Potatis Deformans

a highly creditable Thesis.

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OSTEITIS DEFORMANS.

"Osteitis Deformans & other Diseases of Bone." This may seem a very wide & vague definition for a Thesis. Whatever purports to dwell chiefly on the remarkable case which caused Sir James Paget to introduce the new term of "Osteitis Deformans", & to consider other diseases of bone merely in their relations to it. In this way I hope to be able to shew that the case in question is really an "sui generis", & that it cannot be properly placed under any of our present headings. I will first of all shortly allude to my own connection with the case, then give Sir J. Paget's report & conclusions regarding it, & finally consider separately each of the other diseases with which it might be confounded, dwelling principally on their points of similarity & difference.

In regard to the first point it will be seen my connection with the case was but small, nevertheless it has greatly impressed me as being the most remarkable I have seen since Graduation, & so I have concluded that a careful consideration of it would be of more service than an attempt to draw deductions from a number of less marked ones. A chief reason for coming to this conclusion is that in general practice, though many cases of the greatest interest are met with, there are so many points

of difference in the habits of the patient, in his habitation, in his nursing, clothing, food, &c, that it is very unsafe to draw conclusions as to the cause of any disease, or its course, or the effect of treatment, without a much wider experience than I at present enjoy.

The gentleman (a Rev. F.), in whom the disease occurred, was a very old patient of my fathers, he having attended him over thirty years ago. I first remember him as a tall, & upright man, troubled with a slight lameness. Later the lameness had increased, & he had a decided stoop, but what most impressed me was the remarkable size of his head, & my father's telling me it was growing so fast that he had to have his helmet (for he was in the Militia) enlarged yearly. He left this neighbourhood some eight years ago, & only returned a fortnight before death. He then seemed generally breaking up, his lungs being chiefly at fault, his mind clear to the last. Sir J. Paget had obtained permission to perform a post-mortem examination, & came down from London for that purpose. I had the pleasure of giving him some little assistance, & of securing some of the diseased tissues for microscopical examination. Sir James Paget embodied the results in a paper, read before the Royal Medical & Chirurgical Society, & published in the "Lancet" for Nov. 18th 1876. I have since obtained his permission to make this report the basis for a Thesis, & so will give it at length, as it contains much fuller particulars than I could elsewhere obtain.

A paper "On a Form of Chronic Inflammation of Bones (Ostitis deformans)," by Sir J. Paget, Bart. &c. I opened with a detailed account of a case which had been for many years under the author's observation. It was that of a gentleman in whose family there was no history of gout or rheumatism, but one of whose sisters had died of chronic cancer of the breast; he was a tall, thin, & well formed man, & the father of healthy children. When forty-six years of age he began to suffer from pains in the thighs & legs, & at the end of one year he noticed the left shin to be somewhat misshapen. Sir J. Paget first saw the patient in 1856, or two years from the commencement of the disease. He was then in good health, prematurely grey, & walked stiffly. There was some enlargement & irregularity of the left tibia & lower half of the left femur, but no tenderness. The urine deposited lithates. The case being regarded as one of chronic periostitis, iodide of potassium was given, but without results. Three years later the author again saw the case, this time in conjunction with Mr. Stanley. The left tibia had become larger & longer, so that it was curved anteriorly; the femur also was more distinctly enlarged, & was arched forwards & outwards. The side of the pelvis appeared widened, & the whole limb was about a quarter of an inch shorter than the right. There was very little suffering, the clumsiness of the limb being the chief trouble. He had taken much iodine & other medicine, without the least effect. For the next seventeen years the

disease steadily but slowly progressed. The left tibia continued to enlarge, & became more curved, & the same change taking place on the right side, the two limbs in time became symmetrically affected, & at the same time the knees became gradually bent. The skull also slowly increased in size, the head retaining its natural shape, & the face not being at all affected. The spine became slowly curved & almost rigid, so that the patient's height diminished from six feet one inch to five feet nine inches; & the chest became narrow, shortened, & deeper from before backwards, & all movement was much restrained. The head was bent forwards, & the neck consequently shortened. The arms, not sharing in the shortening of the trunk, seemed long in proportion, & the angle formed by the shaft with the neck of the femur was diminished. In 1890, the left knee-joint became acutely inflamed, & was left more stiff & bent afterwards; at the same time, some insufficience of the mitral valve was detected. In the summer of 1894 the patient suffered partial loss of vision from retinal hemorrhage, & he also began to be somewhat deaf. He then also suffered from neuralgic pains, chiefly in the upper part of the body. In January, 1896, pain in the left forearm & elbow, followed by swelling in the upper part of the radius, appeared; but he was otherwise in good health, enjoyed a good appetite, & his mind was quite clear. From this time he began to fail, & it was evident that the painful swelling of the forearm was due to a cancerous growth, & on the 24th of March, after suffering from pleural effusion, he died. At the autopsy, the head was retracted to a level with the sternum, &

the lower limbs rested upon the nates & heels, from the arching of the bones. The pericranium & dura mater were healthy. The lungs were compressed & contained a few nodules of cancer in their substance. The mitral valve was atheromatous & calcified; the aortic slightly atheromatous. The femur, tibia, & patella, & upper part of the skull were removed for examination. The upper one-third of the left radius was involved in a large grey mass of medullary cancer, the rest of that bone was healthy. Some cancerous nodules also occurred in the skull. The spine was shortened, but presented no outgrowths nor anchylosis. All the sutures of the skull were obliterated, the thickness of the bone being about four times the natural. The whole outer surface of the skull-cap was finely porous & reticulated for the passage of bloodvessels, & internally the grooves for the middle meningeal arteries were deepened, & a layer of dense white bone formed the inner table, but in places were intervals where reticulation was marked, in which a quantity of cancerous material was contained. The condition of the long bones was that of fine undulation of the outer surface without any visible change in the periosteum, the surface being perforated extensively for transmission of vessels. The medulla was natural; the cancellæ had a normal disposition, but the compact substance of the shaft, & especially of the articular ends, was greatly increased in thickness. In places the outer layers of bone appeared to be separated in the form of thin plates, in other parts dense hard patches occurred. Dr. Battin made a careful microscopical examination of the skull & of the tibia, & found a diminution in the

number of Haversian canals, which were widened & very confluent, & were occupied by a large amount of fibro-nuclear tissue, leucocytes, & occasionally myeloid cells & fat, around the contained vessels. The lacunæ & canaliculi were numerous, but not different from ordinary bone. A chemical analysis by Dr. Russell shewed very little difference in composition to exist between the diseased bone & normal bone. The disease of which this case is an example is so rare & peculiar in its course that clinically it is not difficult to distinguish it, but specimens of the affection may be met with in museums under the general name of osteo-porosis, hyperostosis, senile rachitis, &c.

Sir James Paget then proceeds to give a much shorter sketch of four other cases he had met with, in none however had he an opportunity of making a post-mortem examination. All were in men past-middle age, two of whom died of cancer. He had been unable to find recorded any cases precisely similar to these, & he considered the following to be the chief characters of the affection. — It begins in middle age or later, is very slow in progress, may continue for many years without influence on the general health, & give no other trouble than those which are due to the changes of shape, size, & direction of the diseased bones. Even when the skull is largely thickened, & all its bones exceedingly altered in structure, the mind remains unaffected. The disease affects most frequently the long bones of the lower extremities & the skull, & is usually symmetrical. The bones enlarge & soften, & those bearing weight yield & become

unnaturally curved & misshapen, suggesting the proposed name, "osteitis deformans". The spine, whether by yielding to the weight of the overgrown skull, or by changes in its own structure, may sink & seem to shorten, with greatly increased dorsal & lumbar curves; the pelvis may become wide, the necks of the femora may become nearly horizontal, but the limbs, however misshapen, remain strong & fit to support the trunk. In its earlier periods, & sometimes through all its course, the disease is attended with pains in the affected bones, - pains widely various in severity, & variously described as rheumatic, gouty, or neuralgic, not especially nocturnal or periodical. It is not attended with fever. No characteristic condition of urine or of faeces have been found in it. It is not associated with any constitutional disease, unless it be cancer, of which three out of the four cases recorded in the paper were the subjects. The bones examined after death show the consequences of an inflammation affecting, in the skull, the whole thickness, in the long bones chiefly the compact structure of their walls, & not only the walls of their shafts, but, in a very characteristic manner, those of their articular surfaces. The changes of structure produced in the earliest periods of the disease have not yet been observed, but it may be believed that they are inflammatory, for the deposition is associated with enlargement, with excessive production of imperfectly developed structure, & with increased blood supply. Whether inflammation in any degree continues to the last, or whether, after many years of progress, any reparative changes ensue, after the manner of a so-called consecutive hardening, is uncertain.

Having now given the full report of the case of Mr. F., I will proceed to the third part of my paper, & consider the various diseases more or less resembling it. Before doing so, however, to facilitate further inquiry, it will be best to examine somewhat fully the changes in, & results of Chronic Inflammation of Bone, & to determine whether or not the osseous changes were due to that process.

Inflammation of Bone.

Druitt (Surgeon's Vade Mecum, 10th Ed. P. 204) says 'Chronic inflammation of bone is most frequently the result of some constitutional disorder, & generally attacks several bones simultaneously. It is denoted by slow enlargement, tenderness, weight, & pain increased at night. If caused by injury, it may lead to necrosis; but in general it produces no organic change, save irregular enlargement.' The case of Mr. F. would come under this definition in all points, with the slight exception of the 'increased pain at night' being absent. It is however much too general.

Skey (Lectures on Surgery. Lect: XXXVI P. 244) says "In a bone affected with chronic inflammation, the Haversian canals are much larger & more opened out than normally; the dense texture of the bone is also lighter than usual. It becomes granular & spongy, & approaches in character the cancellated texture, though afterwards it becomes consolidated, when the diseased action goes on longer. There is often also

a modulated condition of the bone from the deposition of new osseous matter on the surface. The enlarged Haversian canals can then admit vessels of a very considerable size, which are able to relieve themselves of their serous or plastic contents, & the symptoms of the disease are therefore rendered less intense; but as in all other forms of chronic inflammation, the exudation tends to produce organic changes. A larger amount of nutrition goes on than natural, & at last the exudation becomes consolidated, till the canal of the bone may be entirely closed, & in some cases become positively solid. The bone is thus enormously thickened & irregular; but when the diseased action ceases, gradual absorption takes place, & the bone tends to regain its normal form." This description would also include the case of Mr. T.; the "granular & spongy" state, the hard bone is said to be reduced to in the early stage of the process, is specially worthy of mark for some such change must have occurred to allow the characteristic alteration in the shape of the affected bones.

Erichsen (Science & Art of Surgery. 6th Ed. Vol. I. P. 96) says "In chronic inflammation the changes in the nutrition of the part form the principal element, in acute those in the blood & vessels." He proceeds in quoting Billroth to the same effect. The latter insists on the point that inflamed tissues become at first "more swollen & fatty than normal. Erichsen further points out that there are changes in colour, size, sensation, function & temperature in chronic inflammation, but that these are

different in origin, in degree, & often in order & combination to what are found in acute. Swelling is insisted on as an early & important sign, & is said to be due to effusion; the effusion partly consists of serum which may be absorbed, & partly of plastic matter which is liable to remain & lead to hypertrophy. As regards inflammation of bone Erichsen (Idem. Vol. II P. 136) says 'When a portion of bone is inflamed, the periosteum & medullary membrane participate in the morbid action, &, together with the affected osseous structures, become highly vascular; at the same time the inflamed bone becomes enlarged & softened, partly in consequence of changes induced in its organic constituents, & partly in consequence of the cancellated structure becoming expanded from interstitial absorption; the cancelli being filled with a sero-sanguineous fluid. The compact structure of inflamed bone undergoes a peculiar kind of laminated expansion, so that a section of it presents an appearance of concentric parallel layers. When the inflammation is chronic, its character will vary according as it is strumous or not. When it is strumous, the bone is expanded, softened, & reddened. When traumatic & when occurring in healthy subjects, the bone becomes very dense, indurated, & compact; looking & cutting more like ivory than ordinary bone. In these cases the medullary canal becomes closed by deposit of new & hard bone. Sometimes considerable elongation without much or any thickening takes place. I have seen, as the result of chronic ostcitis, the tibia from one & a half to two inches longer than its fellow.'

The case of Mr. T. does not seem to agree with this description as well as with those of Druitt & Spence, but I think a satisfactory explanation of this may be easily found. The swelling & softening of the affected tissue described by Erichsen was certainly present; again he describes the cancelli as filled with a "serous sanguineous fluid", which agrees well with the fibro-nuclear tissue, leucocytes, myeloid cells & fat found by Mr. Dutton; the "appearance of concentric parallel layers" also agrees with the "thin plates" found in the outer layers. Erichsen agrees, as the final result of the inflammation in a healthy man, the production of a hard, dense, & compact mass of bone with the medullary cavity filled up; this was undoubtedly absent, but I think such absence may be said to be due simply to want of time, the patient having died before the first stage had ceased, at any rate in some parts of the bone.

Paget (Lectures on Surgical Pathology. 3rd Ed. P. 298) says "Perhaps the most striking instance of softening in inflammation is to be found in bones..... In inflammation & caries of bone, in addition to the softening caused by the removal of the earthy matter, there is also a considerable widening of the Haversian canals, lacunæ, & canaliculi, so that many of them disappear, owing to numerous spaces & canals being thrown together. The enlarged Haversian canals present the appearance of medullary spaces, & are filled with a soft rapidly growing tissue, not unlike that of granulations. The softening of bones may permit

peculiar subsequent changes, especially their swelling & expansion..... The characters of a bone thus expanded are easily discerned. The substance may be irregularly cancellous or porous; but the most striking change is a more or less extensive & wide separation of the concentric laminæ of the walls of the bone, so that the longitudinal section of the enlarged wall appears composed of two or more layers of compact tissue, with a widely cancellous tissue between them. Usually, the separated layers are carried outwards, & the bone appears outwardly enlarged; but sometimes the inner layers of the wall are pressed inwards & encroach upon the medullary tissue. In the first periods of the disease, the cancellous tissue between the separated layers of the wall has wide spaces, which are usually filled with a blood-coloured medulla: but this tissue, like the often coincident external formations of new bone, appears to have a tendency to become solid & hard; & its fibrils & laminæ may thicken till they coalesce into a compact ivory-like substance, harder than the healthy bone? This description might have been written specially to include the case of Pat. F. it does so to be completely. For in this case we have the softening; we have the concentric laminæ; the hard patches; the enlarged Haversian canals; "fibro-nuclear tissue, leucocytes, &c" corresponding to the "softly spindly growing tissue". From it also we see how the enlargement of the bone occurred, by the separation & carrying outwards of the concentric laminæ of the walls.

I think I have now fully demonstrated the changes in the bones of Nos. 7. to be the result of Chronic Inflammation, for, in all particulars, they agree with the descriptions of that process & its results, given by Druitt, Spence, Erichsen, & Paget. The determination of this point will facilitate (as before remarked) the consideration of the bearings of the case in regard to other diseases; I will first take

Rickets.

Rickets is defined by Dr. Ashton as a Constitutional disease of early childhood. (Ashton of Practice of Med. P. 208). Niemeyer (Text-Book of Practical Medicine, translated by Humphreys & Hackley. Vol. II P. 509) says it is a disease of childhood, & that "it is doubtful whether the rare cases, where the disease is said to have occurred in adults, or during foetal life, were actually Rachitis."

Billroth (Surgical Pathology. Lect. XXXVI P. 463) says "the disease is peculiar to childhood; it is a disease of the development of bone, which however usually affects so many bones, that it must be regarded, not as a local, but as a constitutional disease." He however thinks that certain diseases, such as flat-foot, genu valgum & varum, & lateral curvatures of the spine, are due to "weakness of the bones, which cannot be distinguished from a mild form of rickets." "Such cases occur later in life, but generally between ten & twenty years, while the disease briefly termed Rachitis is mostly seen in very young children."

Erichsen (Science & Art of Surgery 6th Ed. Vol II. P. 157) says
"Rickets is a disease of early life, usually being met with
in Scrofulous children & never occurring after the age
of puberty".
All these authorities agree in considering Rickets a disease
of childhood, & such is undoubtedly the general idea of it.
If this view be accepted, we cannot for a moment entertain
the opinion that the disease could first manifest itself in
a man forty six years of age, over six foot high, & who had
previously enjoyed good health. The Germans however
seem to admit the possibility of cases occurring in adult
life, & so we will proceed to examine the changes found in
Rickets & compare them with those met with in Nov. 7.
In Rickets the bones are altered in shape & their ends enlarged.
There are two theories to account for these changes; both
hold that the characteristic curves & bendings are due to
the bones, whilst softer than normal, being acted on by
the weight of the body above, & muscular action. Both explain
the deformity equally well, & show how it is we find it
greatest in the lower limbs. Neither accounts for the pro-
liferation of the epiphyseal cartilage, & periosteum, & consequent
increase in size of the ends of the bones, which, by the way,
is most likely due to inflammation.
According to the old theory the bones are originally hard, & are
rendered soft by the taking up by the blood of their calcareous

salts, which again are eliminated through the kidneys. According to the new theory, which may be called Virchow's, as he originated it & is its stoutest supporter, the softening is due to a diminished supply of chalky salts merely, not to their reabsorption. This explanation is now generally accepted & has many strong points in its favour, such as the benefits derived from giving those affected the carbonate & phosphate of lime, & the dyspepsia from which Rachitic children generally suffer, for in this dyspepsia there is less albuminate (& the earthy salts are introduced as albuminate) taken into the system. Yet however cannot be looked on as proved, for it does not account for the proliferation of the epiphyseal cartilages, nor for the bones being so much more affected by this diminished supply of nutrition, than other tissues, nor for cases occurring in non-dyspeptic children. To enable the case of Nos. 7. to come under the head of Rickets we must suppose that these objections, to Virchow's theory, are unanswerable, & that the old idea of absorption of the chalky salts is correct. This is another improbability, but a consideration of the characters of the bones themselves, in Rickets & Osteitis Deformans, will finally remove any remaining doubt as to their being two distinct diseases. In Rachitis the bones are short, thick, & clumsy, the ends are enlarged, & the shafts distorted owing chiefly to curves at the point of junction of the epiphyses & diaphyses,

the two parts of the bone often seeming as if dislocated. In Osteitis Deformans the bones are long, thick, & the ends enlarged; the shafts are round with but badly defined margins, they are curved, but the curve is gradual throughout the whole length of the bone, & in the tibia this curve is from before backwards. The tibia of Rickets is flattened laterally, curved inwards, & has sharp & narrow margins. We can now, I think, safely conclude the case of Mr. F. not to be one of Rickets for there are three primary objections to its being so 1st the age at which the disease occurred, 2nd the manner in which it occurred, & 3rd the results as seen in the bones.

Osteomalacea.

The descriptions given of this disease vary considerably, & this is perhaps due to two distinct ones being classed under one head. The true Osteomalacea, Osteoporosis, Malakosteon, Rachitismus adultorum appears to be much more common in France & Germany than in this country, though cases have been recorded here by Mr. Dalrymple (London Journal of Medical Science, II. 1846), Dr. Bence Jones (Phil. Trans. 1848), & Dr. Macintyre (Med. Chirurg. Trans. Vol. XXXIII). It is found, in the great majority of cases, to occur in females, & in them generally when in the puerperal condition. The disease then usually attacks the pelvis, as insisted on by Rokitansky, & forms it a characteristic shape, it however

often affects other bones, & so causes deformity of the spine, arms, & legs. The Germans agree in there being an actual reabsorption of the lime salts present in normal bone. The medulla in the long bones gradually increases in extent, the cortical substance diminishing in an equal proportion. The spongy bones also become weaker from the trabeculæ becoming thinner & fewer in number. The earthy matter present, in time, becomes so small in amount, that the bone may be easily bent or cut. In the beginning of the disease Lobzmann has shown, (Beiträge zur Kenntnies der Osteomalacie, translated by Dr. Matthews Duncan, Ed. Med. Jour. 1861-2), the medulla to be very rich in blood, partly in the vessels & partly extravasated, so that it has a some-red or almost black colour; the fat cells are greatly diminished in number, but the normal myeloid cells are numerous. When the disease is more advanced the medulla appears redder & more gelatinous, consisting of granulations & much fat. The cause of the above changes is a disputed point. Dalrymple & Macintyre believe it to be a malignant disease, for they have shown the material within the periosteum to be composed of granular matter, nucleated cells, & a few candate corpuscles. They however admit it to differ from other malignant diseases in that, instead of progressively reproducing & developing themselves without limitation, the new & morbid products seem, at an early stage of their existence, to be removed by absorption & carried out of the system. The objections to this theory are

I think inadmissable, for they seem to found it merely on the microscopical appearance of a cell, & it is now generally admitted that no appearance of nucleation, or a candate form, is sufficient to stamp one as "malignant"; the clinical history is of much more importance, & this they allow to be against them.

Billroth (Surgical Pathology & Therapeutics, translated by Dr. Hackley. P. 468) thinks the absorption of the bony salts is due to the presence of lactic acid, which he says, he has found in the medulla of the Labar bones.

Virchow opposes Billroth's theory & declares, on the other hand, the gelatine, escaping from fresh osteomalacic bone, to be of alkaline reaction. He (Niemeyer's Practical Medicine, Vol. II P. 519) classes the disease amongst "parenchymatous inflammations where no interstitial exudation is deposited, but where the inflammatory disturbances of nutrition affect the tissue elements of the affected organ". This view, has so many points in its favour, that, Niemeyer thinks it probably correct, especially from "the rarefaction, the porous, spongy, or areolar condition of these bones, which are perfectly analogous to the changes in osteitis porosa, the frequent occurrence of the disease in the puerperal state, its customary origin from the pelvis, which has been injured during parturition, & lastly, the severe pain accompanying it."

In true Osteomalacia then we may conclude we have a disease of bone, depending on inflammation, causing deformity, & occurring

generally in adults; in these points it closely resembles Osteitis Deformans, but those of divergence are even more marked, for it occurs generally in women, attacks chiefly the pelvis, & causes the affected bones to become lighter & weaker. The two inflammations may run the same course till the taking up of the bony matrix occurs, they then separate, in Osteomalacia there seems to be no effort at reparation, granulation & fat cells fill the place left vacant, in Osteitis Deformans on the other hand new formative lymph appears to be exuded from the blood-vessels, to ossify & cause the bone to become larger & stronger than before.

Having now considered the true form of Osteomalacia, as met with chiefly on the Continent, let us proceed to that form found especially in England. It has been generally described under the name of "Mollities Ossium" & it is distinguished from atrophy accompanied by fatty deposit. This disease appears to be a fatty degeneration & was well described by Hunter in an essay entitled "Observations on the Case of Mollities Ossium described by Mr. Goodwin," in the Lond. Med. Journal Vol. VI 1785. He says, speaking of the humerus, "the component parts of the bone were totally altered, the structure being very different from other bones, & wholly composed of a new substance, resembling a species of fatty tumour, & giving the appearance of a spongy bone deprived of its earth, & soaked in soft fat."
Sir James Paget (Lectures on Surgical Pathology, 3rd Ed. Vol. 102)

describes a femur, presented to the Museum of the College of Surgeons by Mr. Tamplin, "the medulla of the bone had the bright yellow, pink, & deep crimson hues, which are so striking in many instances of the disease. But the constituents of this apparently peculiar material were, free oil in great quantity, crystals of margarine, free, or enclosed in fat-cells; a few fat-cells full of oil as in health, but many more, empty, collapsed, & rolled up in strange & deceptive forms. The pink & crimson colors were owing to the bright tints of a part of the oil globules, & of the nuclei & granules in the collapsed fat cells, & there was no appearance whatever of an excess of blood in the bone, or any of its contents." Mollities Ossium attacks the bones of the extremities more often than those of the trunk, & males as often as females; in these respects it resembles Osteitis Deformans more than true Osteomalacia does. It however does not seem to be due to inflammation, & the light, oily, fragile state the affected bones are reduced to is of course equally distinct from the heavy, earthy, strong bone of Osteitis Deformans.

Chronic Rheumatic Arthritis.

In the discussion, which followed Sir J. Paget's paper, Mr. Barwell remarked that the case described resembled one of this disease, or as the Germans now call it Arthritis Deformans, & said that in it the bones were changed in an equal degree with the joints. I think a review, of the opinions of the chief authorities on Chronic Rheumatic Arthritis, will show

surface of the bones, & in a central induration of the epiphyses, accompanied by a proliferation of bone substance at the periphery. "On anatomical examination of the swollen, misshapen joints, we find the articular capsule decidedly thickened & covered with rugged proliferations. The joint contains a very small amount of dysenia. The articular cartilages are broken down into filaments, occasionally absorbed, & in advanced cases they have entirely disappeared by wasting away, so that the ends of the bones come in contact, & have smooth, articular surfaces. As a result of inflammatory atrophy the central parts of the epiphyses appear porous, while their size is decidedly increased, either regularly or in nearly protuberances, by the formation of osteophytes." We see, from the above extracts, that Heuetyer does not support Dr. Barwell's idea of Chronic Rheumatic Arthritis & Arthritis Deformans being one & the same disease; that in the description of the first no mention is made of the bones being affected; & that the changes described in the latter are carefully confined to the ends, & are altogether different to those found in the case of Mrs. T..

Chronic Rheumatic Arthritis specially attacks the joints of the fingers, toes, metatarsus, & metacarpus, & causes characteristic deformities & subluxations. All these changes are remarkably well exemplified in a maiden lady living under my roof. She is now sixty years of age, & for the last ten years has been unable to walk or stand, her knees are enlarged & fixed in a semi-flexed position, the feet & toes enlarged & useless, & the skin over them

the resemblance to be very slight, & Sir. Bamwell's idea about the changes in the bones in that disease to be wrong. In the first place, as Sir J. Paget replied, Dr. Adams of Dublin denies that Chronic Rh. Arthritis ever attacks the shafts of the bones. Riemeyer (Practical Medicine, Vol. II P. 489) says "Chronic articular rheumatism is the name applied to a chronic idiopathic inflammation of the joints, which usually attacks only one or a very few joints, which passes from one joint to another far more rarely than acute articular rheumatism does, & which, in spite of its long duration, induces comparatively little anatomical change." The anatomical appearances are thus described "the synovial capsule & ligaments of the joints thickened, the fringe-like processes of the membrana hyperplastic, & not unfrequently degenerated, the cartilages relaxed & shaggy, the synovia cloudy." Arthritis Deformans is placed in a separate chapter, but "from the great elasticity of the term rheumatism," Riemeyer thinks it may with equal propriety be classed with rheumatic affections, or considered as a distinct disease. He thus defines it (P. 492) "By arthritis deformans, we mean those forms of articular inflammation where not only the synovial capsule & ligaments of the joint exhibit the signs of a chronic inflammation having no tendency to suppuration, but where, at the same time, the cartilages & surfaces of the bone in the joint show peculiar changes characteristic of this form of arthrophlogosis. The latter consist of chiefly a loss of the articular cartilage &

appears tense & shining; her hands are however the most remarkably affected, some of the fingers are stiff & straight, others almost dislocated backwards at one joint, & forwards at another, so as to assume the most eccentric shapes. With all this deformity, & with hardly any power of grasp, the lady is able, by inserting the needle between her fingers, to do knitting &c of remarkable fineness. I need hardly say none of these appearances were present in the hands or feet of Mrs. T., a comparison of the two at once occurred to me, & made me the more amazed at Mr. Barwell's classing them together.

The late Professor Laycock in his lectures gave three prominent symptoms of Chronic Rheumatic, or, as he preferred to call it, Chronic Deformed Arthritis, 1st. in the first stage more or less inflammation in the joint, with its resulting attacks of pain, & bulging or swelling; 2nd. the occurrence of an analogous transformation of articular, muscular, & fibro-fibrous tissues to bone, & the formation of loose cartilages from what at first appeared mere nodules of fibrin; 3rd. Ebernation, or the further transformation of bone into ivory. Dr. Laycock was opposed to the generally accepted theory of the wasting, or wearing away of the articular cartilages, & contended that their absence was due to their being changed into bone, & this bone in turn to a porcellaneous material like ivory. He agrees with Heinegger in saying nothing about any change in the shafts. Erichsen (Science & Art of Surgery. Vol. II. P. 186) says, "Chronic Rheumatic Arthritis is an active disease of the bones & fibrous

seems not be acquainted with the researches
of Benjamin Bell. & the late Mr Smith of Dublin —

expansions about the joint: it is especially characterised by considerable increase in the size & by alteration in the shape of the osseous structures, which become porous in some parts, honeycellaneous in others; by thickening of the fibrous capsule of the joint, with deposition of nodules or plates of bone in it & ultimate destruction of the cartilages & synovial membrane." Erichsen does not use these days it is a disease of the bones, but with this important addition "about the joint". He then proceeds to give Billroth's ideas, which however are more fully expressed in his "Surgical Pathology" Lect: XL. P. 506. Billroth says "the disease chiefly affects the cartilage, secondarily the synovial membrane also, as well as the periosteum & bone." His description of the changes in the cartilage & synovial membrane agrees very much with that of Meyer, the breaking up of the intercellular substance into filaments being insisted on; he believes the cartilage to be worn away & thus explains the result "Immediately under the cartilage there is always a layer, even if it be very thin, of compact bony substance, lying next to this are the spongy ends of the epiphyses; after the cartilage is destroyed the friction affects this layer, & as a result of the mechanical irritation, new bony substance is formed in this layer; under the point of irritation the medulla of the spongy substance atrophies to a slight extent." The bone in this way may be worn away, but for the above reasons, its surface is always found firm & smooth when motion remains. Billroth also says the inflammation may affect other structures about the joints as the pericosteum, tendons, & muscles.

"These occasionally ossify very slowly, so that the ends of the bones are often covered with bony masses." "Arthritis Deformans" is said to be almost always non-articular, rarely affecting similar joints on the two sides.

Both the like Heinecyer, Laycock, & Erichsen makes no mention of the shafts of the bones being affected, & any alteration in them is directly denied by Todd & Adams. He certainly admits there being changes in the articular ends, but these, instead of being as well marked & important as those in the joints, are insisted on as being secondary to them, & simply due to mechanical irritation.

I think I have now shewn Mr. Barwell's assertion to be wrong; to me it appears that Chronic Rheumatic Arthritis might almost be shortly defined as "An inflammatory disease of the joints, the bones, with the exception of their articular surfaces, being normal" & Osteitis Deformans as "An inflammatory disease of the bones, the joints being normal." The two diseases resemble one another in the age at which they occur, in being due to inflammation, & in causing deformity; the inflammation however attacks different textures in the two cases, & the deformity is due to different causes. The results cannot be mistaken, for the enlarged & curved shafts of the bone affected with Osteitis, the absence of osteophytes from its extremities, & the smooth & normal articular surfaces are widely distinct from the changes above enumerated as peculiar to Chronic Rheumatic Arthritis, or what we may regard as its sub-division Arthritis Deformans.

Tumour.

Would it be correct to class the disease Mrs T. suffered from under the Head of Tumour? In order to reply to this question it will be necessary to consider somewhat fully what is meant by that term, & what are the definitions of it given by different authors.

Hunter says "A tumour is a circumscribed substance produced by disease, & different in its nature & consistence from the surrounding parts."

Erichsen (Science & Art of Surgery. 6th Ed. Vol. I P. 573) "By a tumour may be said to be meant a more or less circumscribed mass, growing in some tissue or organ of the body, & dependent on a morbid excess of, or deviation from, the nutrition of the part. These growths may therefore be considered under the two heads of local hypertrophies, or outgrowths of the normal structure of the part; & of new formations, presenting structural characters which more or less widely differ from those of the parts around. The tumour thus formed increases in size by an inherent force of its own, irrespectively of the growth of the rest of the system, but still obeys the same laws of growth which govern the body generally. In order to constitute a tumour, it is necessary that the normal form of the part be widely departed from; a mere increase in its size, so long as it preserves its usual shape, being scarcely considered in this light. Thus, if the tibia be uniformly enlarged to double its natural size, the enlargement is a hypertrophy; but if a comparatively small

rounded mass of bone projecting directly forwards from its tuberosity, it is said to be a tumour not a mere hypertrophy. These may be considered the Old or the Surgical views of a tumour. They depend on "circumscription" as their leading feature, & seem as if intended to limit the application of the term to growths which are capable of being removed by the Surgeon, at any rate, as far as their connection to the tissues in which they grow is concerned. They would at once exclude the case of Mr. T., for the enlargement found in his bones was remarkable for its diffused character. Further inquiry however will shew that this idea of "circumscription" is quite cast away by more recent authors, for instance I find from my notes that Professor Sanders says "A tumour is a formation of tissue, non-typical, without physiological function, & with an inherent tendency to increase." He further says that they have been called Parasites, & are like them in many respects, but differ from them in having no generative parts, & in regard to osseous tumours that it is often difficult to distinguish them from enlargements the result of hypertrophy or inflammation.

Druitt (Surgeon's Vade Mecum P. 75) gives a short definition "The word tumour is used in pathological language to signify, not any kind of swelling or enlargement, but only such enlargements as are caused by morbid growths. By morbid growths are understood masses of living tissue, growing independently, excessively, and abnormally."

Spence (Lectures on Surgery. Lo XVII P. 107) says "In its ordinary acceptation, the word tumour means a preternatural swelling of any kind. In surgical pathology it has a special signification, & is understood to denote "An overgrowth resulting from morbid or abnormal nutrition, which, instead of merely supplying new material sufficient to repair waste of tissue, yields a redundancy thereby leading to overgrowth, with more or less alteration of structure & form". Mr. Spence proceeds to dwell on the power of growth, independent of surrounding tissues, possessed by tumours, & their other points of distinction from hypertrophies & inflammatory swellings.

Paget attempts no exact definition of the term Tumour, but places it in the great division of Hypertrophies or Overgrowths (Lectures on Surgical Pathology. 3rd Edit. P. 375). All the diseases of this group consist of additions to the organised materials of the body, but there is this chief point of difference between hypertrophies & tumours: "that, to whatever extent the adapted hypertrophy may proceed, the overgrown part maintains itself in the normal type of shape & structure; while a tumour is essentially a deviation from the normal type of the body in which it grows, &, in general, the longer it exists the wider is the deviation." The fibro-muscular tumour of the uterus is taken as an excellent illustration of a tumour, & is contrasted with the hypertrophy which it causes in the walls of the uterus. Paget points out three chief differences between inflammatory swellings & tumours, 1st that the accumulation & increase of

Again the inflammation appears chiefly due to the morbid state of the parts at, or adjacent to, the place of production; a tumour, on the other hand, increases "of itself", depending on the surrounding parts simply for its supply of blood;

2nd the different capacities for development possessed by the new materials; the inflammatory being, in the first instance, little more than that of forming connective tissue; that beginning, or added to, a tumour may assume this form, or any one of several other forms;

3rd the most striking contrast in the events subsequent to the first organising of the two materials. Organised inflammatory products assimilate themselves to the shape & purpose, if not to the texture, of the parts among which they lie; or they are apt to waste, degenerate, & be removed. They tend towards a better state. Tumours tend to a further & further deviation from the proper type of the body. Their structure may be homologous, but not their life, for commonly they are growing while the tissues far & near around them are only maintaining their integrity, or even degenerating, or undergoing alteration from pressure. Again finally concludes that it is not enough to consider the true nature of tumours from their likeness or unlikeness to normal tissues, their physiology must be studied. It is, therefore, not enough to think of them as hypertrophies or overgrowths; they must be considered as parts overgrowing, & as overgrowing with appearance of inherent power, irrespective of the growing or maintenance

of the rest of the body, discordant from its normal type, & with no defining boundary."

These definitions of Sanders, Pritt, Spencer, & Paget may be considered as the Pathological, or Scientific views of Tumours, in contradistinction to the Surgical, or Practical of Hunter & Erichsen.

They all agree in considering the "inherent power of growth" as the chief characteristic of a tumour, no anatomical marks are given by which it may be known, no "circumscription" is thought needful, & of course no idea of removal kept in view.

They all hold tumours to be not due to inflammation, & hence, the fact of having already determined the case of Mr. T. to be due to that process, is enough to exclude it from them. Otherwise the exclusion might be difficult, for if we examine each of the three differences given by Paget we shall find them anything but conclusive, 1st. Then, the growth was constant, & we could not say whether or not there was any decrease in the surrounding parts giving rise to it; 2nd we could not know of what material the excess of tissue was composed of, or whether any alteration was going on in it, though the bending of the bones would certainly point to it not being normal osseous tissue; 3rd the deformity was increasing & for anything evident to the contrary the texture might be deteriorating, no "effort of nature" in the way of repair of injury was to be detected!

Cancer. As the greater includes the less, we thus exclude this form of Tumours from the list of possibilities.

The remarkable number of cases, (three out of four) in which the two diseases have occurred together, yet requires an explanation. If the cancerous had occurred in one of the bones, affected with the osteite, it might have been thought due to the irritation set up by the inflammation, just as epithelioma of the scrotum in sweeps & chimney-sweepers is thought due to that of soot, & of the lip in smokers to that of the pipe.

Syphilis.

The effects of this disease are too numerous & distinctive to need recapitulation, suffice it to say that all those most characteristic & constant, as the cutaneous & mucous eruptions, the broken down health, the enlarged glands, necrosed bone, &c, were absent in the case of Mr. ?. However, in certain cases, periostitis & its results are the only effects noticed by the sufferer, & so let us consider what are the results of syphilis on the bones. As a rule the periosteum is first inflamed, lymph or pus is effused between it & the bone giving what is termed a "node". The Germans confine this term to swellings of a firm consistency, calling the softer variety "gummata". The effused material is reabsorbed, or is organised, or increases in amount; in the first place no or little result is left; in the second we have a "syphilitic exostosis" formed, & find the surface of the bone rough & scaly, & sometimes the deeper parts consolidated from the deposition of fresh osseous matter within its cancelli; in the third the bone beneath is destroyed, from being deprived of

its blood supply. Caries & necrosis again may be the result of a primary inflammation of the bone itself, or of inflammation spreading from the soft parts. The bones most frequently attacked are those which are most exposed to external agencies, especially heat & cold, those of the face, skull, tibiæ, clavicles, & sternum. In the case of Mr. F. we had no necrosis or caries; the tibiæ were enlarged & irregularly nodulated, but then the enlargement was throughout the whole bone, (a change seldom or never seen in Syphilis) & their periosteum was healthy, & their surfaces consisted of normal bone not of the rough, scaly kind characteristic of Syphilis. I think this short consideration will enable us to determine the inflammation of the bones to be not of a Syphilitic type; & that a mere examination of the enlarged bones would lead to that conclusion, putting on one side the clinical history which is certainly conclusive.

Hyperostoses.

This term simply implies an increase in the dimensions of a bone. Taken in the broad way it will of course include the case of Mr. F.; we must therefore consider if any of its described varieties agrees in its particulars with his case. Hyperostosis may depend on simple hypertrophy, this process is merely an increase of normal substance without alteration of structure, "the enlarged organ maintains its natural type, form, & structure however much it may increase in size — it is, as it were, merely magnified." (Spence. Lectures on Surgery. 1st Ed. Vol. I. P. 108).

Such hypertrophy when due to increased use or exercise is regarded as natural, & in fact is necessary to health, for without it the function of the part could not be fulfilled. When there is no such demand the hypertrophy is morbid. In some cases it is very difficult to determine if the enlargement be due to hypertrophy or chronic Inflammation, & a microscopical examination may not enable us to decide, the only distinction, if any, is that laid down by Paget (Surgical Pathology P. 54) "where the enlargement is due to the former there is an increase of functional power, where to the latter there is no such object attained." Simple hypertrophy, as exemplified in lengthening of bone, has been found in connection with Necrosis, Osteomyelitis, Chronic Abscess, & Chronic Hyperaemia of the soft parts of the limb. (See Erichsen, Science & Art of Surgery, Vol. II. P. 156) Such cases have been specially examined by Stanley & Paget, & they have generally found some increase in the circumference of the bone also, which agrees with the observations of Langenbeck. Paget explains the curved shape the tibia, when so lengthened, often assumes by its anatomical connections; it is bound at each end to the fibula, which remains of normal size, the ligaments connecting the two bones seldom or never give way, & hence the tibia must bend. The bone so enlarged & bent closely resembles that of Osteitis Deformans & its diagnosis from a Ricketty one has been already pointed out. Hypertrophy of the skull has been divided by Paget into three kinds (Surg. Pathol. P. 58, &c.) The first he calls Eccentric, it is generally due to Hydrocephalus, the skull is

enlarged but its bones are thin & light. The second, or Concentric form is due to shrinking of the brain, & consequent increase in the thickness of the bone to fill the vacuum so formed; there is no alteration in the appearance of the skull from without. The third form is rarer than the others, but is well exemplified in the case of Mr. T., for there is great hyperostosis of the diploë, & elevation of the outer table, but no change in the capacity of the cranium.

The case of Mr. T. will be seen to resemble pretty closely simple hyperostosis as above described, the enlargement of the bones, & the bending of the tibiæ would at first appear identical with it; the bending of the femora might be accounted for by supposing the weight of the body absent & muscular action to take the place of the fibula in the case of the tibia. There is however no increased functional power which points to Chronic Inflammation being the cause of the enlargement, & a microscopical examination confirms this idea, & removes the case from the class of Hyperostosis. Hyperostosis is also said to be due to Chronic Inflammation, so we must class the case of Mr. T. under this head, & proceed to consider if it agrees in its minutiæ points with any examples of that disease already described. They are generally divided into two classes "Osteoporosis" & "Osteosclerosis". In the former the bone is open & cancellous in texture, it is however closely connected with Osteomalacia, if the two diseases be not identical, & as that has been already fully examined, we need not further consider it, but may pass on to the other form of Hyperostosis, Osteosclerosis.

Osteosclerosis is thus described by Billroth (Surg. Pathol. P. 428) "When Ostitis interna osteoplastica develops in the hollow bones it usually attacks the entire bone at the same time, & also commences simultaneously in several bones. The result of this disease may be the complete filling of the medullary cavity with a tolerably compact bony mass, the almost complete filling of the Haversian canals with bony substance, & generally also the formation of bone on the surface. Thus the entire bone becomes very heavy & denser than normal. This process is also termed 'diffuse hypertrophy of the bone', but more frequently 'sclerosis ossium' (Condensing ostitis, R. Volkmann.). Besides the hollow bones, other bones of the skeleton are also occasionally attacked, e.g., bones of the face & pelvis; in such cases the bony deposits are spongy, puffed, nodular, so that the bone acquires a resemblance to skin affected with elephantiasis; indeed, the diseases are very analogous (Leontiasis ossium, Virchow)." The causes of the above changes are obscure, during life a certain thickening & unequality of the surface is noticed, but other symptoms are undecided, "a dull moderate pain & a consequent slight impairment of function" being the chief. Osteitis Deformans & this Ostitis interna of Billroth have many points of resemblance, 1st in both the original cause is unknown, though the subsequent changes are the result of inflammation, 2nd both are attended with slight pain & slight impairment of function, 3rd both generally attack many bones at once, & the whole of the bone not a part, 4th both cause the bone to enlarge & become finely undulated on its surface.

The points of difference are however as marked for 1st in Sclerosis the form of the bone is little, if at all, altered, it is simply enlarged, in Osteitis the alteration in shape is as remarkable, if not more so, than that in Atrophy; 2nd on handling the former feels dense & very heavy, the latter of normal weight for its size; 3rd the texture of the Sclerosed bone (as the name implies) is hard & close, the medullary cavity & Haversian canals being encroached upon by osseous matter, that of the other normal or increased in density only in patches.

We must therefore conclude that Nov. 7. did not suffer from Osteosclerosis, or any other variety of Hyperostosis at present described, & I think I have shewn that his case will not come under any of the other headings which at first sight might be thought to include it.

In conclusion I can only hope that I have carried out in a satisfactory manner my original aim, that of proving the case to be one "sui generis" & worthy the new name bestowed on it by Sir James Paget — "Osteitis Deformans".

James C. Eames

** mentioned as text but actually omitted —