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 IV.

URINE IN DISEASE. *Arrangement of the Subject. Diathesis.*

EXCESS OR DEFICIENCY OF WATER AND THE ORGANIC CONSTITUENTS PRESENT IN HEALTH. *Excess of Water: Diabetes Insipidus: Deficiency of Water: Increased Acidity of Urine: Principles of Treatment: Nitric Acid in the Urine: Ammonia: on Detecting Urea in the Blood or Serum: on Detecting Ammonia in the Breath: Urea: Excess of Urea: Deficiency of Urea: Colouring Matter: Excess of Uric Acid and Urates: Principles of Treatment: Extractive Matters: General Remarks on the Increase of the Organic Constituents, with Analyses: Analyses of Urine in Chorea: Analyses of Urine in Skin-Disease.* EXCESS OR DEFICIENCY OF THE INORGANIC CONSTITUENTS PRESENT IN HEALTH. *Chloride of Sodium; its Diminution in Acute Inflammations: Sulphates; Increase in Cases of Chorea, Rheumatic Fever, etc.: Influence of Remedies: Alkaline Phosphates; Increased Secretion of Alkaline Phosphates in Inflammation of the Brain; Analyses: Earthy Phosphates; Increase in the Urine of Cases of Mollities Ossium; Analyses.*

EXCESS OR DEFICIENCY OF WATER AND THE ORGANIC
CONSTITUENTS.

[Continued from page 811.]

Uric Acid and Urates are present in certain proportion in healthy urine, but in disease a large increase is very frequently observed. The substances occur as urinary deposits, either from existing in too large a proportion to be dissolved in the urine when cold, or, as is probably the case in the majority of instances, from the development of an acid in the urine, which causes them to be precipitated from their solutions. We shall consider the microscopical characters of these bodies under the head of urinary deposits. In many acute febrile diseases, the proportion of uric acid is increased, and the period of resolution of inflammation is marked by diminished frequency of the pulse and respiration, by a fall in the temperature, by free perspiration, and by a very abundant deposit of urates. In health, from 5 to 8 grains of uric acid are excreted in twenty-four hours; but, in some acute diseases, the proportion may amount to twenty grains. In a case of fever, Dr. Parkes found that 17·28 grains of uric acid were excreted in twenty-four hours. Urate of soda is very readily caused to deposit crystals of uric acid. If the amorphous deposit be merely dissolved by warming the urine, the urate often becomes decomposed; and, as the solution cools, crystals of uric acid are deposited. In some cases, the quantity of uric acid held in solution is so great that, upon the addition of a drop of nitric acid to the urine, an abundant amorphous precipitate, exactly resembling albumen, is formed. Such a precipitate has many times been mistaken for albumen (see *Albuminous Urine*), and, even if examined under the microscope immediately after it is formed, its nature cannot be made out; but if it be allowed to stand for some time, the amorphous particles gradually increase in size, and assume the well known crystalline forms of uric acid. The instances in which I have met with urine exhibiting these characters have almost all been cases of liver-disease. Although the reaction is acid, no precipitate takes place upon the application of heat, which at once distinguishes urine of this character from albuminous urine.

The presence of an abnormal quantity of uric acid in the urine shows that more of this substance or its salts is formed in the blood than in health. It would appear that, in consequence of certain conditions, a large proportion of the uric acid resulting from the disintegration of albuminous substances is not further oxidised and converted into urea, but combines with ammonia, soda, or lime, forming urates of these bases.

In gout, the presence of uric acid has been detected in the blood by Dr. Garrod. *During* the attack there is less in the urine than in health; but *after* it is over, a large quantity of uric acid and urates are often carried off from the system in the urine.

In cases characterised by a tendency to the formation of much uric acid, the principal objects to be attained by treatment are, to favour the further oxidation of the uric acid formed, and to promote its solution and elimination from the blood as rapidly as possible. Good air and moderate exercise, with attention to the action of the skin, will fulfil the first object; and the solution and elimination of the urates will be encouraged by giving alkalies in solution in a considerable quantity of water.

The satisfactory change which in chronic gouty and rheumatic cases frequently ensues from following some of the much vaunted "systems", or going through a course of bathing in Germany or elsewhere, obviously arises from the increased action of the skin, and the improvement of the health generally, effected by the exercise, good air, simple diet, and temperance, wisely enforced in the establishments. If patients could be induced to retire to a pleasant part of the country, where they could take moderate exercise and be free from mental anxiety, meet with agreeable society, live regularly, take small doses of alkalies, and soak themselves for an hour or two a day in warm water in which some carbonate of soda had been dissolved, they would receive as great benefit as by travelling hundreds of miles away, and at much less trouble and expense. I am convinced that there are many patients who would prefer to carry out such a simple plan, rather than submit themselves to all the useless routine and absurd formalities involved in many of the professed universal systems, such as homœopathy, hydropathy, etc., which cannot but be extremely offensive to their common sense, while they are claimed as converts and supporters of doctrines which they do not really believe in. There are many who, for the sake of the advantage they derive from the regular system of living, air, exercise, etc., express no disbelief in doctrines and propositions which they probably feel to be absurd, and which a little reflection must prove to be false.

In all such cases, the nature of the derangement of the physiological processes should be carefully considered before any plan of treatment is adopted. We must ascertain in what points the condition differs from a healthy state, and then consider how the deranged actions may be restored. In such cases, it is obviously quite useless to attempt to relieve the patient by giving drugs, without enforcing attention to all the circumstances which are likely to improve the health. Neither will it be wise to attempt to treat the case as if the presence of the uric acid deposit were the most important symptom, for the reasons I referred to when considering the subject of diathesis. The physiological changes taking place in the organism generally must be attended to, and the patient must be instructed to employ those means which are likely to restore healthy action.

Hippuric Acid, as before mentioned, never forms a deposit.* In diabetic urine, it is often found in large quantity, and seems to take the place of uric acid. It is also found in large quantity in the acid urine of fever patients (Lehmann). This fact is of great interest, when considered in connexion with the sugar-forming function of the liver, and the absence of hippuric acid in the organism in certain cases of liver-disease. Kühne has shown that no hippuric acid can be detected in the urine in cases of jaundice; and benzoic acid, which in health is converted into hippuric acid, escapes unchanged into the urine. There can, therefore, be little doubt that this substance is formed in the liver, whether by the action of glycin or glycocholic acid on benzoic acid, or some other substances, has not been determined.

To Lehmann's statement, that hippuric acid takes the place of uric acid in diabetic urine, there are many exceptions. I have found a considerable proportion of uric acid in the urine of many diabetic patients, and in several there was an abundant deposit of uric acid crystals.

Extractive Matters. The extractive matters present in healthy urine have been previously described; and I have mentioned that Dr. G. O. Rees has discovered in the urine, in certain cases, an extractive matter which has drained away from the blood, and which is distinguished by producing an abundant precipitate with tincture of galls. Now, although

* Dr. William Budd in certain specimens of urine in cases of gout has observed a flocculent precipitate, which was found to consist of benzoic acid, doubtless resulting from the decomposition of hippuric acid.

in many cases albumen exists in the same specimens of urine, this blood-extractive sometimes escapes without albumen; and thus the exhaustion and emaciation, in some obscure cases in which there is no hæmorrhage or escape of albumen, are accounted for. The method of testing urine supposed to contain this extractive matter has been described (page 428). The conclusions at which Dr. Rees has arrived are as follows:—

1. That whenever albumen was present in quantity in the urine, it was always accompanied by the extractives of the blood in large proportion.

2. That the cases in which the extractives of the blood were in the urine in large proportion, were generally those marked by debility.

3. That cases of anasarca with disease of the heart, and unconnected with albuminuria, also showed the extractives of the blood to be excreted by the urine in quantity.

4. That cases of chlorotic anæmia and hysteria give copious precipitates.

5. That when, in albuminuria, the albumen became deficient in the urine, which we know often happens in advanced cases, the blood-extractives also decrease in quantity.

6. That, in cases of anæmia, the proportion of blood-extractives observed in the urine diminished as the cure was proceeding, under the use of ferruginous tonics. (Lettsomian Lectures, *Medical Gazette*, 1851.)

In many cases where the urine contains an abnormal quantity of water, the proportion of blood-extractives is unusually great. In cases of kidney-disease, the relative proportion of extractive matter to the urea is very much greater than in healthy urine. It would seem that extractives merely filtered from the blood in certain cases, and that these substances might escape into the urine when the structure of the kidney was impaired; but that, for the separation of the urea, a healthy condition of the secreting structure is necessary.

The extractive matters are not capable of being converted, by further oxidation, into urea, carbonic acid, or ammonia; and must, therefore, be regarded as excrementitious substances. Scherer (*Würzburg Verhandl.*, B. iii, Heft 2, p. 180) found that the urea, salts, etc., in the urine of a madman who took no food, were very much diminished; while the extractive matters, although less than in healthy urine, were not diminished in nearly the same proportion as the other urinary constituents.

We know nothing of the circumstances under which the extractive matters may be formed in greater quantity than in health, nor the effects which would result from their accumulation in the blood.

General Remarks on the Increase of the Organic Constituents of Urine. The circumstances under which these constituents are excreted in increased quantity have been already considered, and I propose now to call your attention to a few

analyses of the urine in cases of disease in which this character is observed. In almost all forms of fever, in internal inflammations, in acute rheumatism, in many skin-diseases, and in all conditions in which there is increased action of the muscular system, the solids are considerably above the healthy standard; but the constituents do not suffer augmentation in an equal degree. In the conditions just referred to, the increase principally affects the organic matters. Sometimes all the ordinary constituents of the urine are excreted in increased proportion. Dr. L. Lehmann (*Archiv des Vereins für gem. Arb. zur Förderung der wissenschaftl. Heilkunde. Erster Band, Seite 521*) has shown that immersion in the sitzbath, at a temperature of 48° to 60° Fahr., for a quarter of an hour, causes an increase in the quantity of urine, not only of the water, but also of the solid matter. The uric acid, the urea, and the fixed salts, were considerably increased. These results were obtained by estimating the constituents in urine passed during six hours on certain mornings when a bath was taken, and upon others when the observer did not bathe.

The mean of eight analyses of the urine passed during six hours, is as follows:—

	Mornings on which the bath was taken.	Mornings on which the bath was not taken.
Water	443.454 grms.	258.456 grms.
Solids	19.403 "	14.459 "
Urea	10.396 "	7.080 "
Uric acid	0.130 "	0.108 "
Fixed Salts	6.982 "	4.821 "
Volatile Salts and Extractive	1.89 "	2.45 "
Chloride of Sodium	5.814 "	4.319 "

In the following analyses of urine in cases of skin disease, the solid matter is increased; and it will be noticed that the proportion of fixed salts to the organic matters is greater than in health. In No. 4, the quantity of the extractive matter exceeds that of the urea.

In the second series of analyses of the urine in chorea, the principal points to be noticed are the large amount of solid matter, the increase being caused principally by the organic matters. In Analysis 11, the proportion of sulphates is seen to be increased. This increase of sulphuric acid is always observed in cases where the urea is increased.

Urine from cases of Skin Disease.

3. Urine from a case of eczema, with crusts over the whole body: specific gravity, 1025.

4. From the same patient on the following day.

5. From a case of eczema, in a boy, aged 18: specific gravity, 1033; acid, pale colour. Contains much uric acid.

6. From a case of ichthyosis, in a girl, aged 15: acid; specific gravity, 1032.

Analysis.

	3		4		5		6	
Water	948.7		926.1		935.4		929.70	
Solid matter	51.3	100.00	73.9	100.00	64.6	100.00	70.30	100.00
Organic matter	27.9	54.6	51.70	69.97	47.91	74.17	48.35	68.77
Saline matter	23.4	45.40	21.20	30.03	16.69	25.83	21.95	31.20
Urea			24.03	32.51			} 48.35	68.77
Extractives			27.21	36.82				
Uric acid			.46	.62				
Alkaline salts	} 23.4	45.4	} 21.23	28.72	} 16.69	25.83	} 21.95	31.2
Earthy salts								
				.97				
Chloride of sodium					3.99	6.17	1.74	2.47
Sulphates					9.45	14.62		
Phosphoric acid					2.64	4.08		

Urine from cases of Choreia.

7. From a girl, aged 10, recovering—after having been ill for several weeks. The urine contained a great number of Cayenne pepper crystals of uric acid.

8. From a girl, aged 12: specific gravity, 1033; no albumen; much deposit of urates.

9. From a girl, aged 14: specific gravity, 1035; acid; turbid from the presence of urates. Uric acid deposited in the urine—46 per 1000 parts.

10. From a girl: specific gravity, 1030; acid; pale in colour.

11. From a boy, about 10 years of age.

12. From a boy, aged 14: acid; specific gravity, 1034.2.

Analysis.

	7		8		9		10		11		12	
Water	918.75		917.90		930.4		936.8		922.60		915.44	
Solid matter	81.25	100.00	82.10	100.00	69.6	100.00	63.2	100.00	77.40	100.00	84.56	100.00
Organic matter	66.53	82.05	68.50	83.45	51.95	74.65	48.75	77.14	50.79	78.55	65.68	77.68
Saline matter	14.62	17.95	13.60	16.55	17.65	25.35	14.45	22.86	16.61	21.45	18.88	22.32
Urea	30.09	37.03	41.10	50.06	25.33	36.30	29.78	47.12	34.29	44.30	64.69	76.50
Extractive matter	35.27	43.40	27.4	33.37	26.16	37.58	18.52	29.30	26.21	33.85	.76	.89
Uric acid	1.27	1.5			.96	1.30	.45	.71	.29	.38		
Urate of soda											.43	.50
Alkaline salts	13.53	16.65	12.83	15.62	17.16	24.94	13.69	21.66	16.07	20.76	18.88	22.32
Earthy salts	1.09	1.3	.77	.93	29	.41	.76	1.20	.54	.69		
Chloride of sodium									3.35	4.32	2.78	3.29
Sulphuric acid									3.54	4.57	5.81*	6.87*
Phosphoric acid									1.17	1.51		

[To be continued.]

* Sulphate of soda.

Transactions of Branches.

EAST YORK AND NORTH LINCOLN BRANCH.

ADDRESS ON ANTIQUARIAN PATHOLOGY.

By THOMAS SANDWICH, M.D., Beverley.

[Read September 22nd, 1859.]

GENTLEMEN,—In my last address, I endeavoured to prove that our pretended *new* remedies, *new* methods of treatment, and *new* diseases, were familiar to our forefathers; in the present, I trust I shall be equally successful in shewing that there is little or no *novelty* in our vaunted pathological principles.

Our worthy chief, Sir Charles Hastings, by a series of microscopical experiments on the inflamed foot of a frog, has shewn that, in inflammation, the action of the extreme vessels is slower than natural, and the vessels themselves are obstructed. His words are: "The blood in all the smaller vessels becomes very red, circulates very slowly, and in some vessels stagnates." (Hastings *On Inflammation*, p. 90.) What, I would ask, is this but a revival of the theory of Boerhaave, that "obstruction is the sole and immediate cause of inflammation" (*Aph.* 100)? If the extreme vessels, which are destined to receive the thinner parts of the blood, become surcharged with red blood, obstruction is inevitable; there is a true "*error loci*"; and it is easy to conceive that the heart and arteries will be roused to increased action to overcome the resistance. Hence arises the constitutional disturbance called *fever*, and all the local symptoms of inflammation, as "*rubor et tumor cum calore et dolore*". The locality of inflammation depends on predisposition, which, to use the words of Carmichael Smith, consists "in a proneness to *dilatation* in the vessels liable to such diseases" (*Medical Commentaries*, vol. ii, p. 174), and is either natural or acquired; the former depending on peculiarity of organisation; the latter on changes produced in an organ by climate, habits of life, etc. On this account it is that the weak are more liable to inflammation than the strong. The experiments of Sir Charles afford independent evidence of the truth of the theory of Boerhaave; and the only wonder is, that a doctrine so rational should ever have been laid aside, to make way for the Cullenian dogma of *spasm* of the extreme vessels.

We see, then, that one of the effects of *local* inflammation is *fever*; and it is equally certain that *fever* is capable of producing *local* inflammation, as is manifested in catarrhal and rheumatic fevers, peripneumonies, etc. This latter doctrine is in harmony with the causes and treatment of these diseases, which are general as well as local; and its importance will be made apparent hereafter, when we shew the connexion of idiopathic fevers with inflammation. The common opinion is, that all the local *phlegmasiæ* are primary affections; but this is seldom the case, most of them arising from causes which affect the whole frame, as heat and cold, or their alternations. In a

practical point of view, also, the doctrine is important, inasmuch as it teaches us not to rely on local remedies when the heart and arteries are in a state of high excitement, but on those which affect the whole system.

The degree of *inflammation* may be accurately measured by the state of the tongue; for, as Baglivi observes, "other symptoms may deceive us, but this seldom or never". (*Prax. Med.*, c. 13.) When it is moderate, the tongue is dry and white; brown, when more severe; and when very intense, black. This is very important, inasmuch as many practitioners regard even a brown tongue as a sign, not of inflammation, but of debility, and an indication for the use of stimulants. I have bled fever patients, the disease being coupled with cerebral inflammation, when the tongue was either brown or black, and dry as a stick; the teeth loaded; the jaw fallen, and trembling like an aspen-leaf; and had the gratification, in every case, of seeing the fever changed from a malignant to a simple type, and the cases do well. In these cases, the blood was sily and cupped, and contained very little serum. Such a practice is, however, inapplicable in the advanced stages of fever; for, as Dr. William Fordyce remarks, "In the hospitals of France, I have seen a fourth or fifth bleeding ordered in the last stage of fever with delirium, and a black tongue, and teeth covered with a black tenacious slough; in a word, with the pathognomonic symptoms of putrefaction and debility. A speedy dissolution was the consequence, as might naturally be expected." (*Enquiry*, p. 170.) Of the efficacy of a large bleeding in a recent case of fever, when the eyes were set in the head, the face as black as an Indian, the tongue black and hard, and the jaw fallen, an example is to be found in *The Ancient Physician's Legacy*, p. 104. An hour after the loss of fifty ounces of blood, the patient got up, and the next day was out, and as well as he ever was in his life.

Bichat obtained immense credit, and deservedly so, for his *Traité des Membranes*, in which he shewed that inflammations are modified by the texture of the several tissues, and thus laid the groundwork of Pinel's celebrated classification of diseases; but the same doctrine was taught before by our countryman, Carmichael Smith, who says, "Experience has long since shewn us that every part of an animal body, the cuticle and hair perhaps excepted, is liable to inflammation; and by attending strictly to the phenomena, it is equally evident that, according to the nature of the parts affected, the disease puts on different appearances, is of various terminations, becomes more or less acute or chronic, and requires a different, and at times an opposite treatment." (*Med. Com.*, 1785, vol. ii, p. 184.) "The following, then, in my opinion," he continues, "may be justly considered as distinct species of inflammation, each of them having a specific character, strongly marked, which in every instance seems entirely to depend upon the peculiar structure of the part inflamed:

1. The inflammation of the skin (erysipelas).
2. The inflammation of the cellular membrane (phlegmon).
3. The inflammation of the diaphanous membranes.
4. The inflammation of the mucous membranes.
5. The inflammation of the muscular fibres."

The same acute observer has also pointed out the distinc-