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 I.

Note-Book; Conical Glasses for examining Urine; Quantity of Urine; Colour of Urine; Smell of Urine; Clearness or Turbidity; Consistence; Deposit; Specific Gravity; Methods of taking the Specific Gravity; Reaction; Acid Urine; Alkaline Urine, from the presence of Volatile or Fixed Alkali.

GENTLEMEN,—It will be my endeavour, in the present course, to combine the advantages of an oral lecture with those of a practical demonstration; and I think you will agree with me in the opinion that, in this manner, a greater amount of information may be gained in a short time, and its practical bearing upon the investigation of disease shown more satisfactorily than by listening to an ordinary lecture. I propose, therefore, to devote the first half-hour to a short description of the substances which you will afterwards have an opportunity of examining for yourselves. The remaining hour and a half will be occupied in subjecting the different constituents of the urine to microscopical and chemical investigation in the laboratory.

The first part of my course will comprehend the examination of healthy urine; and then I propose to give one demonstration upon the *microscopical examination* of those urinary deposits most frequently brought under the notice of the physician, and the changes which lead to the formation of casts of the uriniferous tubes. The examination of various morbid specimens of urine, and the detection of *extraneous matters*, will then be considered. Lastly, I propose to make a few remarks upon the different forms of *urinary calculi*, and to consider the conditions of the urine which lead to their formation.

My chief aim will be to direct your attention especially to those parts of the subject which bear upon the practical examination of the urine, with reference to diagnosis and the investigation of disease; and I shall only dwell upon those chemical processes and microscopical researches which are adapted for the *clinical examination* of this secretion, and which may, with a little trouble, be pursued by the practitioner. I shall briefly allude to the nature of the morbid changes which we are able to discover by an examination of the urine, but shall not attempt to discuss in detail the treatment to which the patient should be subjected,—for two reasons: first, because many of you are as well able to offer an opinion on this part of the question as myself; and secondly, because, as we all know, in the majority of these cases, the difficulty lies in the diagnosis: the exact nature and history of the morbid changes having been ascertained, the proper plan of treatment often at once suggests itself to the practitioner.*

Before I describe the different substances entering into the composition of healthy urine, I must refer to some preliminary operations to which the specimen should be subjected before it is attempted to separate its chemical constituents from each other, or to examine any deposit that may have been formed in the microscope.

Note-Book. The result of every observation should be carefully entered in a note-book at the time it is made; and it is often of the greatest importance to make a sketch of the microscopical characters of a deposit, and to append a careful but short description of the specimen at the time the drawing is made, as well as notes of the case from which the urine was obtained. (On drawing and measuring objects, see *The Microscope in its Application to Practical Medicine*, 2nd edit., p. 33.)

Now, suppose a specimen of urine brought to you for examination, how is the investigation to be commenced? what

are the first points which should attract your notice? in what order should they be observed? and how are you to ascertain the nature of constituents which are dissolved in the fluid, or which form a visible deposit?

The perfectly fresh urine should be poured into a conical glass vessel.

Conical Glasses for examining Urine. The best form of conical glass for placing specimens of urine in, is one suggested by my colleague Dr. Budd. It is represented in Figure 1. Its advantages are these—that the specific gravity may first be taken, and then the fluid allowed to stand, for the subsidence of any deposit, without transference to another vessel. It therefore combines the advantages of the conical glass and urinometer-tube in one vessel.

Fig. 1.

Quantity of Urine. It is very important in all cases to know the quantity of urine passed in twenty-four hours. The most minute examination often fails to show any fact of importance in the investigation of a case, in consequence of the quantity of urine passed not having been measured. The practitioner in many cases desires to know the general amount of compounds resulting from the disintegration of tissues which are formed in the course of a given time, and this knowledge cannot be gained unless the urine be carefully measured. This is the more necessary, as the amount varies so much even in healthy persons. The temperature of the air, and the amount of moisture present in it; the state of the skin and mucous surfaces generally; the activity of the functions of respiration and circulation; the amount of exercise; the quantity and nature of the food, and, of course, the amount of fluid taken,—are some of the circumstances which affect the *quantity* of the urine passed. In health, it may be said to vary from fifteen or twenty to fifty or sixty ounces. Dr. Thudichum, in some experiments carried on for from fifty to seventy days, in the case of two individuals, finds the average amount to be from sixty to sixty-eight ounces in the twenty-four hours. The experiments were performed during the months of November, December, January, and February. In round numbers, the proportion in health may be estimated at from twenty to sixty ounces; and a greater quantity is passed in the winter than during the summer months.

Colour of Urine. Urine from the same person varies much in colour at different times, and specimens taken from a number of persons in a state of health exhibit the greatest variation in tint. Nevertheless, important information is often gained by observing the colour of urine. In some cases, from the colour, we are led to suspect the presence of certain substances dissolved in the fluid; in others, we may feel sure that certain morbid constituents are not present. The colour of the urine, as well as many other characters, seems to be affected by the period of the day, the nature of the diet, the state of the respiratory process, changes of temperature, and many other circumstances. Healthy urine varies from a pale straw colour to a brownish yellow tint. In disease, it may be perfectly colourless, of a natural colour, bright yellow, pinkish brown, of a smoky appearance, blood-red, or even dark blue. What we learn from these differences in colour will appear when we come to consider the characters of the urine in disease. Urinary deposits also vary much in colour: they may be white, pink, red, pale or dark brown, blue or black. The nature of the colouring matters of urine has been carefully

* This course of Lectures was delivered only to practitioners.

investigated by Heller, who obtained a yellow colouring matter, *uroxanthine*. This can be decomposed into a red colouring matter, *urrorhodine*; and a blue substance, *uroglauine*. The former has the same composition as indigo red; the latter, as indigo blue. *Uroglauine* may be obtained from all specimens of urine, and, in disease, sometimes forms a visible blue deposit. Indigo blue has nearly the same chemical composition as hæmatine: it is doubtless formed from it. Leucine, which has also been met with many times in urine, is another substance which may be produced in the formation of this blue deposit of indigo. The yellow colouring matter of healthy urine was termed by F. Simon of Berlin, *hæmaphain*. The presence of a substance in the urine from which indigo can be obtained must now be regarded as a settled fact; and it is probable that the blue deposit observed in certain instances, and referred to by different authors, was indigo blue, formed by the decomposition of uroxanthine.* Dr. Hassall has published some interesting cases, and has very carefully analysed the deposit.† I can fully confirm his statements, as I have recently had an opportunity of examining a specimen of urine with blue deposit, which was sent to me by my friend Dr. Eade of Norwich.‡ *Uroerythrine* is another colouring matter described by Simon, and always associated with uric acid and urate of soda. This substance is probably the same as *purpurine*, described by Dr. Golding Bird. It has been analysed by Scherer, who finds that it contains about 65 per cent. of carbon. It would seem that, when the elimination of substances from the liver, rich in carbon, is interfered with, an increased quantity of this substance is excreted in the urine. Dr. Harley finds that the colouring matter of healthy urine contains a notable quantity of iron, like the hæmatine of the blood; and he gives to it the name of urohæmatine. Prout believed that the colouring matter of urine was due to the presence of a sort of resin; and Dr. Harley has lately isolated a resinous substance, which possesses many characters in common with the resin derived from certain plants, and closely resembles *draconine*, which is obtained from dragon's blood, the exudation from the stem of one of the resin-bearing palms.

The relation of the colouring matters of the urine to those of the bile has been dwelt upon, and Berzelius long ago drew attention to the resemblance of the latter to the chlorophyll of plants. Certain chemical reagents cause the same change in both these colouring matters. A red colouring material is not unfrequently seen in the cells in the central part of the lobules of the liver, and Dr. Bence Jones met with a gall-stone of a brick red colour. There is much reason for believing that the formation of these colouring matters is connected with the disintegration of blood-corpuscles, and the quantity formed and the intensity of the colour probably depend upon the activity of the oxidising processes going on in the organism; but the whole question of the production of colouring matter in the living body is still involved in great obscurity. The separation of a substance from the urine, from which indigo blue and indigo red may be prepared, must be regarded as a fact of the greatest interest; and further experiments on this subject are likely to lead to important results in connexion with the development of organic colouring matters.

Smell of Urine. From the smell of the urine, in some instances, the practitioner may gain useful information. Healthy urine has a peculiar and very characteristic smell, which has been described as aromatic, but well known to all: it probably depends upon the presence of certain organic acids. In disease, the specimen may be highly *pungent*, from the presence of *carbonate of ammonia*, which is produced by the decomposition of the urea excited by some animal ferment, especially by mucus of the bladder in a state of incipient decomposition. In other instances, it may have the smell of healthy urine, but the odour very much more intense. Sulphuretted hydrogen may be evolved from it. The smell of the urine is affected by many articles of food, such as asparagus, garlic, and cubebs. Turpentine, even if inhaled, causes the urine to evolve an odour something like the smell of violets.

Clearness or Turbidity. Healthy urine is perfectly clear and transparent; but, after it has been allowed to stand for a short time, a very faint, flocculent, bulky deposit collects towards the lower part of the vessel. This cloud consists of a little mucus, with imperfectly formed epithelial cells from the mucous membrane, and epithelial *débris*.

In disease, the urine may be opaque from the presence of different substances held in suspension. Urate of soda is the most frequent cause of this opacity, in which case the colour of the mass is generally of a dirty yellow, or brownish, resembling peas-soup. Very rarely it results from fatty matter in a minute state of division, and the urine has the appearance of milk. This occurs in cases of *chylous urine*. In these instances, the turbidity still continues after the urine has been allowed to stand still for some time; but generally the opacity of a specimen depends upon the presence of a deposit temporarily suspended in it from agitation, but which collects at the bottom of the vessel after a time, forming a visible deposit, leaving a perfectly clear fluid above it.

Consistence. Healthy urine is perfectly limpid, like water, and can be readily made to drop from a tube. In disease, however, the urine may be *slightly viscid*, or so *thick and glairy* that it may be drawn up at the end of a rod like a thread, and cannot be made to drop at all. It may be *semi-fluid*; and in rare instances, although passed perfectly fluid, it has afterwards assumed the form of a thick *firm jelly*, so that the vessel containing it might be inverted without its escape. Such specimens have been met with, associated with a milk-like appearance, in cases of *chylous urine*.

Deposit. The only deposit which urine in health contains is the faint unimportant mucus-cloud before referred to. All the constituents removed from the organism in this excretion, in health, escape in a perfectly soluble form; but when the healthy physiological changes are in any way interfered with, some of these constituents are produced in abnormal quantity, and are deposited, in an insoluble form, either at the time the urine is secreted, while it remains in the bladder, or at a variable interval of time after it has been passed. The deposit may be soluble in the warm fluid precipitated as soon as it becomes cold, or its deposition may be due to certain chemical decompositions occurring in the fluid.

The presence of a visible deposit in urine is, in all instances, to be regarded as *abnormal*. The nature and import of urinary deposits will engage much of our attention in the present course of lectures. I shall describe the different forms of deposit, and the mode of collecting them for examination, in a subsequent lecture.

[To be continued.]

Transactions of Branches.

BATH AND BRISTOL BRANCH.

CASE OF ENTOZOON IN THE BRAIN.

By F. BRITTAN, M.D., Physician to the Bristol Royal Infirmary, and Lecturer on the Practice of Medicine in the Bristol Medical School.

[Read February 24th, 1859.]

DURING last April, I was requested by Mr. Granville to see with him A. M., aged 29. The previous history of the case was as follows.

She had always been healthy, strong, and active, until about a year and a half since. She then began to suffer from irritation of the stomach and frequent vomiting, occurring chiefly in the morning and continuous for several hours. The attacks were variable in severity and effect upon the general health. The matter vomited was like that of pyrosis, watery, or mixed with the food. The vomiting was generally accompanied by pain in the head, closely resembling the nervous forms of headache. During the attack, and for some time after, there was great prostration, so that frequently she was unable to rise from her bed, and inability to take food; whilst general febrile excitement, seldom absent for more than a few days, mingled these symptoms together, presenting a complete resemblance to some well known forms of hysteria.

No definite indication of the true nature of the affection having been discovered, the treatment, Mr. Granville informs me, was directed chiefly to relieve the gastric irritation. "With this view, the various gastric and general sedatives were prescribed, and many indirect modes of allaying the main symptoms attempted, and the principal antispasmodic remedies usually employed in hysterical affections were tried with but slight success. Change of air was at one time recommended, and proved more efficacious; the general state of the patient was

* See note on Heller's observations upon the colouring matters of urine, in Dr. Thudichum's "Treatise on the Pathology of the Urine," p. 326.

† Philosophical Transactions, 1854, p. 297; Proceedings of the Royal Society, June 16th, 1853.

‡ This case will be published in the "Archives of Medicine," vol. i.