granulations grow from the exposed surface of the bone. Pus is forced over the granulations, and within them we find cells arranging themselves in contact with the wounded surface of the bone; these cells become converted into osseous tissue, in precisely the same way that the original bone has been produced from temporary cartilage. The spicula of bone thus formed increase in size; they coalesce, and so gradually fill up the cavity in the bone. The first result of the injury to the bone, however, is the destruction of the bone-forming cells lining the Haversian and other spaces in the bone, in immediate proximity to the wound. A rarefying ostitis is thus established, and the walls of the Haversian canals crumble down so that they are greatly enlarged. After a few days, the medulla immediately beyond the influence of the original injury grows into, and fills, the dilated Haversian canals, and from their open extremities it projects into the wound, forming the granulations above referred to; these doubtless contain numerous leucocytes. The periosteum also plays an important part in the repair of the injured bone; the bone-forming cells of its deeper layer grow rapidly, and, advancing into the wound and over the surface of the granulation tissue, produce an outer covering of bone. After ossification is completed, the parts implicated gradually resume their normal condition.

In this process, we can readily understand the importance of keeping the wound clean, and the surrounding parts at rest, allowing the pus and serous fluid to have free escape from the surface of the wound. For, if the granulations be irritated, inflammation is apt to occur in them, and the excess of pus produced is likely to fill the Haversian canals, and, by pressure, to stop the blood-supply through the vessels which they contain; the result being the necrosis of a portion of the bone. The same result may follow if the serous effusion from the wound be prevented from escaping externally. On the other hand, supposing that the newly formed bone, either from unnecessary movement in the soft parts covering it, or from any other cause, be kept in a state of irritation, its elements grow in excess (condensing ostitis); the natural spaces in the bone are filled in with osseous producing cells, and as these become calcified the bone is formed into a dense or sclerosed mass. The blood-supply in such a piece of bone is very defective, because the Haversian canals and other spaces are much contracted, and so it remains a constant source of pain and trouble to the patient.

OSTEOMYELITIS OF GROWING BONES.—Epiphysitis and acute periostitis are some of the names under which this form of disease has been described, the inflammation commencing at the line of junction of the diaphysis and epiphysis of the diseased bone. The reason why this line is peculiarly likely to become inflamed has already been referred to; it is the most vascular and actively growing part of a bone. Inflammation commencing at this line is apt to run on rapidly into suppuration, which extends along the medulla contained in the Haversian canals, and in the cancellated and medullary spaces of the bone, and from its connections with the periosteum it spreads to this membrane. In consequence of the rapid formation of pus, and its accumulation in the Haversian canals and other lung-spaces, as well as in the deep layer of the periosteum, the circulation through the affected diaphysis may be entirely stopped, and the bone may die. But although the diaphysis may thus be destroyed, it is quite possible that the epiphysis may continue to live, because it derives its blood from a separate source from the diaphysis. It is precisely the same with the periosteum; although this membrane is separated from the bone by pus, and is violently inflamed

¹ Being a surgical subject proposed at the annual meeting of the Metropolitan Counties Branch for discussion during the session of 1884-85.

it continues to live, because its vessels are derived from those of the surrounding soft parts. When the surgeon has removed the whole of the diaphysis in such a case, the periosteum resumes its functions, and with the epiphysis reproduces the bone which has been taken away. In some cases, however, inflammation commencing at the line of junction of the epiphysis and diaphysis may spend its force chiefly on the former, in which case purulent inflammation of the neighbouring joint is established; otherwise, in this disease the joints may escape absolutely uninjured. I lately showed three patients to the Fellows of the Royal Medical and Chirurgical Society, together with their dead and inflamed tibiae. These patients had suffered from the disease we are considering, and in each of them I had removed the entire diaphysis of one of their tibiae; a new bone in each case had not only been reproduced, but the patients had the perfect use of both knee and ankle-joints. It by no means follows, however, that osteomyelitis in growing bones destroys either the diaphysis or the epiphysis. The course of the disease depends upon its severity, its treatment, and the health of the patient. I have no doubt in my own mind that suppurative inflammation commencing in the locality above referred to is the cause of chronic abscess in bone—I do not say of all chronic abscesses in bone; but from the time of Sir B. Brodie's famous case onwards, instances of long years of pain and lameness, commencing early in life, have depended upon an abscess in the head of one of the long bones, usually of the tibia. The disease, in these circumstances, has commenced in osteomyelitis at the line of junction between the diaphysis and the epiphysis, resulting in limited suppuration and necrosis, around which a long continued condensing osteitis has been established.

Lastly, this form of osteomyelitis may cause extensive inflammation in the diaphysis short of necrosis. Subsequently, a condensing osteitis occurs in the whole of the formerly inflamed bone, and, continuing for years, causes great enlargement and sclerosis of the diaphysis. Ulcers form along the integuments, and the patient, after long suffering, is glad to get rid of the diseased limb. I showed a case of this kind at the meeting of the Society above referred to, in which the patient, after nine years' suffering, came into hospital for amputation. In place of this proceeding, I removed the greater part of the diseased diaphysis, saving the periosteum, and from this membrane a tibia has been reproduced, and the patient has now a sound limb. I have had a considerable number of cases of this form of disease under treatment, where the epiphysis has been principally involved. There are two such patients now in the Westminster Hospital, in one of whom the epiphysis of the lower end of the femur, and in the other, the epiphysis of the lower end of the tibia, have been removed subperiosteally, and new bone has been produced in place of that which was taken away. In such cases, ankylosis of the knee and ankle will probably occur, but, in both cases, a perfectly useful limb is secured.

The symptoms of this disease in the long bones (I have met with two instances of it in the scapula) is that, usually after an injury, the young patient is seized with intense pain and violent inflammation of the soft tissues surrounding the extremity of the affected bone. These symptoms, at first sight, resemble acute rheumatism in not a few cases, so near to the joint is the inflammation. In four or five days, however, the inflammation spreads along the limb; the integument becomes red and glistening, greatly swollen, and of a brawny hardness. The pain is intense in the limb, there is a high temperature, the heart's action is excessively feeble, and other symptoms of septicæmia are well marked; pyæmia is less common. It is probable that some cases of so-called acute rheumatism, with very high temperature, are really cases such as those we are now considering; for in instances of this kind various joints in the body may become distended with serous fluid. The disease may subside at any time under appropriate treatment; but, if it progress, suppuration occurs in the soft structure along the course of the limb, and the matter discharges itself through the integument. Death not unfrequently results from septicæmia, or the limb may become completely disorganised, so that amputation is necessary. In some instances, the epiphyses are principally implicated; these cases most frequently occur in infants, and they are peculiarly dangerous, for not only is the epiphysis destroyed, but the neighbouring joint and contiguous bones. In some cases, the inflammation and pain, although intense at first, gradually pass away, and are succeeded by long continued but intermittent pain near the head of the bone, and other symptoms of chronic abscess. In other instances, the inflammation having subsided, the affected bone becomes enlarged, often distorted in shape, and sclerosed. The bone remains a source of pain and constant irritation until removed by the surgeon.

Treatment.—In the early stage of this affection, free incision must be made down to the bone, over the line of junction of the diaphysis and the epiphysis. It is advisable, in most instances, to drill through or

trephine the bone in this locality, so as to allow the products of inflammation freely to escape externally. I have often repented of not having made sufficiently early and free incisions in these cases, but never of having incised and drained the parts too soon or too thoroughly. It does not by any means follow, if the incisions be made early, that pus will flow from the wound; a small quantity of matter, however, shut up in the cancellated tissue of the bone, is sufficient to poison the patient, or cause the death of the bone. If free incisions and efficient drainage be practised, before extensive suppuration has occurred, the disease may be cut short. The question is, when are the incisions to be made? It is needless to remark that, if, with absolute rest, the application of ice, and the administration of salicylate of soda and quinine, the symptoms abate, incisions are unnecessary. But if, after a few days of such treatment, the temperature continued high, and the local symptoms be not relieved, the sooner incisions are made down to the bone the better. The line of junction between the diaphysis and the epiphysis is at once seen in such a case, provided an Esmarch's bandage have previously been applied; and the proceeding is, therefore, bloodless. In many cases the epiphysis will be found loose, or rather the diaphysis is detached from it in consequence of the inflammation which has destroyed the osseous tissue at this line. In more advanced cases, the entire diaphysis is necrosed, and we may then at once remove it, leaving the periosteum and the epiphysis. A proceeding of this kind is even justifiable in cases where the femur is the bone affected; and, unless in extreme cases, this treatment should be adopted either to the epiphysis or diaphysis before we resort to amputation. In apparently most hopeless cases, the entire removal of the dead bone may be followed by an immediate improvement in the condition of the patient. The treatment to be pursued in the more chronic cases, in fact the sequence of this form of osteomyelitis, hardly falls within the scope of the subject we are now discussing.

Osteomyelitis may occur independently of inflammation commencing at the line of junction of the diaphysis and epiphysis, in growing, or in fully formed bones, from the effects of exposure to intense cold; but much more commonly from an injury, and the access of impure air to the bone, such as in compound fractures, or after an amputation. Osteomyelitis, in these circumstances, is usually first suspected from the patient having been seized with rigors; there may be no increase of pain or external inflammation in the part. The rigor is due to the absorption of septic matter into the circulation from the suppurating medulla. On examining such a bone, we find the medulla at the site of injury in a sloughing condition, and denuded of its external and internal lining. The inflammation spreads rapidly beyond the vicinity of the wound, travelling along the medulla, so that it becomes necessary at an early stage of the disease, to amputate the limb at the joint above the site of the disease. Anything short of this will hardly save the patient's life, for abscesses containing putrid matter form along the course of the medulla from one end of the bone to the other; and, so long as these remain, a source of dangerous septic poisoning exists. When once secondary pyæmic abscesses have occurred in the lungs, or any other part of the body, it is seldom of any avail to amputate the limb which has been the primary cause of mischief.

TUBERCULAR OSTITIS: PATHOLOGY.—The question at once arises, What is tubercle? I can only say that, if we are to restrict this term to pathological changes in which the tubercle-bacillus is found, then, so far as my observations go, a great number of cases of so-called scrofulous diseases of bone are not tuberculous. Nevertheless, other observers have found this bacillus, even in the early stage of this form of disease in the osseous tissue. I am convinced of one thing, and that is, in the earliest stages of scrofulous affection of bone, we not unfrequently find semitransparent grey nodules in the medulla, and these grey nodules, either singly or after they have become confluent, undergo caseous metamorphosis and subsequent necrosis. These caseous patches usually pass through still further retrogressive changes; a rarefying osteitis is set up in the surrounding bone, and a passage is thus formed by which the contents of the cavity escape externally, and very often into a joint. A patch of caseous material of the kind is surrounded by an area of extremely vascular tissue, and this subsequently produces cells, which, passing into the cavity formed by the disintegrated material, establish a constant discharge of pus from the diseased bone. Beyond the vascular area, the medulla may be unaffected, so that, if the diseased area were to disappear, its place could readily be occupied by healthy medulla from which new bone might be formed. The formation of tubercle in bone is not, however, always attended with caseous metamorphosis and necrosis; the morbid growth may disappear; in other cases, it excites long continued hyperæmia in the surrounding vessels, forming, on section through such a bone, a brilliant scarlet patch in the bone. After a time, condensing osteitis is

established in this patch, and a dense sclerosed nodule of bone is produced, so dense, that its blood-supply ceases; it dies, and forms a small sequestrum, it may be in the centre of the head of the femur or some other bone. This sequestrum, acting as a foreign body, sets up destructive inflammation in the surrounding bone.

Caries of bone is often due to tuberculosis, but not always. For a bone such as the lower end of the femur, in consequence of chronic disease of the knee-joint, may not only be surrounded by unhealthy tissues, but is also kept at rest for months together. In these circumstances, the medulla contained in the cancellous tissue of the bone undergoes fatty degeneration, and, as in other parts of the body, this degenerated tissue disintegrates, and so cavities are formed in the head of the femur, containing a quantity of oily matter and bone-earth. It is this bone-earth or grit that sets up, not only a rarefying osteitis, but also the formation of the florid granulations characteristic of caries. The same changes occur as a consequence of tuberculosis of the medulla.

On making a microscopic examination of a bone affected with tuberculosis in its early stages, we find nodules composed of an aggregation of round cells (among which are usually one or more giant-cells), which compress and so occlude the vessels in the affected area; but the blood-channels surrounding the nodule and the spaces through which the round cells escape are choked with corpuscles. With the exception of increased cell-growth from the brood-cells, the surrounding tissues appear healthy. I have already referred to the changes which occur in the tubercles, the caseous degeneration of which, in the greater number of cases, ends in destruction, not only of the osseous tissue, but also of the joints, and the soft parts in their proximity.

Symptoms.—There can be no question as to the fact that tuberculosis of bone is in its early stages easy to cure, but most difficult to recognise; in the course of time, however, there is no difficulty as to our diagnosis; but the cure of the disease is almost impossible without extensive damage to the affected tissues. It requires no stretch of imagination to understand that the production of cell-growth in a structure like the medulla, only sparingly supplied with nerves, may progress to a considerable extent without causing pain. There is one symptom, however, referable to nerve-irritation, almost always present in cases of this kind; and that is a certain amount of stiffness in the muscles surrounding the diseased bone. This is especially the case in tuberculosis of the bodies of the vertebrae and of the hip-joint. The stiff back or neck, and the occasional days of stumbling in the early stages of morbus coxarius are well known, but too often disregarded symptoms of diseased bone. From the commencement of tubercular disease of the medulla, however, immediate and forcible pressure on the bone generally causes marked pain; otherwise, the pain is often felt at the distribution of one of the nerves connected with the diseased bone or joint. Subsequently, the pain becomes more marked, and is greatly increased if the diseased part be moved or jarred; suppuration occurs, and sinuses form leading to dead bone, with all the long continued and well known consequences.

Treatment.—We must bear in mind the fact that, supposing the exciting cause of tubercle be a bacillus, it is certain that an hereditary predisposition, and other recognised circumstances, prepare the soil in which any such influence can take root and grow. Pure air, sunlight, and plenty of wholesome food, are essential to the building up, or fortifying tissues against the action of any causes which provoke the growth of tubercles. If tubercles have formed in a bone, means tending to invigorate the patient's health must be enforced, and at the same time the diseased tissue should be protected from concussion or injury. Rest to the diseased bone is useful, and it should be employed so as to relieve pain caused by the pressure of the extremities of tender parts against one another. But, in my opinion, it is a mistake to suppose that rest, or confinement to a couch or bed for weeks and months, particularly in young children, is a judicious method of treating cases of this kind, especially in the early stages of the disease. I am convinced that the actual cautery, applied judiciously, near the seat of the disease, and repeated if necessary, is of great service in many of these cases. In more advanced instances, good hygienic conditions, great patience on the part of the patient, his friends, and the medical attendant, and the removal of diseased bone, together with free drainage, will bring about results more favourable than could otherwise be attained. Subperiosteal excision of the diseased extremities of the bones is sometimes attended with most favourable results.

SYPHILITIC OSTITIS may be conveniently divided into two classes, first, those occurring among adults; and, secondly, in infants.

A. *Syphilitic osteoperiostitis* pathologically differs in no respect from rarefying traumatic osteitis. The inflammatory action, however, may at any time subside, and it is quite possible the open Haversian

canals will then become filled in with medulla, which, together with the increased growth of the subperiosteal layer, forms a dense mass raised above the surface of the bone. Nodes formed in this way are most frequently met with in the diaphyses of the long bones. But the extremities of the bones may also be affected with new bone forming a case round them, which is produced from the periosteum. In such instances, the ends of the bone and the neighbouring joints are often compromised. In its earlier stages, these periosteal formations may, under appropriate treatment, entirely disappear. But, as layer upon layer of new bone is formed from the periosteum in the natural course of the disease, the Haversian canals are apt to become closed from a condensing osteitis, and necrosis of the affected osseous tissue too frequently follows.

B. *Gumma* of bone may be either circumscribed or diffuse; the former is generally cured, so that this pathological condition is seldom a matter for observation. If gumma happen to form on corresponding points of the external and internal surface of the skull, the intermediate portion of the bone undergoes a rarefying osteitis, and is thus destroyed. The same thing happens if gumma form in the medullary canal, and on a corresponding portion of the surface of the bone. The histological elements contained in a gumma cannot be distinguished from those of tuberculous formations; but gummata contain blood-vessels, and, although liable to undergo degeneration and caseous changes, they are less destructive than tuberculosis. Nevertheless, if gummata form in the medulla, in proximity to a joint, they may give rise to serious mischief in the part. Necrosis of large portions of the bone is common in instances of syphilitic osteitis, and, if neglected, when the cranium, or bones of the face, are affected, the condition of the patient becomes most distressing.

Syphilitic Osteitis in Infants differs from that of adults, in that the osseous tissue is not fully elaborated; otherwise, the skull and the extremities of the long bones are the parts principally involved. I have already remarked that in adults, especially if affected by hereditary syphilis, the extremities of the long bones are apt to become encased in a thick periosteal formation; and so in infants, the offspring of syphilitic parents, the periosteum round the ends of the long bones may become thickened. This newly formed bone interferes with the circulation, and so degenerative changes are apt to occur between the diaphysis and epiphysis of the affected bones. There is no inflammation, but simply disintegration and softening of the tissue, at this line, and the epiphysis may be separated from the diaphysis. In the same way, the bossed skulls of syphilitic children are the results of osteitis of the cranial bones. Like all other syphilitic lesions, however, those of the bones in young persons are peculiarly amenable to mercurial treatment. The history of the case, and the concomitant symptoms, at once enable us to form a diagnosis as to the nature of the disease, and its treatment requires no comment.

Space will not permit of my making any lengthened remarks on syphilitic osteitis. I must also pass over the subject of chronic inflammation of bone, and that form caused by phosphorus, or from the various zymotic diseases. I would conclude my observations by saying that, unpromising as the study of affections of bone at first sight appear to be, there are no more interesting and instructive cases to be found, in the domain of surgery, than those included under the various forms of osteitis.

ST. GILES.—Beyond the provision of a coroner's court and mortuary for the district, Mr. Lovett's report for 1882 contains no feature of special interest. The birth-rate was 29.7 per 1,000, or 1.1 above the decennial average; the death-rate 24, or .6 above the decennial average. The mortality among infants was at the rate of one death to every 6.6 births, and among children underfive at the rate of one death to every 3.6 births. The number of uncertified deaths was small (6 only), all of which were infants. To zymotic diseases 156 deaths were referable; 15 below the average for the preceding decade, but 14 in excess of the deaths of the previous year. The increase was occasioned by the heavy fatality from measles, which accounted for 41 deaths. The number of deaths from diphtheria (21) was the largest hitherto recorded in this district; but it should not be forgotten, as pointed out by Mr. Lovett, that this disorder was exceptionally prevalent throughout the metropolis during the year. The remainder of the chief diseases of this class showed a diminished mortality, as compared with the average. The aggregate zymotic death-rate was 3.3 per 1,000. The absence of typhus fever from the district is a gratifying feature.

FEMALE VACCINATORS IN MADRAS.—We learn from the *Indian Medical Gazette*, that in order to place vaccination within the reach of females of all classes, without in any way interfering with the caste prejudices and feelings peculiar to the Hindus, two Hindu women have been entertained as probationary vaccinators at Madras.