ON
MYELOID AND MYELO-CYSTIC
TUMOURS OF BONE;

THEIR STRUCTURE, PATHOLOGY, AND MODE
OF DIAGNOSIS.

BY
HENRY GRAY, F.R.S.,
LECTURER ON ANATOMY AT ST. GEORGE'S HOSPITAL.

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THERE are probably few subjects in surgical pathology that present so great an amount of interest as the different forms of tumours, and more especially those which attack the osseous tissue. The varied form of structure which they present, the difficulty attending their diagnosis, and the great importance of the part they affect, inasmuch as their existence in it, in some cases, involves the removal of part or of the whole of the affected limb, necessarily gives them an amount of interest far greater than attaches to those which arise in other tissues. It is from these circumstances that I have been induced to lay before this Society the results of some observations that I have made upon some forms of tumours of bone, which, as far as I am aware, have been but very slightly noticed by surgical writers. It is well known that

there are some forms of tumours of bone that present, in every respect, so marked a resemblance to hæmatoid and medullary cancer, as far as the naked eye examination goes, that it is almost impossible to distinguish them from it. Sir Benjamin Brodie, in his last edition on the diseases of the joints, was the first, I believe, who called attention to this form of disease. In a statement he makes of an examination of a limb amputated for disease in the femur, he observes :¹ "On examining the limb afterwards, the femur was found to terminate abruptly, about five inches above the knee-joint. In place of the condyles, and lower part of the shaft of the bone, there was a large tumour, of irregular form, the structure of which bore a nearer resemblance to fungus hæmatodes than to any other morbid growth." And further on he says : "It may be observed, that the structure of the tumour is described not as being that of fungus hæmatodes, but as bearing a nearer resemblance to it, than to that of any other morbid growth. It would appear, therefore, that I must, in the first instance, have entertained some doubt as to the exact nature of the disease. To whatever extent these doubts existed, subsequent observations have satisfied me that they were not without foundation, and have, indeed, led me to the conclusion, that the disease was not fungus hæmatodes, but a peculiar change in the structure of the femur, of local origin, and not, in the proper acceptation of the term, malignant."

Now, although Sir Benjamin Brodie doubts the similarity of these tumours to hæmatoid cancer, no further observations were made by him of their structure. The account, however, that I shall give of these cases will, I think, clearly prove that they are not of a malignant nature, but that they represent in their structure a kind of overgrowth of some of the normal constituents of bone, originating, probably, from some local cause; thus bearing out the opinion first enunciated by Sir Benjamin Brodie, "that the

¹ 'Pathological and Surgical Observations on the Diseases of the Joints,' by Sir B. C. Brodie, Bart., fifth edition, p. 275.

disease was not fungus hæmatodes, but a peculiar change in the structure of the femur, of local origin, and not, in the proper acceptation of the term, malignant."

Some cases of tumours of bone, to all appearance of a malignant character, have occurred, in which the entire bone has been removed by operation. In these cases, the disease not having recurred in other parts of the body, the line of practice has been adopted of removal of the bone in the joint above the diseased part, in nearly all cases, as a preventive measure against the return of the disease, and the non-occurrence of the disease for some years after seemed to warrant the practice adopted.

In one of these cases that I have examined, of disease of the upper end of the humerus, in which the bone was removed at the shoulder-joint, under the supposition that the disease was of a malignant nature, I have found its structure precisely similar to those above mentioned, consequently the conclusions drawn from this case, as to the probable success of a like operation, in cases of malignant disease, is negatived.

Again, some forms of tumours of bone, to all appearance of a malignant nature, have existed, in which the patient has died previous to any operation, and in which, on a post-mortem examination being made, no similar disease has been detected in any other part of the body. Such cases have been thought favorable instances of a malignant disease confined to the bone alone, and consequently favorable cases for operation. In a tumour of such a kind that I have examined, supposed to be of malignant character, the structure was precisely similar to those mentioned by Sir Benjamin Brodie, and the disease was not of a malignant nature. The conclusions consequently drawn from this case, as to the probable success of an operation in a case of malignant disease of bone, is also negatived.

I have made these observations, in order to show the extreme interest that must attach to a class of tumours bearing so close a resemblance to malignant disease, that the eye alone fails to detect any difference between them—

the importance of being able to diagnose their structure and properties,—the doubt that must now necessarily arise in our minds as to the accuracy of some reported cases of malignant disease of bone,—and the conclusions drawn from them, as to the question of amputation, and the ultimate result of the disease.

It is probable that these tumours were first received under the head of sarcomatous or osteo-sarcomatous tumours.

At a later period, M. Lébert described a class of tumours, including these and other forms, under the name of “fibro-plastic,” and showed the similarity which they bear to malignant disease.¹ More recently, Mr. Paget described the fibro-plastic tumours of Lébert under the name of myeloid, from the circumstance of their characteristic constituent consisting of large nucleated corpuscles, exactly similar to the same forms that have been described by Kölliker and Robin, as a normal constituent of the marrow of bones, especially in the foetus, and at an early period of life. He showed, also, the close affinity they bear to cartilaginous and osseous tumours, from their structure being occasionally mixed with cartilage and normally developed, well-formed, cancellous bone.

In the account which I shall now give of these tumours, I hope to be able to show :

1st. That the essential element consists, in all cases, of forms precisely similar to what is found in the marrow and other elements of bone in the foetus, and at an early period of life; hence the name “myeloid” tumours. In some instances, however, their structure is so intermixed with cysts, that I would propose the term “myelocystic” tumours to be given to them in such cases.

2dly. That these tumours are, for the most part, limited in their development and growth to the osseous tissue, or its investing membranes, the periosteum and dura mater.

3dly. That they may probably occur in any bone.

¹ ‘Physiologie Pathologique,’ par H. Lébert, tome ii, p. 120, 1845.

4thly. That they occur in all the cases at present recorded at an early period of life,¹ and that their growth is generally much less rapid than that of malignant disease.

5thly. That these tumours are not malignant, and when entirely removed never return.

6thly. That they present a near relation with fibrous and fibro-cystic tumours, and cartilaginous and osseous.

Before detailing any account of the cases of this disease that I have examined, I am anxious to state that none of them were recent specimens, but had been preserved for some years in alcohol; I have no reason, however, to believe that their structure has been otherwise altered than by the loss of colour which they had possessed in their recent state.²

CASE 1 (Plate 1).—The following notes of the history of this case are taken from the case-book of Sir Benjamin Brodie, who has permitted me to make use of them :

“Miss H— consulted me, in the spring of 1825, on account of an enlargement of the head of the tibia, attended with little pain, and producing slight impediment to the motions of the knee. The tumour gradually increased, still producing but little pain, the knee retaining its mobility up to the day of amputation, which was in September, 1827. Several glands in the neck of this patient were enlarged, and she suffered from cough. She died ten days after the operation; and on examining the body, there were no marks of internal disease, except a small cyst of the ovarium, containing about an ounce of dark coloured fluid. On examination of the limb, the knee-joint was perfectly free from disease, the synovial membrane and cartilages assuming their natural appearance.”

¹ I have recently had an opportunity of examining a specimen of this disease from a female of middle age.

² Since the above was written I have had the opportunity of examining several recent specimens of the disease; the general appearances, as well as the minute structure, were in every respect similar to those which had been immersed in alcohol.

In an accurate examination that I have lately made of the diseased part, I found that the upper portion of the shaft of the tibia terminated abruptly about four inches below the knee-joint, and in place of the head and upper part of the shaft of the bone, was a large tumour of a somewhat rounded form, contained in a cyst formed of periosteum and a layer of condensed cellular membrane; the bone in which the tumour was developed being absorbed in every part. The cartilage which covered the head of the tibia was in every part very much thinned, but in no part had it been entirely destroyed. The tumour consisted of a large mass of solid structure, of a greyish-white colour, with a flocculent surface, the chief part of which lay free in the cavity in which it was contained. It was of a firmer consistence in some parts than in others, very vascular, and presented patches of a buff-yellow colour disseminated through it, which indicated the existence of advanced fatty degeneration. The shaft of the bone was somewhat abruptly broken where it joined the substance of the tumour; and the medullary canal, for about half an inch in its extent, was filled with a deposit similar to that of which the tumour was composed, but the bony tissue was not infiltrated with it.

The structure of the tumour differed somewhat in different parts. At its upper part, immediately beneath the cartilage of the tibia, where its structure was firmer and more dense, it was composed entirely of a mass of variously shaped fibres. Some of them were of an acicular form, and contained nonuclei; others were of a spindle shape, containing chiefly rod-like or oval nuclei, with granular contents, or occasionally a few refractive oil globules. All the softer and more flocculent portions of the tumour consisted of large cells and fibres. The fibres were similar to those above mentioned as composing the firmer portions of the tumour. The cells varied much in their size; some were about the size of the normal medulla cells, others five or even ten times that size; their form was rarely circular, more frequently oval or oblong; the cell wall in some cases was very distinct, in others less so; occasionally they presented branched or caudate fibres proceeding from

one point of their circumference, or they were encased in foldings of these spindle-shaped fibres, arranged concentrically around their outer surface. Their contents also varied; some containing a few circular or oval-shaped nuclei, with central nucleoli, the rest of the cell being full of fine granules; in others the contents of the cell presented so dark an appearance, that the individual elements occupying the interior could not be detected. Others, but these were few in number, contained many oil globules, or presented a delicate transparency, as if the contents of the cell had become liquified or discharged.

Such were the various elements composing this tumour, and it will be seen that they differ in every respect from those which are peculiar to the varied forms of cancer.

The entire absence of cystic cavities, and the fact of its being composed throughout of solid matter, form interesting points in this case. In the remaining cases to which I shall allude, cysts were combined with the solid matter in varying proportions, in the second case being few in number, whilst in the third and fourth, they formed the chief part of the whole mass.

CASE 2 (Plate 1).—The following notes of the history of this case are transcribed, by the permission of Sir Benjamin Brodie, from the last edition of his work on the ‘Diseases of the Joints,’ p. 272.

“In June, 1826, I was consulted respecting a young lady, about 18 years of age, who laboured under a considerable enlargement of one shoulder. The head of the humerus was expanded into a broad and somewhat elastic tumour. There was some, but not considerable, pain in the joint. The mobility of the spine was necessarily impaired from the increased size of the humerus, but did not seem to be affected otherwise. In a consultation between Sir A. Cooper and myself, it was agreed that the limb should be removed at the

shoulder joint, which operation I afterwards performed in the presence of Sir A. Cooper and Mr. Aston Key.

"The disease was wholly confined to the head of the humerus, which was converted into a medullary or fungous tumour of considerable size, with very little remains of earthy material in it.

"The scapula, the cartilage lining the glenoid cavity, the capsular ligament, and synovial membrane of the joint, were in a healthy state. The cartilage covering the head of the humerus remained entire, adhering to the surface of the morbid growth. The wound healed readily, and I know that there had been no return of the disease two years afterwards."

In a minute examination that I have recently made of the diseased part, I found that it consisted of the development of a large tumour in the head and upper part of the shaft of the bone. The tumour was of an oblong rounded form, about the size of a small cocoa nut, and of a moderately uniform surface externally, it presented a grayish white colour, and consisted of two distinct portions, solid matter and cysts. The whole circumference of the upper end of the bone was involved in the disease, from the articular surface of the head, which still remained, to the commencement of the upper third of the shaft, which was abruptly broken immediately below the tumour. The tumour was invested with a thick fibrous capsule, which was continuous with the periosteum. The shaft of the bone, where abruptly broken immediately below the tumour, had, bulging into its medullary canal, for about half an inch of its extent, a quantity of growth similar to that which composed the mass of the tumour, and with which it was directly continuous: immediately below the point where the fracture had occurred a quantity of new bone had been deposited on the external surface of the shaft, but separated from the old bone by a protrusion of the same material in the interspace between them.

The solid matter of the tumour was of a yellowish white colour, firm, solid, and somewhat brittle in texture. Its structure was precisely similar to that of the preceding case.

There is one fact, however, of very considerable importance to be learned from the naked-eye examination of these two tumours, viz., the circumstance of the remaining part of the shaft of the bone in both cases not being infiltrated with the disease.

It is well known that in the great majority of cases of malignant disease of bone, and more especially of that form which arises in the cancellous tissue, that the shaft of the bone, for a considerable extent above the part where the disease is most developed, is extensively infiltrated with a similar deposit. In these cases, however, the disease does not infiltrate the substance of the bone, and it is evident that the growth which filled the upper part of the medullary canal, for about half an inch in both cases, is to be explained by the protrusion of the morbid structure into it, which resulted from the diminished amount of resistance offered to its progress at that part.

In the third case, the history of which I shall now relate, the disease also commenced in the articular extremity of one of the long bones. In this instance, however, the tumour had in its growth approached so near to the surface of the joint, as to cause inflammation to take place in it, and numerous soft bands of adhesion might be seen to exist between the cartilaginous surfaces, which prevented the extension of the growth into its cavity.

CASE 3 (Plate II).—For the notes of this case I am also indebted to the kindness of Sir Benjamin Brodie, who has permitted me to transcribe them from his work on the 'Diseases of the Joints,' p. 274.

"Mr. O—, æt. 25, in January, 1828, first experienced a sensation of weakness in the right knee, with a slight pain, after walking even a short distance. These symptoms continued; and, in the course of two or three months, he observed a small tumour over the external condyle. He remained in this state, the tumour not increasing in size, through the spring and the greater part of the summer.

In the middle of the following August he one day went through a great deal of fatigue in grouse-shooting, after which the tumour began to increase in size. On the 1st of September, in walking over a field, his foot slipped into a hollow in the ground. This caused great pain in the knee, and he was under the necessity of riding home. After this accident the tumour progressively increased. On the 25th of January, 1829, he came to London, and placed himself under the care of Mr. Griffiths, of Pimlico, and myself. At this time there was a very considerable enlargement of the whole of the upper part of the knee-joint, so that it was four inches more in circumference than the corresponding part of the opposite limb. The tumour was soft and elastic, occupying the situations of both condyles of the femur, but being more especially prominent in that of the outer condyle. The head of the tibia and the patella did not seem to be implicated in the disease, and the joint retained its natural degree of mobility.

“For some time after I was consulted the tumour remained nearly stationary: then it began to increase; and, as no remedy seemed to have any dominion over the disease, a consultation was held with Sir Astley Cooper, in which it was determined that the limb should be amputated. The operation was accordingly performed on the 6th of July, 1829.

“I heard of this patient being alive and well five years after the operation, having had no recurrence of the disease.

“On examining the limb the femur was found to terminate abruptly about five inches above the knee-joint. In place of the condyles and lower part of the shaft of that bone, there was a large tumour of an irregular form, the structure of which bore a nearer resemblance to fungus hæmatodes than to any other morbid growth. The cartilage which had covered the surface of the condyles of the femur was seen expanded over the lower part of the tumour, being everywhere thinner than natural, but nowhere in a state of ulceration. In some parts it had contracted adhesions to the cartilages covering the head of the tibia and side of the

patella. In other parts the tumour was covered by some thin remains of the periosteum and a layer of thickened cellular membrane, which forms a kind of cyst in which the growth is contained."

In a careful examination that I have recently made of the diseased part, I found the medullary canal, where abruptly broken off at its connection with the tumour, filled up by a nearly solid mass of newly formed cancellous bone, so that the growth did not project into the canal, nor was there any infiltration of the cancellous texture at that part.

The tumour consisted of solid matter and cysts, the minute structure of which was precisely similar to that last described.

The description of this case accords in nearly every respect with the two already recorded. In all, the structure of the morbid growth presented the same characteristic elements. In all, the bone terminated abruptly at the point where it was connected to the tumour. In all, the structure of the shaft was not infiltrated with the disease, and in the clinical history of this case it has been shown that, although amputation of the limb was performed through the bone only a short distance above the diseased point, no return of the disease was known to have occurred for several years afterwards.

In the next case which I shall relate, it will be seen that the morbid growth, which also commenced in the articular end of one of the long bones, had made its way into the neighbouring joint, which it distended throughout, absorbing by its pressure the articular surfaces of all the bones forming its cavity, and protruding into the substance of the bones in many parts.

CASE 4 (Plate II).—For the particulars of this case I am also indebted to the kindness of Sir Benjamin Brodie.

“— B—, æt. about 36,¹ was carrying a heavy burden, when his right foot became entangled in a hole in the ground, and he fell. He immediately experienced a severe pain in the knee, and it was after this accident that the enlargement of the joint was first observed. The tumour continued to increase, with a severe shooting pain, until it was twenty-six inches in circumference. Six years from the time of the first appearance of the disease I amputated the thigh, in St. George's Hospital. I have since heard of the patient, who was alive and well, having had no recurrence of the disease several years (ten) afterwards.”

In a recent examination that I have made, I found that the tumour, which was nine inches in length, and twenty-six inches in circumference, commenced at the lower part of the shaft of the femur, just where it joined the condyles; externally, the surface was deeply uneven, and covered by a strong fibrous investment, the remains of the periosteum, and, in parts, by a thin shell of bone, the remains of the condyles of the femur, which were spread over the surface of the tumour. The articular surface of the condyles had been entirely absorbed, and the morbid growth had made its way into the cavity of the knee-joint, which it distended throughout, pushing the patella and its ligament forward, absorbing the cartilaginous surface of that bone, and making its way into the cancellous tissue. The cartilage covering the head of the tibia had the growth adhering to it in some parts, whilst in others the cartilage had been absorbed, and the morbid structure had made its way into the cancellous tissue of this bone, but only to a very slight extent. At the back part of the tumour a deep groove in its substance received the popliteal vessels and nerves. Just at the point where the shaft of the bone joined the morbid growth, a thick outgrowth of bone had been developed, which was intimately adherent to the shaft, and projected over the upper part of the tumour. Nearly the whole anterior half of the tumour presented an opaque-white colour, was very firm in texture, and of a tough, leathery consistence, composed entirely of

¹ The exact age of this patient I have not been able to ascertain.

wavy fibres, like ordinary white fibrous tissue, with imbedded nuclei of an elongated oval form. These fibres were arranged into bands and masses, of different forms and sizes, which enclosed cystic cavities, varying in their size from a millet seed to a walnut. In every respect this portion of the morbid growth corresponded, in its general appearance and structure, with the ordinary forms of fibro-cystic tumours. The whole of the posterior half of the tumour was of a buff colour, it was softer in texture, and tore up more readily, than the other portions of the growth. In general appearance, and in its minute structure, this portion of the tumour was analogous to the tumours in the cases previously recorded.

The cysts had a wall formed of a fibro-granular lamina, without an epithelial lining, and contained either serum,—or the remains of effused blood,—or fibrin, as clearly ascertainable by the peculiar fibrillation of the contained fibrin, and the existence of large, granular lymph corpuscles,—or degenerate fibrin, in the form of granules or granular masses of a circular form and of an oleo-albuminous composition.

This tumour presents many points of considerable interest; the combination of the myeloid and fibro-cystic structures in one tumour; its extremely slow growth; its extension into the cavity of the joint; the non-infiltration of the morbid structure in the shaft of the bone above the diseased part, and its non-recurrence ten years after removal, are facts of great importance, inasmuch as most of them present a marked contrast to malignant tumours.

CASE 5.—For an examination that I have recently made of this preparation, I am greatly indebted to the kindness of Mr. Stanley and Mr. Paget, who allowed me the freest access to the rich collection of tumours of bone contained in the Museum of St. Bartholomew's Hospital.

The details of the case are described by Mr. Lawrence, in a paper entitled, "Observations on Tumours, with Cases," in vol. xvii of 'The Medico-Chirurgical Transactions,' and was apparently regarded by him as a disease of a mixed

kind, but of a decidedly malignant character. The tumour was connected with the upper end of the tibia; its growth was of eighteen months' duration previous to amputation: it appeared after a fall, and was occasionally very painful. It occurred in a female, 30 years of age.

In a recent examination that I made of this tumour, I found that the soft substance which presented so close a resemblance to medullary cancer was composed of the same elementary structures that have been described and figured in the preceding cases.

CASE 6.—For the notes of this case I am indebted to the kindness of Mr. G. Borlase Childs.

Harriet H—, æt. 23, was admitted into the Royal Free Hospital, under the care of Mr. Childs, on 4th December, 1855, with an enlargement of the lower part of the right thigh. To the eye, the disease much resembled a chronic swelling of the joint itself, the enlargement being about equal in all parts, and evenly rounded. On looking more carefully, however, it might be noticed that its boundaries, above and below, were too abrupt for joint-disease. The head of the tibia just below the overhanging mass, and the leg itself, were free from any disease. The finger confirmed this impression, the patella being movable, and without any degree of swelling beneath its ligament. The lower fifth of the femur, on the contrary, was felt to be involved in a hard, bone-like enlargement, twenty inches in circumference, which had greatly expanded its condyles, but which decreased above rather gradually. The overlying skin was somewhat thickened, but not in the least inflamed. The joint was moveable, though not so much so as natural, and no pain was complained of in the examination. The inguinal glands were not enlarged, and there were no symptoms of malignant disease of the internal organs. The history she gave was, that in March, 1853, she began to feel occasional weakness in the knee, which would at times "give way," in walking, and cause great pain. Some months after the aching began, a little enlargement on the outer side was noticed, but no

great increase in size took place until March, 1854, when the tumour rapidly increased in size for about two months, and then became almost stationary. Whilst increasing in size a great deal of pain was present, and the least jar to the leg used to cause a wrenching pain. When quiet, there was no material aching; but for all this, at times she was kept awake by it. In June, 1854, she was sent to the Margate Sea Bathing Infirmary; during her residence there she improved in health, but the size of the limb increased, according to her statement, an inch and a half in circumference. In March, 1855, she became, for the second time, an inmate of the London Hospital, the limb retaining the same size and general appearance. The summer of 1855 she again spent at Margate, but without benefit. It will be observed that no increase in the size of the tumour occurred during the eight months prior to the amputation: its circumference, in December, being exactly what it had been in March.

On December 10th amputation of the thigh was performed. A section made vertically through the bones constituting the knee-joint showed the tibia and patella quite healthy, the joint also free from effusion, and, excepting a few tough bands of old adhesion here and there, in a normal condition. There was no absorption of the cartilage, but that covering the condyles of the femur was in some parts very thin.

From a careful examination that I have lately made of this tumour, it would appear that the morbid structure had taken its origin in the lower extremity of the condyles of the femur, and that in its growth it expanded the compact surface of the entire circumference of the bone into a shell, which, with the periosteum, formed a complete cyst, in which the morbid growth was contained. There is one point, however, in which this tumour differed from any of the preceding ones, namely, in the manner in which the shaft of the bone above the diseased part was connected with it. In all the cases previously recorded, the shaft of the bone was abruptly broken off immediately beyond the disease; in this

specimen this abrupt termination of the bone did not exist, but the lower end of the shaft, for about the extent of three inches, was somewhat compressed from before backwards, and formed part of the anterior solid wall of the tumour, leading one to the conclusion that the tumour had in the first place originated in the articular end of the bone, but in its growth had projected upwards and backwards behind the lower end of the shaft, which it compressed forwards so as to occupy the situation already mentioned. The section of the tumour consisted of cysts and solid matter.

The cysts varied in their size from a marble to a small orange; their interior was in all cases perfectly smooth, their wall consisting of a nuclear fibrillated membrane, in some cases of considerable thickness, without any epithelial lining.

The chief mass of the solid matter consisted of a soft substance, pulpy in consistence, of a light brownish-red or salmon colour, interposed between the cysts, and occurring more or less in irregular and variously shaped isolated masses. This substance was precisely similar in structure to that in the other cases already recorded.

Besides the reddish pulpy structure above mentioned, the tumour in part consisted of a mass of soft, cream-white or yellow pultaceous substance, pulpy and granular in consistence, and evidently the *débris* of the degenerating element of the tumour. Certain portions of the tumour presented a number of isolated patches of fibrin of a perfectly white colour, and from their structure evidently of varying dates of growth. In two separate parts of the tumour these masses of fibrin were deposited in the interior of the cysts. They were soft in consistence, and in their texture and general appearance resembled in every respect fibrin recently deposited on serous surfaces as a result of inflammation. There were also large masses of the same substance, but they were evidently of a much older date, being firm and solid in texture, and presenting the ordinary structure of pure white fibrous tissue. These masses were of a rounded or irregular form, varying in size from a hazel nut to a walnut.

Bone occurred, also, in the substance of the tumour; 1st, as an isolated mass of small size, and 2dly, in the form of ossification of the fibrous boundary of one of the cyst walls.

The result of this examination would lead me to regard this tumour as a specimen of myelo-cystic, among which large masses of fibrous tissue in various degrees of development were deposited, the myeloid structure being in some parts normal, in others presenting indications of fatty degeneration.

The above are the only cases in which I have been able myself to examine these tumours. Mr. Paget has, however, kindly placed at my disposal the notes of another case (Case 7) of the same disease, a detailed account of which is given in his work on 'Tumours,' and which forms the only additional one that I have been enabled to collect, in which the morbid growth has arisen in the interior of a bone, and has at the same time presented a similarity with, or has been mistaken for, malignant disease; and in which also I have been able to obtain a clear history of the origin, the progress, and the termination of the disease.

I think I have shown, in the preceding cases, that the morbid growth may consist entirely of solid matter, or that the solid matter may be mixed with cysts, or with a fibro-cystic growth.

I shall now relate the histories of two cases in which these tumours were combined, in one case with cartilage, and in another with cartilage and bone: and I detail them, not merely to show the varieties their structure may present, but also to exhibit the affinities which they bear in this diversity of structure to all the primordial elements of bone.

CASE 8.—For the account of this case I am also indebted to Mr. Paget, who has most liberally placed the notes of it at my disposal, and from them the following account is abridged:

The tumour, which involved the lower end of the fibula and external malleolus, was sent to Mr. Stanley by Mr. Langston Parker, and was removed from a young man, 19 years old, whose leg was amputated for the disease. The swelling had been observed twelve months, and had increased slowly without giving much pain. No cause could be assigned for it. During its existence the tumour pulsated synchronously with the arteries, but only in that half of it which was next the tibia. It measured about three inches by one and a half. The walls of the cyst were partly osseous, partly fibrous. The substance of the tumour was firm, for the most part cream white, like firm medullary cancer, but blotched and shaded with blood colour, and having imbedded in it small isolated nodules of cartilage of irregular form.

The structure of the non-cartilaginous portion was precisely similar to what has been observed in the previous cases.

The patient from whom this tumour was removed recovered from the operation, and was known to be well in September, 1854, four years from the period of its removal.

CASE 9.—In the 'Medical Times' for the year 1852, page 214, an interesting case is recorded (with accompanying illustrations) by the late Mr. Bransby Cooper, of a diseased growth, the principal characteristic features of which were the coexistence of the myeloid cells with cartilage and bone.

There can be hardly any doubt, from the description of this tumour, that it was a myelo-cystic growth, containing masses of cartilage, and bone in progress of development.

It will be observed that the structure of the morbid growth which I have described was precisely similar in the first three cases. In the first case, it consisted entirely of solid matter; in the second and third, of solid matter intermixed with cysts. In the fourth and sixth cases the growth was

mixed up with pure fibrous and fibro-cystic structure; in the fifth, with bone; in the eighth, with cartilage, and in the ninth, with cartilage and bone.

I propose now, in the first place, to consider—Of what nature are these tumours? Are they malignant, or are they analogous in their structure to some of the normal textures of the body?

The tumours were composed of solid matter, in some cases mixed with cysts. The solid matter consisted of fibres and cells.

The fibrous element differed somewhat in its structure in different parts of the same tumour, and in different specimens, according to its date of development, growth, and decay. In the 2d case, where the morbid structure had been most recently formed, the fibres were variously shaped; some were of an acicular form and contained no nuclei, others were of a spindle shape, containing chiefly rod-shaped or oval nuclei with granular contents. In this stage of their development it would appear that in some cases the fibres degenerate in their structure, and present an advanced condition of fatty degeneration, as in the 1st case, where large masses of buff or light yellow coloured deposit showed the fibrous elements of this portion disseminated with numerous oil globules, or presenting a finely dotted granular degeneration and breaking up of the individual fibres. On the other hand the fibrous element in some cases advances in its development and becomes converted into simple fibrous tissue, presenting similar appearances to those observed in this tissue in normal textures. Such an advanced condition in the development of this element of the tumour was observed in a portion of the tumour in the 3d case, and also in nearly the whole of the anterior half in the 4th.

The chief and most important constituent in these tumours consists of cells of large size and very peculiar form. They vary in size from the $\frac{1}{350}$ th to the $\frac{1}{1000}$ th part of an inch in diameter, those of large size being by far the most frequent.

They vary also in form. Occasionally they are circular ; more frequently oval, or oblong, or flask-shaped ; more rarely the outline is lobed like a terminal vesicle of a gland ; and in some cases they present well-marked caudate prolongations of large size. Their cell wall in some cases is clear and well defined, in others the contents are arranged in a cell-like mass without any investing membrane. Their contents also vary. Most frequently they consist of numerous circular nuclei, which vary in number from four or five to ten, twenty, or even more. They are occasionally transparent, spherical in form, with central nucleoli, and these are blended with a finely granular substance. Frequently the contents of the cells are dark, from the coagulation of the contained material. The proportion of the cells to the fibrous element of the growth also varies ; more frequently the cellular forms predominate, in some parts they may preserve a nearly equal proportion, or the fibrous element may be more marked. Occasionally, in those parts of the growth where it is evident that degeneration of the structure is proceeding, these cells may be observed to contain numerous oil globules, or the cells dwindle in size, their walls collapse, and their contents disappear. These, together with a few free nuclei, similar to those contained in the larger cells, and from which all the stages of the development of the fibrous element may be traced, make up the constituent solid parts of this morbid growth.

The cystic portion of these tumours appears to form a large part of them. In one of the present cases, however, cysts were wanting, the whole tumour being composed of solid matter. These cysts vary considerably in their size, often being as small as a millet seed, or as large as a small apple ; they vary in number from three or four, to forty or fifty. Their walls consist of a delicate fibro-granular lamina, not epitheliated, in the texture of which a plexus of blood-vessels is distributed. Their contents vary ; occasionally they are filled with a serous fluid, or blood-tinged serum, or coagulated fibrin, the composition of which is ascertained by

the peculiar fibrillation of the fibres and their co-admixture with granular lymph corpuscles.

Such are the essential elements of which the morbid growth constituting the greater part of these tumours is composed.

The next and most important point for consideration is as to whether these elementary forms are such as are met with in cases of malignant disease, and whether the history of the morbid structure,—its mode of growth, its rate of progress, and ultimate result,—is such as to justify us in classing it amongst this formidable class of diseases.

It would appear that the naked-eye examination, (however well versed the observer may be) is quite incapable, even with the greatest care, of detecting the true composition of these morbid structures. This is admitted by all. Sir Benjamin Brodie remarks, "Its structure bore a nearer resemblance to fungus hæmatodes than to any other morbid growth." Mr. Paget also, in a case lately recorded by him, observes, "None who examined this disease with the naked eye alone felt any doubt that it was an example of medullary cancer, with cysts abundantly formed in it." It is only by minute investigation, such as is afforded by the microscope, that its structure, as I have described, can be detected. It is hardly necessary here to observe that these forms do not bear the least resemblance to the varied cellular and fibre forms that are found in malignant disease. But I consider this test to be one of the slightest weight in determining the malignancy of these tumours, when compared with the more important ones which have already been mentioned in the history of these growths; and perhaps there is no test of more practical or diagnostic interest than is obtained by the comparison of the duration of the disease in these cases, with that in undoubted malignant disease. Of the nine cases recorded in this paper, in eight of which the duration of the disease previous to operative interference has been noted, one had existed a year, two a year and a half, one two years and a half, two three years, one six years, one

twelve years. The average duration of the disease, then, in these eight cases, previous to any operation, was nearly four years; a period considerably greater than even the duration of life, with or without operative interference, in malignant disease.

Again, also, in this disease the duration of life after operation is seen to be far greater than after any form of malignant disease in which the diseased part has been removed. Of the nine cases here recorded, in six of which the duration of life after the operation was known, three were known to be alive two years afterwards, one four years afterwards, one five years, and one ten years. Of the three remaining cases, one died from the effects of the operation; and in the other two, the cases were recorded soon after the operation, and the result, as to the duration of life, or recurrence of the disease, is unknown. In all the cases, also, that have been recorded, there has been complete absence of all infiltration of the morbid growth in the shaft of the bone beyond the diseased part, a circumstance of most common and almost constant occurrence in malignant disease. In all these cases the lymphatic glands have been unaffected, there has been complete absence of the malignant cachexia, and the removal of the limb, although in many of these cases through the bone in which the disease had originated, has been followed by no return of the disease after many years.

These are facts of the very highest practical importance, and when coupled with the minute examination of the morbid growth,—presenting, as it does, a marked contrast to the varied forms found in cancer,—I think we are justified in considering that no one of these tumours, either in its minute structure, or in its history, presents the least resemblance to malignant disease.

If this disease, then, be not malignant, which normal texture of the body does it most resemble?

Kölliker and Robin have lately shown that the medullary cavities of bone in the fœtus, however they arise, are filled

with a soft, reddish substance, the foetal medulla. This substance at first consists of nothing but a small quantity of fluid, and many rounded cells, with one or two nuclei, and faintly granular contents. In process of time, these cells are developed in the usual way, into connective tissue, blood-vessels, fat-cells, and nerves. In the adult it has been shown that these cells only normally exist in certain bones, namely, the articular extremities of the cylindrical bones, the vertebræ, the true cranial bones, in the sternum, and in the ribs, and apparently in variable number in the bones of the face. Kölliker, also, in speaking of the elementary processes in the development of the layers of bone formed from the periosteum, observes, that the bone-cavities of the periosteal layers, besides medulla-cells and vessels, contain round, elongated, or dentate, flattened, faintly granulated cellular corpuscles, with from three to twelve or more vesicular nuclei and nucleoli, which are probably referable to the multiplication of the medulla-cells. These last-mentioned cellular forms are in every respect identical with those forming one of the constituent parts of the morbid growth in the tumours under consideration.

In the cancellous tissue of the shaft of a femur, of a foetus of seven months, I found, besides the small medulla-cells, a few large circular-shaped cells containing from eight to ten circular nuclei with nucleoli. I examined the same part in a child of six months, as well as the epiphysal end of the femur. In the shaft I saw a few large and variously shaped cells, in every respect identical with those found in the structure of the morbid growths. One of these was of an oblong or club-shaped form, of very large size, and contained from eight to ten circular nuclei with nucleoli; others, also of large size, presented several caudate prolongations proceeding from various parts of their circumference; but neither of these forms abounded. Similar cells were found in very considerable numbers in the lower epiphysal end of the femur of a young man, 19 years of age, whose limb had been amputated for inflammation and abscess

of the bone which led into the knee-joint. The cancelli of the epiphyses were filled with them ; they were of unusually large size, of very irregular form, and crowded with nuclei. A fourth time I found them in the cancellous tissue of the epiphysis of the femur of a young woman, 18 years of age, whose limb had been amputated for disease of the tibia. In other cases, at the same period of life, where the cancelli were full of fat, I have failed to detect them. At a late period of life I have never seen them.

These large many-nucleated cells were perfectly transparent, so that their contents were clearly discernible, and in this respect they presented a marked contrast to those which form a constituent part of these tumours. On the addition of alcohol to them, they immediately lost their transparency, became opaque, their contents darkly granular, and to such an extent as to obscure the nuclei, which, previous to the addition of this reagent, were so well marked. This experiment was repeated several times and with the same result, which convinced me that the dark granular appearance of the many-nucleated cells composing the tumours was derived from their immersion in alcohol, which coagulated the albuminous contents of the cells.

These facts would seem to show that these cells are essential constituents of the medulla of the bone, during the most active periods of growth, and that when this is completed they degenerate into the fat with which the cancelli are filled.

It would appear, then, from the result of these investigations that these tumours, so far at least as one of the elementary forms composing them is concerned, consist of an abnormal amount of some of the normal constituents of the medulla,—the medulla-cells ; hence the name “myeloid” tumours which has been given to them ; and from their being occasionally mixed with cysts, I would propose the name of “myelo-cystic” tumours ; the fibrous element which they present is most probably derived from the organization of lymph effused as a result of chronic inflammatory action, or from some

abnormality in the development and growth of the fibrous element of bone.

Now, if it be admitted that these tumours are analogous in their structure to some of the normal constituents of the medulla, it will be necessary to show—

1st. That they are confined to the osseous tissue or its investing membranes.

2dly. That they occur at the period of life in which the above-described forms exist in normal bone.

From M. Lébert's article on Fibro Plastic Tumours (in his '*Pathologie Anatomique*'), under which title tumours in every respect identical to the "myeloid" are included, it would appear at first sight that they occurred in various situations. If, however, such cases only are included as are figured and described by forms similar to those detailed by me in this paper, it will be found to embrace only those growths which are connected with the osseous tissue or one of its investing membranes, the periosteum, and dura mater.

Mr. Paget, following M. Lébert, has also stated that these tumours may be found in many situations; but all the cases he describes are connected with the osseous tissue, excepting two, in both of which he doubts the true "myeloid character" and suspects a malignant nature, which their history and termination would appear to prove.

In the nine cases which have been recorded in this paper, the disease has occurred between the ages of 18 and 36. In the five cases also recorded by Mr. Paget the variation in age has been between 15 and 24 years.

It would appear, then, that these tumours occur at an early period of life and within the period in which the cellular forms above mentioned form a constituent part of the normal medulla.

It is a remarkable circumstance, also, that in every one of these nine cases the tumours have taken their origin in the epiphysal ends of the long bones.

It has thus been shown that these tumours, in their minute structure, bear a very close analogy with the normal constituents of the marrow of the bones ; a fact, too, which is corroborated by the circumstance that they are confined to the osseous texture, that they occur at the period of life when such constituents of the medulla exist to the greatest amount, and that they are developed in those parts of the osseous system in which such structures exist in a most distinct and well-marked form. The fact that these growths are occasionally mixed with some of the other elements of bone in its rudimentary state, as fibrous tissue and cartilage, and even of those of bone itself, serves to make this analogy more complete.

I shall now make some few observations on the pathology and mode of diagnosis of these tumours.

The number of cases at present collected is probably too small to determine if either sex is more liable than the other to this form of disease. Of the nine cases recorded in this paper, six occurred in females, three in males. In the four recorded by Mr. Paget, two occurred in males and two in females.

It is difficult to assign a local cause in all cases, so as to account for the origin of this disease ; but of the nine cases here collected, there were two very clear cases of history of severe injury, followed immediately by swelling, which did not subside, but constantly increased, and where there was evidently no interval between the assigned cause and the appearance of the disease. In four other cases no cause whatever could be assigned, and in the two remaining ones, the history affords no clue to enable us to determine whether any local cause existed or not.

When it is known that the mean age of the occurrence of medullary cancer is at an early period of life, and that the bones, in the great proportion of cases, are the organs which are particularly the seat of the disease, it becomes a

very important point to discriminate, if possible, between "myeloid" or "myelo-cystic" disease and medullary cancer, on account of the different operative measures that are required in the two cases.

In the nine cases recorded in this paper, there are eight in which the duration of the disease has been noted. In one case it was a year, in two cases a year and a half, in one two years and a half, in two cases three years, in a fourth case six, and in one case twelve years. Now, if these periods are compared with the duration of life in medullary cancer, a very striking difference is observed. From a table of fifty cases of medullary cancer collected by Mr. Paget, in which the disease pursued its course without operative interference, the average duration of life was rather more than two years, the latest period being four years. Again, in forty-six cases, also collected by the same author, in which medullary cancers were removed by excision or amputation, the average duration of life was something more than twenty-eight months.

The long duration of the disease, as compared with medullary cancer, affords, then, a very important diagnostic mark, more especially when it is considered how closely osteoid and malignant tumours resemble it in their general form.

Other minor diagnostic marks of importance may be also noticed—the absence of the malignant cachexia, so marked a feature of medullary cancer, even while the local disease is of a trivial nature; the absence of lymphatic glandular enlargement; and the absence of disease in the internal organs.

The chief results of these investigations, I think, clearly prove that there are a class of tumours which have their origin either upon, or in the interior of, the bones, and which bear so close a resemblance to malignant disease, that the eye fails to detect their true character. Minute examination of them, however, shows them to consist,—partly, of structures in every respect identical with some of the normal

constituents of the medulla—partly, of a fibrous element mixed up with cysts of varying number and size—and, occasionally, of fibro-cystic structure, or some of the primordial elements of bone itself.

It would thus appear, that non-malignant tumours of bone may consist of structures which are composed entirely of a tissue analogous to one of the normal elements of bone, or of some, or all, of these tissues intermingled. Thus, the fibrous element of bone may be represented by the development of a fibrous tumour, growing either upon or in the interior of the bone, and consisting either entirely of solid matter, or mixed up with cysts. Again, the cartilaginous, osseous, or vascular elements may be represented by the development and growth of one of these structures from the surface, or from the interior of a bone. I think, also, the cases and observations contained in this paper, prove that the *medulla* element of bone may be represented by the development and growth of a tumour, which, in its structure, may be analogous to the cellular structure found in the normal medulla, and consist either entirely of solid matter, or of solid matter intermixed with cysts, and be mixed up, in some cases, with some or all of the primordial elements of bone, as fibrous tissue, cartilage, or bone, in various proportions.

It also appears that these tumours are confined in their growth (as far as we are at present aware) to the osseous tissue, or its investing membranes; that they occur at an early period of life, and bear some relation as to their period of growth to the time of life when the medullary cells are most active, and exist in large proportion. It has also been seen that, although the local cause which has given rise to their development has been traced, in some cases, to a distinct injury, still in many no cause whatever can be assigned for their origin. That their growth is slow, extending in many cases over many years, accompanied by pain, varied in intensity in different cases, attaining occasionally a very considerable size, but in no instance presenting any tendency

Fig 1.

Fig 2

2. Myeloid cells, some of which are furnished with caudate prolongations.
400 diam.

Myeloid Tumour of the Tibia.

Fig 3.

Fig 4.

Fig 5.

400 diam.

1. Fibrine with included Lymph Corpuscles from the interior of one of the cysts. 2. Nucleated spindle shaped fibres, from the solid matter of the Tumour.

3. Myeloid cells from the solid matter of the Tumour.

Myelo Cystic Tumour of the Humerus.

Fig. 1

Fig. 2

1. Fibrous tissue from the solid matter of the Tumour.
400 diam.

2. Arrangement of the capillaries in the solid matter
of the Tumour.

Myelo Cystic Tumour of the Femur.

Fig. 3.

Fig. 4.

Fig. 5.

400 diam.

3 & 4 Nucleated fibres and fibrous tissue
(4) from the fibro cystic portion of the Tumour.

5 Myeloid cells, and nuclear spindle shaped fibres
from the buff coloured portion of the Tumour.

to ulcerate or protrude externally ; and presenting, lastly, a marked contrast to malignant disease, in their microscopic structure, in the non-infiltration of the bone from which the tumours take their origin, in their slow growth, in the absence of lymphatic glandular enlargement, and of the extreme wasting and pain and sallow aspect, so marked in most cases of malignant disease. Lastly, the non-recurrence of the disease in any case, during many years after the removal of the limb, is a still more conclusive proof of their innocent character.

I cannot conclude this communication without thanking Sir Benjamin Brodie, Bart., Mr. Stanley, and Mr. Paget, all of whom, in the most kind manner, placed at my disposal their notes of such cases as I required, and allowed me the freest access to their preparations.

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