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A Course of Lectures

ON

URINE, URINARY DEPOSITS, AND CALCULI.

DELIVERED AT THE PATHOLOGICAL LABORATORY,
DURING THE SESSION 1857-58.

BY

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LECTURE XI.

IV.—THIRD CLASS OF URINARY DEPOSITS.

[Continued from p. 969.]

Cystine occurs occasionally as a crystalline sediment in urine, and also enters into the composition of a rare form of calculus which has been termed the *cystine calculus*. *Cystine* was formerly spoken of under the name of *cystic oxide*, and the same term was applied to the calculus.

Cystine forms a whitish deposit, which is found, upon microscopical examination, to consist of characteristic *six-sided plates*, which may be distinguished from uric acid crystals of

Fig. 43.—Crystals of cystine.

the same form by dissolving a portion of the deposit in ammonia. Upon the spontaneous evaporation of this ammoniacal solution, the *cystine* is again deposited unchanged in its hexagonal crystals; while uric acid would have been converted into urate of ammonia, which, on evaporation, would have remained as an amorphous residue. Ammonia, it appears, merely dissolves the *cystine*, and does not enter into combination with it. *Cystine* is insoluble in boiling water, in strong acetic acid, and also in very weak hydrochloric acid; but is readily dissolved by oxalic, and by the strong mineral acids. The most remarkable property of this substance is, that it contains as much as 26 per cent. of sulphur—a character in which it resembles *taurine*. Potash, like ammonia, readily dissolves *cystine*; but it is insoluble in carbonate of ammonia. The presence of sulphur in *cystine* may be proved by heating the substance in an alkaline solution of oxide of lead, when a black precipitate of sulphuret of lead occurs. This test cannot be regarded as diagnostic of *cystine*, because all animal matters containing sulphur exhibit a similar reaction. Urine containing *cystine* is said to smell very much like sweet briar.

Dr. Golding Bird has observed that calculi composed of this substance undergo a change of colour by long keeping. From pale yellow or fawn coloured, they have been found to assume a greenish grey, and sometimes a fine greenish blue tint. Crystals of *cystine* may be obtained from a calculus composed of this substance by dissolving a portion in a solution of potash, and adding excess of acetic acid to the alkaline solution, when the *cystine* will be deposited in six-sided plates. Virchow and Cloëtta have proved that *cystine* is sometimes found in the liver; while *taurine* as well as *cystine* have been detected in the urine.

Of the conditions of system which give rise to the elimination of this substance by the kidneys, little is at present known. In the majority of cases in which it has been found, the general health and nutrition of the patient have been bad. Dr. Johnson found *cystine* once in the urine of a prisoner, and it is from time to time met with in the urine of ill-nourished persons. When examining the urine of the insane for Dr. Sutherland (*Trans. Med. Chir. Soc.*, vol. xxxviii, 1855, p. 26), I was surprised at the number of specimens which emitted large quantities of sulphuretted hydrogen after standing a few days. It is not improbable that the sulphur resulted from the decomposition of *cystine* or some allied substance.

The notes of the following interesting case were sent to me by Dr. Milner Barry of Tunbridge Wells, who also procured some specimens of the urine for analysis.

CASE. "Mr. A., aged 23, dark complexion, well built and well nourished, of active habits, assiduously engaged in the duties of a laborious profession, suffers occasionally from sick headache, but is otherwise in the enjoyment of excellent health. The presence of *cystine* was ascertained microscopically at the beginning of October 1857; but, as deposits supposed to be urates had often been previously noticed, the probability is that the *cystine* had been excreted in the urine for a long time. It seems now never to be absent from the urine. Debilitating agencies, and whatever promotes the metamorphosis of tissue, intellectual exertion, active bodily exercise, mental anxiety, and smoking, appear to cause an increase in the amount of *cystine*. You will observe the much larger relative proportion of the ingredient in the morning urine than in that passed in the evening a few hours after a meal. There is no lumbar pain, and no irritability of the bladder." (*Archives of Medicine*, vol. i.)

The first specimen of urine was received in October 1857. It was of the natural colour, of acid reaction, and had a smell not unlike that of sweet briar. Specific gravity, 1028.

Analysis 61.

		In 100 grs. of solid matter.
Water		937.60
Solid matter		62.40
Urea		32.80
Uric acid		.50
Extractive matter		12.90
Sulphuric acid		1.70
Fixed salts	{ Chloride of sodium	12.00
16.00	{ Earthy phosphates	1.00
	{ Alkaline phosphates	2.50
		4.00

The next specimens were received on January 28th, 1858. No. 62 was passed on the morning of the 27th, at eight o'clock (before breakfast). Its specific gravity was 1034.

Analysis 62.

		In 100 grs. of solid matter.
Water		916.00
Solid matter		84.00
Cystine		.906
Urea		49.00
Extractives		16.94
Fixed salts	{ Chloride of sodium	9.30
17.6*	{ Sulphuric acid	4.50
	{ Earthy phosphates	.60
	{ Alkaline phosphates	4.20
		5.00

No. 63 was passed at 9 P.M. on the 26th, three hours after dinner. Specific gravity, 1027.

* In these analyses the fixed salts were estimated by incineration, while the sulphuric acid, phosphoric acid, and chloride of sodium, were estimated volumetrically. The slight discrepancy in the numbers arises partly from the volatilisation of some of the saline constituents during incineration, and partly from slight errors in the analyses, unavoidable when only small quantities are operated on.

Analysis 63.

		In 100 grs. of solid matter.
Water		949.30
Solid matter		50.70
Cystine		Too little to estimate
Urea		28.40 56.01
Extractives		1.30 2.76
Fixed salts	(Chloride of sodium	11.20 22.09
19.6	(Sulphuric acid	1.90 3.74
	(Earthy phosphates	.60 1.18
	(Alkaline phosphates	2.30 4.53

In these analyses, it is interesting to notice that the sulphuric acid is by no means deficient; indeed, in the second, the amount present is considerably above the average quantity met with in healthy urine. The proportion of cystine present, although occupying a considerable bulk, is really very small; so that the opinion commonly entertained with reference to cystine being a compound in which the sulphur is removed from the organism in an unoxidised state, in consequence of the oxidising processes of the organism being in a low condition, will not explain its formation in the present instance, as the analyses prove that a much larger quantity of sulphur passed off as sulphuric acid than in a state of combination in the form of cystine. It is interesting to notice the large proportion of sulphuric acid present when the cystine existed in sufficient amount to be determined quantitatively.

Carbonate of Lime is said to occur occasionally in the crystalline form in human urine; its microscopical characters are somewhat similar to those of the carbonate of lime which is met with in the urine of horses and other herbivora; but the crystalline spherules are smaller and more delicate. From the drawings given, it would seem that the slender crystals of which the globular mass is composed are not arranged so compactly together as in the case of the salt so common in horses' urine. In highly alkaline urine, in which the alkaliescence is caused by carbonate of ammonia set free by decomposition of urea, carbonate of lime occurs in small quantity, but in an amorphous form. This is the only form in which I have yet seen carbonate of lime in human urine. Carbonate of lime may be recognised by the effervescence produced upon the addition of a drop of acetic acid to the deposit suspected to contain it, care being taken that the sediment be well washed with distilled water before adding the acid, in order to remove any soluble carbonate that may be present. Urinary calculi containing carbonate of lime have been met with, but they are not common. Mr. Hitchins of Oxford has removed two or three, which are deposited in the Oxford Museum. Chalk or marble is occasionally added to urine, for the purpose of deceiving us. The presence of these substances is easily recognised by the action of acid, and by their being insoluble in water.

Silica, it is asserted, in a few instances forms a constituent of some calculi. Berzelius long ago showed its presence in minute quantity in the ash of human urine; but it has never been met with as a deposit in this secretion, unless placed there in the form of sand, for the purpose of imposing upon us. I have received the urine of a hysterical girl for examination, containing nearly a fourth of its bulk of common house-sand. In this quantity, we could hardly fail to detect its composition; but the presence of a few grains might possibly give rise to some little difficulty, when they were found in urine. Their nature, however, would be determined by treating them with boiling nitric acid, in which they are quite insoluble. Under the microscope, they appear as crystalline particles, of a very irregular form.

Blood-Corpuscles usually form a red or brownish-red granular deposit, which sinks to the bottom of the vessel. A few corpuscles are diffused through the tissue. If the urine be perfectly neutral, or slightly alkaline in its reaction, the colour of the globules will be bright red; while, in those instances in which the reaction is decidedly acid, the globules will be found of a brown colour, imparting to the supernatant fluid a smoky hue. When the urine has a decidedly smoky appearance, it will generally be found that the blood is derived from the kidney; while, in the majority of cases in which it retains its florid colour, it is derived from the bladder, prostate, or urethra. Occasionally, however, when the urine is alkaline, the blood, although it comes from the kidney, exhibits its ordinary florid red colour. If blood-globules remain long in urine, they become much altered in form, the outline appearing irregular and ragged, and the surface granular. (Fig. 44.) Not unfrequently the blood-corpuscles are swollen and very much

distended. These changes, no doubt, are chiefly dependent upon physical causes.

Fig. 44.—Blood corpuscles. *a, b, c*, taken from the living body; *d, e, f*, from the urine; *d*, corpuscles smaller than natural; at *e*, their circumference serrate and ragged; and at *f*, a somewhat similar appearance is shown.

Of Blood in the Urine clinically. Blood in the urine may be derived from any part of the genito-urinary mucous membrane. In the female, it often escapes from the vessels of the uterus or vagina. It is of course always met with in the urine of the female at the catamenial periods.

Blood may come from the kidney, in consequence of recent inflammation or old standing disease leading to congestion and subsequent rupture of the vessels of the Malpighian body, or its escape may depend upon that peculiar condition of system in which there is a tendency to capillary hæmorrhage in all parts of the body. When blood-corpuscles are found entangled in casts, we may feel certain that they come from the secreting structure of the kidney. In these cases, the urine generally exhibits the well known smoky appearance which depends upon the action of the acid of the urine upon the colouring matter of the blood. In cases in which, from various symptoms, we are led to suspect the existence of chronic kidney-disease, it is a favourable sign if the albumen is not detected after we fail, upon microscopical examination, to find blood-corpuscles. If the albumen, however, continues to be passed, we may feel certain that it was not solely derived with the serum which escaped through the ruptured capillary vessels with the corpuscles, but is to be attributed to chronic renal disease. Hæmaturia may depend upon a calculus being impacted in the kidney, or upon the existence of fungus of the kidney or bladder. Its escape may be due to disease of the bladder or prostate. In malignant disease, the patient is often terribly exhausted by the violent and frequent hæmorrhage which no remedies will restrain. Simple hæmorrhage, not dependent on organic disease, sometimes takes place from the mucous membrane of the bladder, as well as from other mucous membranes, as from that of the nose, throat, lungs, stomach, etc.

Chemical Characters of Urine containing Blood. Urine containing blood-corpuscles must also contain serum; but the quantity of this fluid is in many cases very small, although numerous blood-corpuscles are to be discovered by microscopical examination. If there be much blood, the albumen of the serum is readily detected by the ordinary reagents.

Circular Spherules closely resembling Blood-Corpuscles. Occasionally the spherules of fungi are found in urine which very closely resemble blood-corpuscles in size, and also in their general appearance. (*Archives of Medicine*, vol. ii, p. 49.) Upon very careful examination, however, with a high power, a little point may frequently be observed just external to them; and not unfrequently two sporules may be seen united together. They vary in size more than blood-corpuscles. A short time since, I received a specimen of urine from a friend which contained numerous sporules; and the resemblance to blood-corpuscles was so great that, had I examined the specimen

Fig. 45.—Circular sporules resembling blood corpuscles from acid urine.

carelessly, I should certainly have considered them to be of this nature. By using a power of seven hundred diameters, their characters were distinctly made out. In these cases,

albumen due to the existence of kidney-disease may be found in small quantity, which would complicate the case, and increase the chance of our being led to form a wrong conclusion. When doubt exists, the deposit should be set aside for a few days, when the spores will germinate, and all question as to their nature will be removed.

BODIES RARELY MET WITH IN URINARY DEPOSITS, AND SUBSTANCES OF A DOUBTFUL NATURE.

Under this head I must include tubercle and cancer, and a few bodies of the nature of which I am not perfectly certain. Some of these substances have been carefully examined by other observers, but the results have not been sufficiently satisfactory to justify positive statements as to their nature.

Cancer-Cells. In cases of cancer of the bladder, it is not uncommon to meet with well defined cancer-cells in the urine. Some time since, Mr. Fergusson requested me to examine for him a small portion of gelatinous-looking matter, which had been passed by a patient suffering from bladder-affection. Of the exact nature of this matter there had been some difference of opinion. Upon treating a fragment of it with a little glycerine and water, and subjecting it to examination with a power of two hundred diameters, I had no difficulty in making out loops of capillary vessels covered with a thick layer of cancer-cells. The specimen presented the usual appearances which distinguish a cancerous tumour which is rapidly growing into a hollow viscus, and was evidently one of the tongue-like or villous processes, broken off from the mass. There could, therefore, be no further doubt as to the exact nature of the case. The diagnosis was confirmed by subsequent examination of the parts.

From time to time, specimens of urine are sent for examination containing numerous well defined spindle-shaped cells, which, from their general resemblance to the cells of scirrhus, are sometimes considered to prove the existence of this terrible malady in connexion with the kidney or bladder. In several such instances, I have no doubt that the cells in question have been derived from the ureter, and their presence was quite unconnected with disease. It is very important to bear in mind that the epithelium of the ureter, and some cells derived from certain parts of the mucous membrane of the bladder, very closely resemble in form and general appearance the drawings which are given of the cells of hard cancer.

Tubercle. Tubercle is occasionally met with in urinary deposits. Dr. Thudichum (*The Pathology of the Urine*, p. 265) alludes to a remarkable and undoubted case which he saw in the Brompton Hospital. It is often very difficult to identify tubercular matter in sputum; and in many cases where the deposit escaped in the urine, the disintegration of the tubercular matter would be so great as to interfere with its detection. The characters of tubercle are represented in *The Microscope in its Application to Practical Medicine*, 2nd ed., pages 276 and 290.)

Spherical Bodies containing Nuclei and Granular Matter. Round structures presenting these characters are not unfrequently met with in specimens of urine; but I have not been

The cells represented in Fig. 46 were found in the urine of a patient suffering from rheumatic fever. The smaller round bodies are altered blood-corpuscles.

The large cells above referred to contained several transparent bodies within them, which became very distinct upon the addition of acetic acid (nuclei?). The central bodies did not refract light as oil-globules, nor did they present the circular dark and well defined outline so characteristic of them.

In Fig. 47 are represented specimens of large cells filled with dark granular matter, but not containing any oil-particles, from the urine of a case of chronic bronchitis. There were also a few pus-globules present in this specimen. Fig. 48 represents a curious cell found in the urine of a case of renal dropsy of seven weeks duration. Casts of medium diameter, with a few small cells containing oil, were also present in the same specimen of urine. Of the nature of these bodies I am not certain, neither have I been able to ascertain from what part of the genito-urinary mucous membrane they have been derived. Every care was taken to prevent the presence of matters of extraneous origin; but it is not impossible that some of the peculiar cells have been derived from sputum which has been altered by the action of the urine.

Fig. 47.—Large cells filled with granular matter in the urine of a case of chronic bronchitis. X 215.

Fig. 48.—Cell found in the urine of a case of renal dropsy. X 215.

Cells presenting somewhat similar characters have come under my notice in several other cases; and from that portion of the mucous surface of the bladder known as the trigone, I have obtained cells agreeing with them in general characters. It is not unreasonable, therefore, to assume that many of these peculiar cells are modifications of bladder-epithelium.

"Small Organic Globules". Under this name, Dr. Golding Bird has described some little bodies smaller than the pus or mucous corpuscles, with a perfectly smooth exterior, and unaffected by acetic acid. Dr. Bird suggests that they may be nuclei which have been set free from a cell by the bursting of the investing membrane.

Fig. 49 represents the appearance of the deposit from the urine of a patient suffering from calculus. The small round bodies represented in different parts of the figure were insoluble

Fig. 49.—Small globules and octohedra of oxalate of lime. X 215.

in strong acetic acid, and were unaltered on the addition of ether or potash. Many of them contained a central dark spot. They were accompanied with numerous small octohedral crystals of oxalate of lime. From their highly refractive properties and chemical characters just referred to, it is probable that they were composed of oxalate of lime.

Dr. Balfour of Edinburgh (*Edinburgh Medical Journal*, vol. i, 1856, p. 617, note) has shown that altered blood-corpuscles may be regarded as Dr. Golding Bird's small organic globules. After the crenated margins, so often seen in blood-corpuscles in urine, have made their appearance, the globule undergoes further change, until at last it resumes its spherical appearance, but becomes much smaller than before, and is not altered by hot or cold acetic acid. These so-called small organic globules may therefore consist of little spherules of oxalate of lime, altered blood-corpuscles, or the sporules of fungi. I have

Fig. 46.—Cells from the urine of a case of acute rheumatism. a. In the natural state. b. Treated with acetic acid. c. Cells resembling pus. d. The same treated with acetic acid. The small circular bodies are blood corpuscles X 215.

able to determine with accuracy the portion of the mucous tract from which they are derived, or their pathological importance.

demonstrated the last in a great number of cases; and sometimes they form a "visible white deposit", such as Dr. Bird described. It is a pity that the name "organic globule" has been used at all, for certainly several widely different substances answer to the characters given to it. The so-called "large organic globules", or "exudation-corpuscles", have been shown to consist of an aggregation of fat-globules, such as is found in cases of fatty degeneration of the kidney. I have therefore thought it better, in order to avoid confusion, not to employ the term in these lectures. (See Lecture ix; also *The Microscope in Medicine*, 2nd ed., p. 326.)

If the practitioner should meet with objects whose nature he cannot ascertain, he should at once make careful drawings, and take notes of the case in which they occurred. The importance of being familiar with the appearances of all the extraneous substances likely to be met with has been already referred to.

[To be continued.]

Clinical Lecture

ON

BLOWS ON THE EYE-BALL, ATTENDED WITH RUPTURE OR LACERATION; AND DISTURBANCE OF THE CONTAINED PARTS.

By HAYNES WALTON, Esq., Surgeon to St. Mary's, and to the Central London Ophthalmic Hospitals.

GENTLEMEN,—Blows on the globe of the eye may cause rupture of its coats, or the separation, or dislocation, of some of its internal parts. Bursting is no uncommon occurrence, and when the sclerótica suffers, the superior, or the internal portion, between the cornea and a line concentric to the attachment of one of the recti muscles generally gives way. I have seen but one exception, when the rupture was on the outer side. It has been suggested that the sclerótica tears at a point nearly opposite to that which is struck, the blows which reach the eye-ball being, for the most part, on its lower, or its outer side; the upper edge of the orbit and the nose protecting it in these positions. The vitreous humour may escape in greater or lesser quantity, and accompanying this may be prolapse of the retina and the choroid. With so much damage the organ is very often destroyed. In a few cases I have seen profuse hæmorrhage.

Loosening of the lens, or more commonly displacement of it, is another effect of blows on the eye and on the head. Dislocation forwards is that most usual; and it may be either alone or in the capsule. If it be thrown against the back of the iris, and does not become opaque, the nature of the accident might be temporarily overlooked. The pupil may be occupied by the lens, but rarely for any length of time, since it either falls against the iris, or, what is more likely, into the anterior chamber. Pain is the usual concomitant of any form of this accident. It may exist with little or no inflammatory action. Sometimes it is of an intensely neuralgic character, portending destruction of vision, not only in the eye, but about the orbit and head. Acute inflammation mostly supervenes, and the organ is destroyed. I have, in a few cases, seen low inflammatory action, with little or no pain, equally fatal. In all cases the dislocated body must be extracted, if possible; but if this be impracticable, it should be reclined.

But the lens may lie in the anterior chamber without any untoward symptoms; and, most assuredly, if no irritation were set up, I should leave it alone and trust to absorption. Even with slight local disturbance, in a patient under forty years of age, I should not interfere. Above forty, when the lens fibres increase in density, and absorption of them cannot quickly occur, I should make the earliest symptoms of irritation the signal for me to act. A dislocated lens and capsule should be removed from the chamber at once, that is as soon as we have assurance that the capsule is present, for months and years may pass away before absorption occurs, and even were it to be effected before the eye has been destroyed, the capsule might prove a source of much irritation, and, perhaps, become the seat of calcareous deposit. Mr. Laurence mentions the particulars of a patient who occasionally visited the London Ophthalmic

Infirmiry, with the lens surrounded by its capsule in the anterior chamber, where it had been for twenty-eight years; the general state of the eye is not given.

But the capsule may not get opaque; and how is its presence to be detected? I answer this by an extract from the review of my work on the eye, in the *British and Foreign Medico-Chirurgical Review*, by Dr. MacKenzie. He says "weeks, months, and, I suspect, years, may pass before any decided opacity shows itself in the lens or capsule, provided the latter enclosing the former has been separated from its connections, without any aperture by which the entrance of the aqueous humour is permitted. In such a case, the lens shows itself in the anterior chamber like a drop of water, of different specific gravity from the rest of the aqueous humour, and its margin seems surrounded by a narrow gilt ring of a splendid yellow colour! In this state he had extracted the lens and capsule before they exhibited the least opacity, although they had been dislocated for weeks. This is a point that I have fully considered in the forthcoming edition of my book, now in the press.

I may mention incidentally the particulars of a case of spontaneous dislocation of the lens and its capsule into the anterior chamber, in which the eye was lost by the irritation produced. An overgrown girl of thirteen was brought to me about three years ago, with staphyloma completely around and close to the cornea, enlargement and semi-opacity of the cornea, much pain, extinction of vision, and general redness of the eye-ball. While endeavouring to ascertain the cause of all this, an opaque capsule enclosing the lens passed forward into the anterior chamber. I now learnt that for some months this opaque body had been observed to pass from one chamber of the eye to the other. It was at once apparent that all the morbid action was produced by the dislocated part. As the other eye was suffering from supposed sympathetic implication, it was examined carefully, and its lens and capsule, quite opaque, were found to be reclining backwards into the vitreous humour, but yet retained a slight attachment to the lower portion of the suspensory ligament. The necessary operation on the right eye, that of "extraction," was followed by a cessation of all irritation. The parents of the girl would not allow the other eye to be touched.

Mr. Henry Howard relates, in one of the periodicals, an instance of spontaneous dislocation of lens into the anterior chamber of the eye, being productive of cerebral derangement. A female, aged 30, suffered from pain and inflammation in her left eye for nearly seven months, during the latter three of which headaches, attending with vomiting, were so severe as to deprive her of her senses. Mr. Howard found the whole eyeball inflamed, and the lens, with a small quantity of lymph, lying in the anterior chamber. Extraction was performed; from that time the vomiting ceased, and the head symptoms gradually subsided, and were quite lost after forty-eight hours. The lens must have been contained in its capsule. I am inclined to think that it escaped from its position so enclosed, and not, as Mr. Howard thinks, without it, in consequence of destruction of the capsule by inflammation. It is likely enough that there was softening and giving way of the suspensory ligament.

Many instances of spontaneous dislocation, some in young people, and which are, of course, always associated with morbid changes in the eye, are recorded by the late Mr. Dalrymple and others.

Sometimes there is a rent in the sclerótica, while the conjunctiva remains intact, or but slightly torn; the crystalline lens is forced out of the eye, and rests between these in close proximity to the cornea, constituting what is called "external dislocation of the lens." With this the iris is more or less paralysed or torn, and a portion, I believe, always carried out with the lens. Much blood is effused within the eyeball, yet vision may be retained.

The removal of the lens is the proper course. The simple process of raising the conjunctiva, snipping it, and removing the body is easily effected. It has been suggested not to interfere till a fortnight after the accident, that an opportunity may be afforded for the healing of the sclerótica; and that a simple rupture thereby may not be converted into a compound one, and the chances of recovery perhaps materially diminished. Certainly this would not be advisable if the pressure of the lens was productive of pain or irritation. In two cases I tried the method, but I conferred no benefit on my patients. In one, a young adult female, at the end of a fortnight the lens had become decomposed, and now was revealed the cause of the undue irritation, which before was unaccountable. In the other