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Heresis
On
The Pathology of Tubercle.
By
David Hodgson.
Malignant growths have been divided by pathologists into two classes: Analogous and Heterologous. Those which present, on inspection by the naked eye, a distinct resemblance to some structure normally entering into the composition of the body are called Analogous; and those which present no such resemblance are called Heterologous.

But since the introduction of the microscope, as an instrument of research in morbid anatomy, it has been discovered that very few tumours can be called Heterologous, that is to say,
the minute histological elements of which these are composed, are seldom entirely misrepresented by those revealed by the Microscope. For instance, Cancer has been found to contain cells not differing essentially in form and general appearance from some of those which line the healthy mucous surfaces, associated with fibers exactly resembling those which constitute the normal cellular or acellular tissue.

The histological elements of most tumours may be divided into 1.

The Organic, comprehending cellular formations, fibres, molecules and granules, amorphous solids and semi-solids and fluids. And 2. The Inorganic, comprehending molecules and granules, amorphous masses, and Crystals.

In distinguishing and comparing different species of a large class of tumours, we are most adapted by the observation of differences in the character of their cellular elements. In some tumours the cells are large, well formed, rapidly generated, manifest little tendency to pass into the form of fibres or other secondary tissues of permanent
experience, and tend ultimately to break up into molecules & granules, in which case the entire tumour which they compose becomes softened and disintegrated. Such are the characters of the cells found in the various kinds of Cancer. In other cases the cells are also well formed, but are developed in fewer numbers and with less rapidity, while they manifest a greater degree of plastic or formative energy. Such cells are observed in most of the simple tumours. Again, the cells may be imperfectly formed, may show no aptitude for transformation into secondary tissues, and may be subject to more or less rapid disintegration. These conditions are furnished by the cells which constitute the greater part of figments, lecrolons, and tubercular ulcers.
II. I shall divide tubercular deposits, as observed by the naked eye, into the grey and the yellow.

A grey tubercle appears in the form of small semi-transparent nodules, from the size of a tolerably large pin's head downwards. The lungs are the most common seat of these nodules, but they are also found on the serous membranes, the pleura, peritoneum, pericardium, and according to Lebert and Albers, on false membranes in festoon position with these. Considerable dispute has prevailed as to whether the grey semi-transparent granulations should really be regarded as a form or stage of tubercle. The arguments in favour of this view have been stated at some length by Louis. In lungs where the grey granulations
are found, the Milian or Maped form of the yellow tubercle, and perhaps appearances indicating a still more advanced stage of disease, as Bonvicini &c., are almost invariably observed also. The injection of these last is generally towards the apices of the lungs, while the semi-transparent granulations mostly occupy the lower lobes. Besides, according to the statement of Louis and other observers, the grey gum may sometimes be seen in the act of transition into the yellow; they profess to have seen some nodules, in which, while the peripheral portion retained the semi-transparent and vitreous aspect, the centre had become more or less yellow in colour and opaque. If these observations are to be relied upon — and I see no reason to doubt their accuracy — we cannot resist the conclusion to which they naturally
lead, that the grey granulations are really tubercular, and that, at least in some instances, the yellow and more ordinarily seen tubercle is formed out of them.

The grey granulations contain few molecules or granules. They consist of a hyaline substance, throughout which are distributed the peculiar tubercular bodies. These bodies are cellular formations in a more or less perfect state of development. Their shape is on the whole roundish or oval, but not regularly so, for in most of them there exists a tendency to angularity of outline. Their margin is clearly defined. They are semi-opaque and have a speckled or granular aspect. Lebail says they are vestiges of nuclei, but this is not consistent with the appearance of others.

The probability is that those of them which present no appearance of this
Kind ought to be regarded as real nuclei, which may afterwards become invested by the separate cellular membrane, though this is not always formed. Pogge states, that these tubercular bodies rarely attain a diameter to the 200th of a line; their size usually varying between the 400th and 800th of a line.

In a recent clinical lecture recently delivered, Professor Bennett spoke of the microscopic appearances of these bodies. A small portion squeezed between glasses, and examined under the microscope, presents a number of irregular shaped bodies, approaching a round, oval, or triangular form, varying in their largest diameter from the 200th to 400th of a millimetre. These bodies contain from one to seven granules, are unaffected by water, but are tendered very transparent by acetic acid.

They are what have been called the "tubercle corpuscles." They are always
Mingled with a multitude of molecular processes and granules, which are more numerous as the tubercle is more soft. Occasionally, when lifted, the tubercle resembles pus. Constituting lessulous insulent matter, we find the corpuscles more rounded, and approaching the character of pus cells. They do not, however, on addition of acetic acid, exhibit the peculiar granular nature of these bodies.

"When they occur in the lungs, their seat appears to be between the fibrous bands which form the parenchyma of these viscera, and not in the air cells or bronchial ramifications. Albes adduces in support of this view the fact that tubercular bodies are rarely found in the sputum of persons labouring under phthisis in its incipient stage. The origin of the tubercle cells has been disputed. Most authorities adopt the opinion that..."
they are formed out of a fluid matter

Addison, however, holds

that they are nothing more than

the-colonel's corpuscles of the blood,

which become accumulated in particular parts and undergo certain modifi-

ications. But this doctrine appears to

have met with little favour in the path-

logical world: Bogel seems to consider

it sufficiently disproved by the perfect

manner in which the interstices of the

tissues are filled up by the deposit, which

he considers conclusive in favour of the

theory of an original fluid blastema.

No explanation, as far as I am aware,

has been offered of the fact that the exud-

ence of the grey granulations appears to the

naked eye to be defined with tolerable exacti-

tude, and conveys a corresponding sensation

to the finger, when passed over the cut

surface of the lung, for example.

This may perhaps be accounted for by supposing that the attribution of the

minute arterial ramifications from which


the formative exudation of each granulation is found, is confined exactly to the limits which bound that granulation.

I shall now very briefly consider the yellow form of tubercle. This occurs sometimes in the shape of small nodules (Millian tubercles) only a little larger than the grey granulations. At other times the yellow tubercles is seen in the shape of masses of considerable size; occasionally as large as a turkey's egg. This deposit occurs most frequently in the lungs, lymphatic glands, and mucous membranes; but scarcely a single organ or tissue of the body equals which it does not invade.

It is of a hard, cheesy consistence, of a dull yellow colour, and opaque. Sometimes, as has already been stated, it appears to result from a secondary change in the properties of the grey granulations,
but there can be no question of its occasional, and even general occurrence as a primary form.

In the Meizenteric groans and in certain other parts, it is always primary; and it is no doubt most commonly so in the lungs. Albers appears to regard the yellow tubercle in the lungs as developed in the air cells and small bronchi.

Chiefly lungs. It is much more liable to softening than the gray form; and Albers accounts for this by supposing it to be, by virtue of its situation, further removed than this latter from the vital organizing influence of the living textures.

The yellow tubercle contains besides the tubercular bodies and the hyaline blastema, a large or smaller number of granular and molecular. Some of these appear within the proper tubercle cells; others float in the surrounding
Substance. They are partly composed of oil, and partly of some protein compound. In the yellow tubules, the tubule cells and cystoblasts are seen with greater difficulty than in the grey, from the large proportion of other histological elements existing in the former.

The proportion between the quantity of the Molecular and granules and that of the cells in yellow tubule is extremely various, especially if we compare specimens of the deposits of different ages, and in different degrees of advancement towards softening, &c. This circumstance will be more fully stated immediately.


Many specimens.

III. The Chemistry of the tubular deposit is still in a very unsatisfactory state. Vogel and Schwann say it is mostly composed of some modification of protein.
Bondet believes, from a quantity of analyses he made of tubercular matter in different stages, that both the Conde and the softened tubercle contain a large quantity of fat, partly saponifiable and partly in the form of Cholesteroline. He has also found in both a certain proportion of Casein. This principle, he observes, is solid in the Conde tubercle, but exists in a state of solution when the depot becomes softened, possibly from the agency of Ammonia, which he supposes to be developed at the time when liquefaction commences. Bondet has also individualized the fibrin and the Albumen in these depots. He has analyzed the Calcareous tubercular matter and reports the following results. These matter, when simply dried by the agency of heat, only become more hard and brittle than they were originally.
When exposed to a red heat, they assume a consistence nearly similar to that of the Contra tubercle. They contain only a small quantity of Carbonate and Phosphate of Lime, but a large proportion (about 70 per cent.) of soluble Bases—of the Muriate, Phosphate, and Carbonate of Soda. It appears very extraordinary that these Bases should remain in a solid state in the lungs, when they are exposed to the solvent influence of the Blood in the Capillary Network; and Bonnet has not attempted to give any explanation of this circumstance. In the whole, the results of Chemical Analysis of Tubercle, though of course valuable prospectively, have been so various and conflicting as to throw very little light on the subject of which I am treating. More Observations, Conducted by men of Acknowledged Accuracy, are required
before we can avail ourselves of such facts as can be eliminated in this way, in making conclusions as to the Pathology of the Tubercular Anæsthesia.

IV. The remarks already made on the minute anatomy of the tubercular deposits chiefly refer to these while still retaining their original form and consistency. While, in fact, the term "crude tubercle" is still applicable to them, I shall now take a short view of the various changes which they may afterwards undergo. In the first place tubercles may become reabsorbed. The conditions necessary for this result, says Vogel, are these—to be not too large a mass of ecdudation, that it be in a position to be freely infiltrated with fluids, and that the age of the patient be advanced. Absorption takes place in this case in accordance with the usual laws by which
It is regulated. The part to be absorbed becomes in the first instance liquified before it can be taken into the venous and lymphatic circulations. This liquefaction is a slow and partial process, very different, even different from that which, in thickness, goes by the name of softening. In the case of the latter, the result is not absorption of the matter; at least to a considerable amount. As the tubercular matter becomes absorbed, plastic fibres may be deposited in its stead, or a deposition of the various baths above noticed as entering into the composition of calcareous tubercle may take place. Absorption is, as might be supposed, most likely to be effected in those instances where the deposits take the form of the grey granulations. It is seldom perfect; part of the tubercle usually remains, in an
indolent form and showing a firm consistence, for many years together, associated or not associated with the calcareous particles. When calcareous tubercle is examined under the microscope, many of the cells may be seen tolerably entire, and built, as it were, into the map of inorganic molecules and grains of which the tumour is partly composed. When tubercular matter is deposited in the substance of an Organ to any great amount, it seldom fails to produce well-marked injury of the textures which are immediately contiguous. These become more or less compressed and disintegrated, while as the disease advances, remarkable changes take place in the constitution of the deposit itself, as well as in its relations with the neighbouring textures. These will now be carefully considered—Although tubercle in hot or warm.
in the strict sense of that term,—that is, not capable of conversion, at least generally, into permanent tissue, supplied with bloodvessels and lymphatics—yet there can be no question that the surrounding living tissues may, under certain circumstances, exert on it some degree of vitalizing and conserving influence. It is partly, perhaps, from this cause, and partly because that part of the deposit is the older (for the deposition always takes place without, that the central part of the tubercles is the first to soften, and that that part of the gray granulations is the first to become converted into the yellow zone.

Softening consists partly of liquefaction of the proper substance of the tubercle, and partly of the infusion into this from the blood or tissues of a serous fluid.

The liquefaction of the proper substance is said to depend on putrefaction,
Lebert has observed that, during softening, the intima of the arteries becomes liquefied, and that the cells or tubercular bodies become larger, more regularly round in form, and more apparently globular than before. These phenomena must depend on the reception into their cavity, or on the infiltration into their substance, of the fluid by which they are surrounded.

As these changes proceed, the walls of the cells become more clear and their outline fainter, till at last they break up, when their fluid contents escape, and the solid parts of which they are composed are dissolv ed or reduced to the condition of molecules and granules.

It appears from some analysis by Lehmann, that, during the process of softening, the protein compound on compounds lose part of their
Phosphorus and sulphur, and that at a certain stage no trace of these principles can be detected. When tubercle is present in any considerable amount in an organ, as it generally is before these changes commence, its destructive influence on the tissues of that organ becomes apparent. The blood vessels become complicated, as well as the other structures, and at last the course of the blood in that situation is completely checked. In this way a sort of gangrene is produced immediately adjacent to the point of the tubercle.

By the time a tubercular cavity has become established, we find this lined by a thin membrane, the continuity of which is interrupted at many points, and which seems to consist of coagulable lymph. Under this lies the pyogenic membrane, a membrane with a
fibrous base, secreting, as its name indicates, the usual pus globules and granules, and the pus fluid. This again overlaps the hard wall of the cavity, which consists of an exudation of hard plastic fibrine, and which very rarely contains calcareous granules. This wall appears very much in thickness and consistency in different instances. Sometimes it is almost or entirely wanting, and then the cavity is merely separated by its lining membrane from the healthy type of the organ, as is observed occasionally in the case of tubercular lesions in the lungs. At other times it is so dense as to be described as cartilaginous or even bony. This character is imparted to it by the presence of a very densely disposed collection of fibres. The lining membrane may secrete other substances besides pus. One of these is the ordinary
form of inflammatory exudation, consisting of the compound granular bodies of some injured anatomy. These bodies are cells filled with little granules, which consist of oily matter enveloped in an outer coating or membrane of some protein compound. These granules also occur without the cells, as in other inflammations. The usual contents of tuberculous mucus in the lungs are tuberculous matter, fat and blood corpuscles, exudation corpuscles, glands, epithelial cells, lung fibers, broken up epithelial constituting mucus and crystals. The crystals are generally those of the triple phosphate of magnesium and ammonia; and these are sometimes found even in the still unsoftened tubercle.

Tubercular exudation unlike that of cancer frequently softens the animal protoplasm unsightly, and the
Mineral portion being left behind
and forming Cretaceous Deposits.
The cavities closing around there.

It is only in this manner that a cure of
this very formidable disease, if one
it may be called, can be effected

David Rossman

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