CLINICAL LECTURE

ON

SOME URINES AND URINARY CALCULI.

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3. *Calculi composed of Carbonate of Lime* are rarely formed in the urinary organs of man. In our own museum, we possess no authentic specimen; and, although the catalogue of the splendid collection at the Royal College of Surgeons contains a space wherein such a specimen should be recorded, the space is as yet a blank.

Considerable interest, therefore, attaches to the three small carbonate of lime calculi which I here produce. They were passed by a young man of 22 after symptoms of considerable prostatic irritation. They have the hempseed form characteristic of prostatic calculi, and this, taken together with the symptoms, makes it probable that they came from the prostate.

The calculi were originally six in number. Of these, one has been crushed to form the microscopic preparation on the table, one has been chemically examined by Dr. Bernays, and one by myself. The chemical examination shows them to consist of carbonate and phosphate of lime with an organic matrix. Their microscopy is extremely interesting. They are composed entirely of minute spherules in diameter twice or thrice the size of blood-corpuscles. The spherules are closely aggregated in most parts, and are slightly flattened at their points of mutual contact. They refract light very powerfully, and, when one is seen separate from the rest, it usually exhibits concentric internal lines—lines of lamination. The matrix is clear, transparent, and structureless. The forms are altogether like the spherical forms obtained in Mr. Rainey's original experiments, when mixtures of carbonate and phosphate of lime were slowly deposited in gum. The regularity of form and size indicates, according to Mr. Rainey's original observations, and others since made by myself, that the calculi were formed slowly in a muciform colloid, and they illustrate also the influence of the high temperature of the body. (See Fig. 2.)

Fig. 2.

As useful subjects of comparison, I exhibit two calculi composed of carbonate of lime taken from the urinary passages of the horse, one irregular, nodulated, evidently moulded to the form of its place of formation, and extremely compact, from the pelvis of the kidney; the other, soft, friable, and roundish, from the bladder.

In the friable vesical calculus, the earthy matter is held together by only a small proportion of not very adhesive animal matter. Small pieces can be easily picked off with the finger-nail and crumbled to dust between the fingers. The dust, on drying and examination under the microscope, consists of minute crystals and spherules. The spherules are beautifully perfect bodies, of all sizes up to the eighth of an inch, or even larger. They are marked with concentric shadings and with radiating fibrillation indicating a tendency to centrifugal crystallisation. I will not describe them in further detail, because they have every character belonging to the spheres of carbonate of lime formed artificially, and completely described by Mr. Rainey in his book on *Molecular Coalescence*. The spheres are mostly separate from each other; here and there a string of three or four is found, and some few little globular aggregations of very tiny spheres occur. With the spheres are found a long series of forms linking them on to the rhombohedral crystal. This form itself is not found perfect. There are found—I.

Dumb-bells; 2. Rounded bodies, partly crystalline, partly rounded, with central cavity; 3. Rounded rhombohedra without central cavity; 4. Six-sided crystals, some with a little rounding, some with sharp angles. (See Fig. 3.)

Fig. 3.

1. Of the dumb-bells, some are clearly such as are produced by the coalescence of spheres of equal size. Others have every indication of an origin in modified hexagonal prisms. Both kinds usually present a very small central cavity.

2. The rounded rhombohedron with central cavity is sometimes found single, sometimes in the form of a St. Andrew's cross. The central cavity is the starting-point of a number of markings, which would tend to make oval figures. These rhombohedra exactly resemble forms which I have drawn and described in the *St. Thomas's Hospital Reports* for 1871 and in the *Quarterly Journal of Microscopical Science*, 1872. They were composed of carbonate of lime and were deposited in gelatine.

3. The simple crystal is here more declared and in varying degrees of perfection. With the central cavity the oval markings are also absent. When the earthy matter is dissolved by an acid, the organic matrix still remains perfectly transparent and structureless, retaining the form of sphere or crystal.

This large, hard, irregular, and tuberculated calculus came from the pelvis of the kidney of a horse. Its section shows it to be capable of taking a polish, on account of the great compactness of its structure. It has several nuclei, around which the laminæ wind irregularly, like the layers in walnut-wood, and it has all the appearance of having been formed by the binding together of several original calculi by subsequent enveloping deposit. One side of it is flattened, smooth, and pale, looking as though it had been in contact with another calculus. Probably, if time had been allowed, this would also have been cemented to the general mass. The surface of the section is whitely brown, in lighter and darker lines; the external surface a dark blackish brown. The earthy matter in this calculus is carbonate of lime. Associated with it is a large proportion of organic matter, which forms thick rich brown flakes after solution of the earthy matter in acid. Here is a section of the calculus at right angles to the surface prepared for the microscope. It consists in some parts of dense agglomerations of spherules of all sizes, with a few oblong forms. In other parts, thick laminæ are seen running parallel to the surface. They are transparent and are evidently composed of completely fused crystallised spheres. They have smaller secondary laminæ, reminding one of the circumferential laminæ of bone. (See Fig. 4.)

The animal matrix looks exceedingly like soft vegetable structure that has undergone partial decay in water. Under the microscope, it is brown, and is completely occupied by round and roundish cavities of various sizes, corresponding evidently to the spherules. In some places, the structure is almost fibrous, and here probably it corresponds to laminæ.

These three carbonate of lime calculi can be advantageously compared. You will observe that they present three degrees of hardness and compactness, the calculus from man holding in these respects a middle position, but inclining to friability. The readiness to disintegration in the first is not, indeed, to be measured by its present condition. When first examined *in situ*, it was soft and plastic, like a lump of clay. This condition is associated with the presence of but little colloid, and that of a thin, and not tenacious, quality. Now, I have no hesitation in laying down the rule that, in proportion as a colloid departs from the typical form of colloid albumen, it has less power in disturbing the molecular arrangements of crystals and in binding the molecules after the first disturbance into spheres and masses of spheres.

Carbonate of lime is more easily turned than most crystalloids from

* Concluded from page 672 of last number.

the crystalline into the spherical forms by colloids. And the weak influence of the colloid in this case is shown, first, by the presence of many crystalline forms, and, secondly, by the marked individuality and perfection of the spheres. A stronger colloid would have subdued all the crystals and matted and cemented, and still further compacted by actual coalescence, the resulting spheres. This is exactly what we see in the hard renal calculus, where the colloid is present in large quantity and of considerable strength, in spite of the great condensation of the earthy material. The calculus from man has much colloid; but, while the crystals are entirely replaced by beautiful spheres, these latter are only slightly united together, and are nowhere fused into laminæ. The presence of phosphate in this calculus probably influences the form and increases the cohesiveness of the spheres. In Mr. Rainey's experiments, the most beautiful and perfect spheres were formed when mixtures of carbonate and triple phosphate were used. It seems to me a clear corollary from these observations that the question whether calculi shall be formed in the urinary passages is very much determined by the amount and character of the colloids present in the

Fig. 4.

Fig. 5.

urine, or shed into it by the surfaces. Colloid was present, gluing these spheres and calculi together into a soft clay. A little less colloid, or a little softer one, being present, the clay would have been soft mud. And with less colloid, the mud would have been only a turbidity in the urine. If it were otherwise, calculi, as Dr. Thudichum has well pointed out, would be exceedingly common, or almost invariably formed in the herbivora. The urine of these animals is mostly alkaline, and full of large crystalline forms of carbonate and oxalate of lime.

So with human beings. Here the crystalline constituent is most commonly uric acid, less commonly oxalate of lime. Both are constantly found present in fresh urine; both are frequently passed for years together by a single patient without the production of calculi. It is only when some colloid nidus, like a clot or mucus, or colloid impregnation of the urine by albumen, or the like, is added, that the formation of calculi takes place.

Whether, indeed, carbonate of lime calculi are ever deposited from the urine or in the direct tract of the urinary passages, is very doubtful. Dr. Thudichum is of opinion that they are only deposited when the influence of the urine is cut off. The present specimens are just such as might have been deposited in prostatic diverticula, although the two examined by me gave no indication of being built upon any structure resembling the prostatic concretions described by Sir Henry Thompson. The calcareous prostatic calculi described by the same author are, again, very different from these, being very firm, hard, and polished, looking like pearl-barley. On the whole, these calculi rather correspond with some carbonate of lime calculi briefly described by Mr. Smith in the eleventh volume of the *Medico-Chirurgical Transactions*, p. 14, which were, like these small bodies, composed of carbonate of lime held together by animal mucus. To my mind, the calculi now in question are probably deposited in large ducts of the prostatic, and are to be compared to the earthy concretions formed in the ducts of racemose glands, though it is true that these are generally more completely composed of phosphates.

4. The next specimen follows very well on the foregoing to point its moral. It is a long narrow calculus, pointed at both ends, and resembling in shape a large orange-pip. It was passed by the urethra. The patient, a young man aged 24, who passed it had been healthy and free from bladder-troubles till about four years previously, when, by an injury to the neck, he was paralysed in the lower part of the trunk and lower limbs. For many months, the bladder was totally paralysed and the urine became ammoniacal and loaded with purulent mucus. And, when this had been going on for some time, he began to pass calculi. This is one of the largest; when cut through, it shows a white polishable surface in concentric layers, while its surface is crusted with a reddish material. The crust is chiefly uric acid.

The substance (nucleus included) gives the following reactions.

1. Heated on platinum, in the flame of a Bunsen's burner, it first turns black and then fuses. The fused matter is soluble in hydrochloric acid, and yields triple phosphate on the addition of ammonia, giving no precipitate afterwards with oxalate of ammonia. The nature of the precipitate is verified by the microscope, which shows the housetop crystals only.

2. Liquor potassæ causes the evolution of fumes of ammonia.

3. The nitric acid (murexide) test gives very feeble indication of uric acid.

4. A piece of the calculus dissolved in weak hydrochloric acid leaves a small pinkish residue, consisting of spherules, glomeruli, wheat-sheaves, and six-sided tables of uric acid, all of them such forms as would be assumed in presence of mucus or albumen. (See Fig. 5.)

The urine, when I saw him a day or two after the passage of the calculus, was, as he informed me, in its ordinary state. It was alkaline, very offensive, of specific gravity 1026, and contained albumen and much purulent mucus. In the mucus were crystals of triple phosphate in abundance, and numerous spherules of dark brown urate of ammonia. The present state of the urine demonstrated, in fact, the mode of production of the calculus. The crystals and the spherules were actually blending into masses in the mucus under one's eye. And without the influence of the mucus or albumen the crystals would no more have fused into calculi than do the carbonate and oxalate crystals constantly present in the urine of the healthy horse.

5. The last specimen about which I shall speak to-day is the bit of soft horny-looking matter, which is all that remains of a soft solid mass as large as a small bean, which a medical friend brought to me not long ago for examination. It looked then (and in drying has not altogether lost the resemblance) like caoutchouc softened by heat; so much so, in fact, that a suspicion had arisen of its being caoutchouc, and question had been made as to the possibility of a caoutchouc instrument having been broken in the bladder. Some of the stuff, on being touched with the flame of a match, had burned with a large smoky flame like camphor or caoutchouc.

When first examined by me, the substance was of a dark brown colour, tenacious, not elastic, and without smell. A portion exposed on platinum put to the flame of a spirit-lamp took fire and burned with a yellow smoky flame, giving off a smell like that of charred flesh or hair, not a resinous odour; the ash fused under the blow-pipe flame and gave afterwards indications of phosphoric acid. The nitric acid reaction for uric acid was used with negative results. Under the microscope, no structure was found, but part was clear and transparent, part granular and opaque. There were a few crystals of hæmatoidin. The hæmin test, with dry chloride of sodium and glacial acetic acid, brought out no more crystals; but it was observed that the granular portions became swollen, and that the granules on the surface expanded into spheres and tubes. The tubes thus shot out from the free surface were exactly like the tubes observed by Dr. Montgomery when myelin was placed in contact with water. The observations of Dr. Montgomery were made several years ago, when he was curator of the museum of this hospital, and it may be useful to make brief reference to them. To obtain his material, Dr. Montgomery made an extract of yolk of egg by long digestion in hot alcohol. The alcohol, on cooling, threw down a soft solid, which at that time generally received the name of myelin. Dr. Montgomery showed that, when a little piece of this was exposed to the action of water under the microscope, it could be seen to throw out from the surface a forest of tiny processes with rounded ends. The processes grew from the base, and by this means lengthened themselves almost indefinitely without variation of calibre; they were transparent, refractile, and had often a double outline, which made them look like tubes; they could hardly be distinguished from the processes which issue from the cut ends of fresh nerves on immersion in water.

I have lately obtained similar tubes in great beauty from specimens of a highly phosphorised matter extracted from brain-substance by Dr. Thudichum—his kephalin. His "buttery matter", a less purified extract rich in cholesterine, yields even more beautiful fibres and processes. And no other substances that I know of give the reaction. Dr. Thudichum's myelin, a subcrystalline educt of the brain, does not, nor will fresh blood-clots; but there is certainly good reason for believing in the presence of highly phosphorised colloids in blood-corpuscles, both white and red.

On the whole, I am inclined to regard this substance as an old blood-clot long detained in contact with inflamed or ulcerated surface in some part of the urinary passages. Most of the colouring matter has been washed out or decomposed, leaving the brown tint and the few crystals of hæmatoidin. A clot so placed would be liable to infiltration by amœboid corpuscles; and, if so, these in their turn have probably undergone decomposition, leaving behind only their very

stable phosphorised material. For it may be noticed that, whereas lecithin is a very unstable matter, kephalin has been shown by Dr. Thudichum to be remarkably indisposed to decomposition.

The presence of such a phosphorised matter in large quantity would cause combustibility, as well as give rise to the singular microscopical reaction described.

AN ADDRESS

ON

OPHTHALMOLOGY IN ITS RELATION TO GENERAL MEDICINE.

The Annual Oration delivered before the Medical Society of London.

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IV.

LEAVING now the consideration of paralytic affection of the eyes from central disease, with other specially associated motor symptoms, we pass to sensory affection of the eyes with other specially associated sensory symptoms. We first note that there is a sensory symptom which is the strict analogue of the motor symptom—lateral deviation of the eyes—hemipia. This sometimes occurs with hemiplegia, and with that kind in which there is great defect of sensation. What is more to the point, it occurs in some cases where there is one-sided defect of sensation without discoverable paralysis. In all the cases of hemipia I have yet seen, the disposition has been that the patient had lost power to see to the side on which his body was anæsthetic or dysæsthetic, just as in the analogous motor cases the patient has always lost power to look to the side on which he was paralysed.

Here, then, we have an unilateral motor and a corresponding unilateral sensory symptom. The former, beyond all question, depends most frequently on destruction of the corpus striatum; in one case of the latter, there was disease of the optic thalamus. It is certainly doubtful whether hemipia with hemianæsthesia depends on disease of the thalamus only. Charcot says that one-sided amaurosis is produced by lesion of the posterior part of the internal capsule. He attributes any hemipia accompanying hemiplegic anæsthesia to lesion, direct or by compression of the optic tract. He thinks that lesion of the posterior part of the internal capsule produces defect of sight of the opposite eye only, there being no ophthalmoscopic appearances. To explain this, he supposes that the external fibres of the optic nerve which do not decussate in the chiasma decussate with their fellows in the corpora quadrigemina, whilst the fibres which decussate in the chiasma pass directly through the corpora geniculata to the cerebral hemisphere. For my part, I have not seen loss of sight of one eye from disease of any part of one cerebral hemisphere, except by the process of optic neuritis, and only two cases in that way. But, at any rate, there can be little doubt that hemipia and hemianæsthesia are owing to a destructive lesion in the region of the optic thalamus, and, speaking clinically, it is certain that there does occur from one sudden lesion a sensory paralysis the perfect analogue of the hemiplegia with lateral deviation of the eyes.

We saw that there was a mobile counterpart to hemiplegia in unilateral spasm, with spasmodic lateral turning of the eyes to the side convulsed; so there is a mobile counterpart of the one-sided sensory disorder with hemipia. In some cases of migraine, as Latham and Living have told us, there is a development of retinal sensations to one side, along with pricking, formication, etc., of the limbs of that side. This is the sensory analogue of spasmodic turning of the two eyes to the side convulsed in unilateral epileptiform seizure. In the one, there is discharge of convulsions in connection with the corpus striatum, as there is in the other, I think, of convulsions in connection with the thalamus opticus. Both are, I think, epilepsies in the sense that there are "discharging lesions" of some part of the cortex cerebri, although of different parts of the cortex. In cases of paroxysmal sensation development, as well as in cases of the motor development (epileptiform convulsion), we shall profit very largely by what Ferrier has done in his researches into the sensory areas of the brain. It seems to me that all clinical evidence points to the region of the optic thalamus as the seat of the discharging lesion in cases of migraine with visual phenomena. Latham thinks that the paroxysm of migraine is owing

to arterial contraction in the region of the posterior cerebral. Living thinks that there is in the paroxysm a "nerve-storm" traversing the optic thalamus and other centres. Ferrier's experiments, if not decisive, supply the only physiological evidence there is as to the cerebral locality where retinal impressions are specially represented. It is true that, in monkeys, he finds that extirpation of the angular gyrus is followed, not by hemipia, but by loss of sight of the opposite eye; his conclusions are endorsed by Charcot from clinical evidence. Hence I freely admit that there is a want of harmony betwixt present clinical investigations and physiological experiments. What, however, I would urge is careful attention to Ferrier's researches in this matter and methodical study of the very striking visual phenomena occurring in some cases of migraine along with other sensory symptoms of that disease. It would, however, be difficult to add to what Latham and Living have already done as to migraine. Excepting these physicians, little attention has been paid in this country to abnormal developments of visual sensations in their relation to developments of other sensations. But abnormal developments of sensations are as worthy of study as are developments of movements.

In the study of epilepsy, it is as important to note that coloured vision is a constant precursor of some seizures as that spasm of the hand is of others. It is very important that this kind of work should be done methodically, especially as there do occur cases which show degrees of intermediateness betwixt unilateral epileptiform seizures and the cases of migraine above spoken of—cases in which I suppose the discharging lesion is wide or betwixt the motor and sensory areas of the cerebrum. One general remark may be made; viz., that development of sight-sensations are more frequently precursors of epileptic attacks than any other special sense warnings, except touch. Smell is next in frequency, and an auditory sensation is rare. That sight should be the sense most often to suffer one would conclude *à priori*; it is the most representative sense; most ideation is carried on in visual ideas, whether that be the ideation of waking or that of dreaming, or the morbid ideation of delirium. Auditory hallucinations are rare, and, when they occur, betoken unusual gravity of mental affection. There is as yet no precise *post mortem* evidence as to the whereabouts of disease in any single case of epilepsy or epileptiform seizure beginning by development of sensation of smell, sight, hearing, or taste. Ferrier's researches as to the sensory areas of the brain are here very valuable. We should, if we happen to obtain *post mortem* examination in any case of epilepsy beginning by retinal or other sensations, search with great care the particular sensory areas, which Ferrier declares to be the seat of such sensation. This advice will only do harm to those who determine to find when they should be only carefully searching.

But, keeping to development of sight-sensations, there are some points of direct utilitarian interest. A patient may have attacks of coloured vision only long before he has severe epilepsy heralded by that sensation. Thus a married woman twenty-five years of age was one day sitting peeling potatoes, when "her sight became blue", and then she lost it; this she supposed lasted ten minutes; feeling her way, she went into another room and bathed her eyes. Subsequently, she had an exactly similar attack, followed by a severe fit with loss of consciousness and tongue-biting. It is a very common thing for a patient to have both partial attacks with coloured vision, and severe attacks heralded by that sensation. It has been noticed by Falret, and I think it is so, that red is the colour most often developed; it is what one would expect *à priori*, for red is the colour soonest lost in amaurosis; we should expect it to be so from the analogy of motor affection. Those parts which are most frequently paralysed are those most often seized by spasm.

Again, it is a very common thing for a paralysed or partially paralysed part to be seized with paroxysmal spasm, and similarly it is not uncommon for a patient who is blind or partly blind from cerebral disease to have attacks of coloured vision. There is still another analogy: it is a common thing to find temporary paralysis of a part after it has been recently convulsed. There is, I think, as Todd and Alexander Robertson have suggested, temporary exhaustion. It would be well to note, when we have the chance, whether, after development of colour-vision, there remains loss or defective power to perceive that colour. Dr. Alexander Robertson has noticed this sequence in one case. In the case of the woman who had development of the colour blue, there was a loss of sight for a time; the loss of sight, however, may have resulted either from local exhaustion of the parts discharged or from the discharge becoming very excessive, for during excessive discharge there is no sensation.

I now come to speak of the value of the ophthalmoscope in medical practice. In cases of blindness or great defect of sight, we nearly always discover something wrong in the eye. It may seem at the first glance that, when the defect of sight is produced by intracranial dis-