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.*

URINE IN DISEASE. VI. GRANULAR AND CRYSTALLINE DEPOSITS, SMALL IN QUANTITY. *Uric Acid. Of the Crystalline Forms of Uric Acid. Tests for Uric Acid. Of the Clinical Importance of Uric Acid. Oxalate of Lime. Octahedral Crystals of Oxalate of Lime. Form and Composition of the Crystals. Dumb-Bell Crystals of Oxalate of Lime. Of the Formation of the Dumb-Bell Crystals. Of the Conditions under which the Dumb-Bell Crystals occur. Deposits often associated with Oxalate of Lime. Of the Examination of Deposits of Oxalate of Lime in the Microscope, and of their Chemical Characters. Of Oxalate of Lime in a Clinical Point of View. Cystine. Analyses of Urine containing Cystine. Carbonate of Lime. Blood-Corpuscles. Chemical Characters of Urine containing Blood. Of Blood in the Urine clinically. Circular Spores closely resembling Blood-Corpuscles. BODIES VERY RARELY MET WITH IN URINE, AND SUBSTANCES OF A DOUBTFUL NATURE. Cancer-Cells. Tubercle-Corpuscles. Spherical Cells containing Nuclei and Granular Matter. Small Organic Globules. ENTOMOZOA. Echinococci. Diplosoma Crenata (Farre). Strongylus Gigas. Larvæ of the Blow-fly. Acari.*

IV.—THIRD CLASS OF URINARY DEPOSITS.

Uric or Lithic Acid. Among the deposits which I have arranged in a third class, and which are characterised by their small bulk, by their crystalline or granular appearance, as well as by their density, may be mentioned, in the first place, *uric* or *lithic acid*—a substance which has before been brought under notice as a constituent of healthy urine, and of which the chemical properties and general characters were then briefly referred to. In this place, I wish to draw your attention to the various crystalline forms this substance assumes in different specimens of urine, and to the most simple methods of recognising its presence when its true nature cannot be positively determined by its crystalline characters. It forms a most important deposit, and perhaps is more frequently met with than any other form of urinary sediment, with the exception of the urates; and, although there seems reason to believe that, as chemico-pathological investigation advances, we shall no longer regard the presence of this, or indeed of any other substance, in the urine, as evidence of the existence of a particular diathesis, its presence in many cases as a deposit affords an indication that the chemical changes in the organism are more or less modified, especially when the deposit occurs very frequently.

The quantity of uric acid in the urine depends to a certain extent on the activity of the skin; and, as a general rule, when there is profuse cutaneous perspiration, the amount of uric acid in the urine will be found to diminish. If, on the other hand, the function of the skin be in any way impaired, or perspiration be impeded by cold, a considerable increase in the

quantity of uric acid will take place. Marcet found that the amount of uric acid diminished after severe perspiration; and Fourcroy noticed more uric acid in the urine of a man in winter than in summer. In this way may be explained the presence of the large quantity of uric acid in the urine of persons affected with acute dropsy, or dropsy after scarlatina; and it seems probable that the frequency with which these deposits are met with in the urine of persons affected with skin-diseases (especially eczema and lepra) may be due simply to the impaired function of the skin. In increased muscular exertion accompanied with imperfect respiratory action, uric acid occurs in abnormal quantity. It is present as a deposit in almost all cases of chorea. It should, however, be borne in mind that uric acid is often dissolved in the urine as a urate at the time it is passed, but is afterwards precipitated, being probably separated from its combination with soda (urate of soda) by the process of acid fermentation.

Of the Crystalline Forms of Uric Acid. In the great variety of crystalline forms which uric acid assumes, it is not surpassed by any other substance. Its true primitive form is not easily determined; but that in which it appears most constantly is the rhombic, although in many instances this occurs with two of its angles rounded. From its salts, however, the acid may be separated in rhombic tablets, or in six-sided plates, somewhat resembling crystals of cystine, by the addition of acetic, nitric, or hydrochloric acid.

The form of the crystal is much affected by the strength of the acid which is added. This subject has been investigated by Dr. A. E. Sansom (*Transactions of the Medical Society of King's College, London, Winter Session, 1856-57, p. 128*). The following are the results:—

Acid in small quantity	Crystals regular; mostly tables and squares; lozenges.
Acid in large quantity, added to a strong solution of urate of ammonia	Large and long tables, very elongated lozenges.
Acid strong; amorphous urate itself used	Acicular prisms most frequent.

The various forms which the substance assumes in urine may often be traced, by intermediate stages, from one into the other; but the conditions which determine the changes have not yet been satisfactorily explained. Doubtless the length of time occupied in the formation of the crystal has much influence in determining its form; for not unfrequently one crystal is observed to acquire entirely different characters if it

Figs. 38 and 39.—Some of the commonest forms of uric acid crystals.

be allowed to remain for a longer period immersed in the urine. Some of the commonest forms met with are represented in Figs. 38 and 39. The most important crystalline forms, besides the rhombic, are the rectangular quadrilateral prisms with terminal planes, and the dumb-bell crystal. All other forms appear to be some modification of these three. The dumb-bell form of crystals is occasionally met with in deposits; but it may often be readily obtained by the addition of an acid to urine. These crystals must not be mistaken for dumb-bells of oxalate of lime, from which they may be dis-

* ERRATUM. In last lecture, page 932, second column, line 30 from the top, for Fig. 38, read Fig. 37.

tinguished by their large size and darker colour, and by their being readily soluble in alkalis. Pure uric acid often crystallises in micaceous plates. Uric acid deposited in urine can generally be distinguished by its colour from other crystalline deposits, although two or three instances have come under my notice in which the crystals were found to be perfectly colourless. Various forms of uric acid are represented in the *Illustrations*, Plates IV, V, VI, VII. A very curious form of crystal is referred to at p. 134, and figured in Plate XIX, Figs. 3 and 4, vol. i, of the *Archives of Medicine*.

Uric acid is sometimes deposited very rapidly, when it forms a thin glistening film, in which no indication of crystalline form can be detected. A film of this kind was brought to me some time since by Dr. Chambers. After the lapse of a day or two, well marked crystals made their appearance. Some of these films are composed of layers of small crystals, closely matted together. After the lapse of a short time, the larger crystals grow, while the smaller ones disappear; so that at length a number of large well defined crystals are produced.

Tests for Uric Acid. When we are in doubt as to the nature of a deposit suspected to consist of uric acid, we may examine it as follows. If it consist of uric acid, it will be insoluble in hot water, but soluble in alkalis.

1. A portion of the deposit is to be dissolved in a drop of potash. The alkaline solution is then to be treated with excess of acetic acid. After the lapse of a few hours, crystals of uric acid will be formed, which must be subjected to microscopic examination.

2. A sediment, suspected to be composed of uric acid or a urate, may be placed upon a glass slide, and treated with a drop of strong nitric acid. After evaporation to dryness at a gentle heat, the slide is to be exposed to the vapour of ammonia, or a drop of ammonia may be added to the dry residue. A beautiful violet colour, owing to the formation of murexide, proves the presence of uric acid or a urate.

Of the Clinical Importance of Uric Acid. This substance exists in the blood, in combination with a base, as an alkaline or earthy urate, which is comparatively soluble. The soluble urate may be decomposed; 1, when it arrives in the uriferous tubes; 2, subsequently, when the urine reaches the bladder; or, 3, as more commonly happens, the acid may not be set free until some time after the urine has been passed.

In the first case, the acid may accumulate and block up the tubes, or perhaps form a small concretion; but, as I shall show in the next lecture, oxalate of lime very frequently forms the real nucleus of these uric acid calculi which are so common. In the second case, if any small concretion of any kind exist in the bladder, uric acid is deposited around it, and a uric acid calculus becomes rapidly formed. The deposition of uric acid after the urine has been passed is often merely accidental, and depends upon the decomposition of the urates by a process of acid fermentation, which has been fully investigated by Scherer. The acid crystallises sometimes very soon after the urine has been voided, sometimes not for some days afterwards. I have before alluded to the importance of not regarding the deposition of uric acid crystals as in all cases depending upon excess of the acid in the urine. There may actually be less uric acid than is present in health, although it may be deposited entirely in an insoluble form.

The occasional occurrence of uric acid as a deposit may be regarded as unimportant, especially when it is due to a change occurring in the urine long after its secretion. In not a few instances, however, when this deposit of uric acid is observed *day after day*, it does indicate the existence of derangement of the health. I may state generally, that you are likely to meet with this deposit in cases where a liberal meat diet is indulged in by those who take very little exercise; and in the urine of people who lead very sedentary lives, it is not uncommon. In various gouty affections, it is very frequently observed. In diseases of the liver, it is especially common; and temporary congestion of that organ is very frequently associated with the presence of much uric acid in the urine. In chronic diseases of the respiratory organs, we often meet with uric acid and urates in the urine. It is common in emphysema of the lung, and in chronic bronchitis. In pneumonia and rheumatic fever, it is often found. It is seldom absent in chorea, and very often exists in various forms of skin-disease, and in cases of acute inflammation of the kidney. It is occasionally met with in diabetes. There are many cases in which the tendency to deposits of uric acid is not very easily explained. Some children are very liable to suffer from uric acid deposits, and their appearance is accompanied by frequent desire to pass urine. In such cases, it is necessary to interfere, in case a

calculus should form. I have seen instances occurring in adults in which ordinary remedies appeared to exert no effect. The urine of a patient suffering from emphysema of the lung always contained a large quantity; and it appeared while she was taking considerable doses of alkalis, and also when she was put upon mineral acids.

Occasionally we meet with patients who appear generally in good health, but who complain of getting thin, although they live well, in many instances perhaps too well, and suffer from an almost constant deposition of uric acid. It is very difficult to explain this symptom in every case in which it occurs; but I feel sure that many of these persons overtax their digestive organs, and are in the habit of eating too much. They think that the only way to gain flesh is to consume a large quantity of food; and, in consequence of too much work being thrown upon their digestive organs, assimilation is not properly carried on, and a quantity of material is formed which is unfitted for conversion into tissue, and is perhaps got rid of in the state of urea, uric acid, and urates. By cutting off a great part of the supply, you may relieve their anxiety as to the gravel, and at the same time, to their surprise, cause them to gain strength and increase in weight.

I have already alluded to the great objection of employing the term uric acid diathesis, and have referred to the general principles which should guide us in the treatment of cases in which an excess of uric acid is eliminated in the urine.

[To be continued.]

Illustrations

or

HOSPITAL PRACTICE:

METROPOLITAN AND PROVINCIAL.

CASES OF OVARIOTOMY AT THE LONDON SURGICAL HOME.

Under I. BAKER BROWN, Esq.

CASE I. L. P., aged 20, married; no children. The tumour was first noticed two years ago; it was multilocular. An operation was performed on October 20th, 1858. The incision extended from the umbilicus to the pubes. The adhesions were unimportant, and easily separated. The pedicle was secured externally to the abdominal cavity. The patient recovered without a bad symptom. She is now perfectly well, and menstruates regularly.

CASE II. Miss N., aged 21, single. The disease was evidently congenital, but began rapidly to develop ten years ago. She had never menstruated. The cyst was multilocular. Operation was performed on February 10th, 1859. The incision was six inches long. The adhesions were unimportant. The pedicle was secured externally. Symptoms of peritonitis came on, collapse supervened, and she died seventeen hours after the operation. *Post mortem* examination showed a good deal of peritonitis, chiefly on the left side. The heart was small and flabby. The liver was adherent to the diaphragm. The removed cyst contained fat, hair, bone, and teeth.

CASE III. Mrs. D., aged 35, married, the mother of four children, had been tapped repeatedly. The disease was co-existent with ascites and general anasarca. She had been a hard drinker for many years. The operation was done on February 24th, 1859. The incision was seven inches long. Forty pints of ascitic fluid were removed before the cyst. The adhesions were few, but strong; and the vessels of one required ligature. The pedicle was secured externally. After the operation, incessant vomiting of bile came on, which lasted three days; and she sank. The *post mortem* examination showed great disease with much softening of the liver.

CASE IV. Miss N., unmarried. The disease rapidly came on. She was tapped once through the vagina. The operation was performed on December 5th, 1850. The incision was four inches long. The adhesions were easily broken down. The pedicle was retained without the abdomen. Three hours after the operation, violent pain came on; and she was bled, with great relief. On the eleventh day, a pint of pus escaped from the vagina. After this, she rapidly recovered, and has remained up to the present time perfectly well.

CASE V. J. B., aged 15, unmarried. The disease was of ten