came excessively pallid; his skin was hot, and covered with sweat. Pulse 120. Soon afterwards, he sank and died. He had taken iron and quinine, and improved somewhat for a time.

POST MORTEM EXAMINATION. The body was spare, of medium height. The thymus gland was enlarged; it weighed 537 grains. The heart was full of fluid blood, and healthy. The lungs were healthy. The liver, kidneys, and spleen, were immensely congested, but firm, and quite normal in appearance. The stomach was almost empty. The intestines were empty and contracted. The superficial vessels of the brain were slightly congested. The brain substance was firm; the grey matter was darker than usual; the vascular points were more numerous and evident. The lateral ventricles contained a little serum. The choroid plexuses were rather congested. Nothing abnormal was found in the brain; all the parts were very carefully examined. The spinal cord appeared to be firmer than usual in the part corresponding to the lower dorsal and upper lumbar regions; the upper part was much softer than this, but sections of both these portions revealed nothing unnatural in appearance or worthy of remark. Mr. Gascoyne, who conducted the autopsy, informs me that he considered the softening as a *post mortem* change. Dr. Sibson and I carefully examined portions of the spinal cord and pons Varolii the next day under the microscope, but we could discover no organic morbid change; there was no alteration of the coats of the minute vessels, nor glomeruli. The kidneys were also examined microscopically, and found healthy.

REMARKS. In this case, the nerve-disorder was diffuse, but incomplete; it seemed to affect all parts of the cord and the medulla oblongata, but did not cause any actual paralysis till the last. Even the centres of vision seem to have been temporarily disordered. The fatal event probably resulted from arrest of the heart's action, induced through the vagi. The impairment of masticating power shows that the seat of origin of the fifth pair was involved in the paralyzing morbid action; and, from the proximity of that of the vagi, it cannot be matter of surprise that the latter nerves should come to suffer also. As to the existence of any organic alteration, the negative evidence to my own mind appears satisfactory, but I do not expect it may be fully so to all. At the least, however, the case seems well worth recording, if only as adding something to the probability of the existence of central dynamic changes, which may induce the gravest peril, without leaving their record in any organic alteration. (I wish to acknowledge gratefully the kindness of Dr. Sibson in allowing me to make use of this case.)

CASE III. J. C., aged 30, male, was admitted December 27th, 1858. He had been ill two days. He went to sleep on the 25th for one hour, and, on waking up, found he had no use of the left hand. He is not aware that he had pressed his arm in any way while lying asleep. He was quite sober at the time. He has but feeble grasping power with the left hand. He experiences sensations like "pins and needles" in the thumb only. The left hand and wrist are cold and dry, and do not get warm and perspire like the other hand. The tongue is clean; the appetite good; the bowels open. He feels in good health.

℞ Quinæ disulphatis gr. iij; strychniæ gr. 1-20; acidulphurici diluti g.; aquæ ʒi. M. Fiat haustus ter die sumendus.

September 31st. On being galvanised, he soon became faint, but found immediate benefit in the arm. He seems to be a weakly nerved man.

℞ Anamonæ sesquicarbonatis gr. v; tincturæ cinchonæ ʒi; spiritûs ætheris sulphurici compositi ʒss; infusi cascariæ ʒi. M. Fiat haustus ter die sumendus.

January 3rd, 1859. He had been galvanised three times: he can grasp much more strongly. There is much less numbness, but the wrist still feels weak. The mixture was continued; and he was ordered to take a scruple of saccharated carbonate of iron three times a day.

January 5th. He is further improved; the hand and wrist now get warm and perspire like the other. He ceased attendance.

[To be continued.]

ST. BARTHOLOMEW'S HOSPITAL. An endeavour is now being made on the part of the treasurer of this admirable institution to convert the large gravelled airing ground forming the quadrangle of the hospital into a garden, for the benefit of the patients; the shrubs already planted appear to thrive very well.

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.

[Concluded from page 272.]

Specific Gravity. By ascertaining the specific gravity of a specimen of urine, we are enabled to form a rough estimate of the quantity of solid matter dissolved in the fluid; and, by measuring the entire quantity of urine passed in the twenty-four hours, we have data for judging approximately of the quantity of solid material removed from the organism in this secretion in twenty-four hours.

The specific gravity of healthy urine may be considered to be about 1015, and the quantity of solid matter passed in the twenty-four hours at from 800 to 1000 grains. It has been considered sufficient to calculate the quantity of solid matter from the specific gravity by multiplying the number over 1000 indicating the specific gravity, by about 2.5. The result will give an approximation to the quantity of solid matter in 1000 grains of urine. This calculation is by no means correct, and is useless in careful investigations. Its inexact nature is shown by the fact that three very different numbers have been proposed, namely, 2.58, 2.33, and 1.65. When it is considered how widely different the composition of the solid matter may be in various specimens of healthy urine, it is obvious that results obtained in this manner must often be very wide of the truth. Take, for example, *albumen* and *common salt*. A fluid containing 136.4 grains of the former in 1000 grains will have a specific gravity of 1030; while one containing only 80.0 grains of common salt in the same quantity will have a specific gravity of 1064. This clearly shows that any attempt to calculate the quantity of solid matter in an animal fluid cannot be very exact. In investigations, therefore, where any approach to accuracy is required, we must evaporate a given quantity of urine (1000 grains) to dryness, at a low even temperature, and weigh the solid matter. In practice, this operation takes some time; and physicians are compelled, as a general rule, to be content with taking the specific gravity. In many cases, the information gained by this simple operation is very important. Thus the urine may be not more than 1002 or 1003—a condition commonly met with in hysteria. A patient may be continually passing urine of specific gravity 1010 to 1012, which is commonly the case with albuminous urine passed by patients suffering from certain chronic kidney diseases. Urine containing a very large quantity of urea, so much that crystals of the nitrate of urea are formed upon the addition of nitric acid (*excess of urea*), usually reaches 1030 or a little higher; and, in cases of confirmed diabetes, where very large quantities of sugar constantly escape from the organism, the urine has a specific gravity of 1035-1040, or even higher.

Methods of taking the Specific Gravity. The specific gravity of a fluid is obtained most correctly by ascertaining the weight of equal bulks of the fluid to be examined and distilled water respectively. For this purpose, a small bottle, with a tubular stopper, holding exactly 1000 or 500 grains of distilled water, at a temperature of 60°, is the most convenient form of apparatus. All that is necessary is to fill the bottle carefully with the urine, wipe it dry, and then weigh it, after having counterpoised the bottle. The number of grains which the fluid weighs is the specific gravity in the case of the 1000-grain bottle, double the weight for the 500-grain bottle, four times the weight for a bottle holding 250 grains, and so on in like proportion.

This method, although perfectly exact, and readily per-

formed where a good balance is at hand, is nevertheless too tedious and troublesome for the practitioner in a general way, and, in the sick-wards, a much simpler, though less correct method, is usually resorted to. The specific gravity is obtained by a small hydrometer, usually termed a *urinometer*. The form of this instrument, and the mode of using it, are well known; but there are one or two points in its construction and management which it may be well for me to refer to. As sold, these instruments are often nearly useless, in consequence of the carelessness displayed in their manufacture. Out of twenty instruments, I have found several differing as much as ten degrees from each other. If the stem of many urinometers be examined, it will be found that all the degrees marked upon it are equal, which clearly ought not to be the case; for when fluids of low specific gravity are operated on, a very small portion of the stem remains above the surface of the liquid, while the reverse holds with respect to liquids of great density. In the latter case, there is, of course, a much greater weight of stem above the liquid, tending to force the instrument lower in the fluid than in the former. Allowance must also be made for the fact that the fluid becomes denser as we pass from the upper to the lower strata.* The tendency of the instrument to indicate a higher density than the real one renders it necessary that the degrees should decrease in length from the upper towards the lower part of the stem. The practitioner should carefully examine his urinometer, to see that there is this difference in the degrees; and, if not, it should be changed. I strongly recommend every one to test the urinometer by immersing it in fluids, the specific gravity of which has been ascertained by the bottle, or by a well made and previously corrected urinometer. If the degrees are incorrect, the observer can always bear in mind the amount of error, and allow for it in taking the specific gravity of different specimens of urine. The vessel which is employed for immersing the urinometer in should not be too narrow, in case the bulb should rub against the sides, when it becomes difficult to ascertain the real density. The diameter of the glass vessel should be rather more than a quarter of an inch over that of the widest part of the bulb of the urinometer. The glass delineated in Figure 1 is a very convenient form.

Another method of taking the specific gravity, which is sometimes followed, consists in having a number of small glass bulbs, with the density of the fluids in which they neither sink nor swim marked upon them. By placing one after another into the urine, one is found which remains just beneath the surface, and the number upon it indicates the specific gravity of the fluid.

Reaction. You may easily ascertain the reaction of urine by the use of litmus-paper, which is prepared by soaking a thin but firm smooth paper in an infusion of litmus. It is desirable not to use blotting paper, or any spongy form of paper, for this purpose. Urine, having an acid reaction, immediately reddens this blue paper. The alkaline reaction of urine is ascertained by the use of *reddened litmus-paper*, prepared by adding a very small quantity of dilute acid to the infusion of litmus. An alkali always restores the blue colour of this reddened paper. If no change occurs when the urine is tested with both kinds of paper, the reaction of the specimen is *neutral*.

Acid Urine. The cause of the acid reaction of urine is obscure, and probably is not always of the same nature. Sometimes the reaction may depend upon carbonic acid, which is present in greater or less proportion in all the animal fluids. In this case, the blue colour of the paper is restored by gently warming it after it has been changed by the acid. A fixed acid reaction may be due to the presence of an acid phosphate of soda—a salt which exhibits an acid reaction, without the presence of any free acid. This salt may be formed by the action of uric acid upon common rhombic phosphate of soda. If I add a little uric acid to this solution of common rhombic phosphate of soda, the mixture still exhibits the characteristic alkaline reaction of the salt; but now, when heat is applied, decomposition occurs; the uric acid disappears, and combines with one equivalent of the soda to form urate of soda; and an acid phosphate of soda is produced. The acid reaction of urine, however, cannot always be explained in this manner; and it is probable that traces of free organic acids are often present. Lehmann has found both free lactic and free hippuric acids in some specimens of urine. Lately, Hallwachs has shown that a large amount of hippuric acid salts exists in healthy human urine.

Many specimens of urine which are slightly acid when passed from the organism, become more strongly so after standing for some days, and crystals of uric acid are deposited. The acid reaction may remain for weeks or even months, but usually the acidity gradually diminishes, and the specimen at last becomes alkaline from the presence of carbonate of ammonia formed in consequence of the decomposition of the urea. The beautiful researches of Scherer have proved that the gradually increasing intensity of the acid reaction, and the deposition of uric acid, were due to a process resembling fermentation, which was excited by the presence of a small quantity of mucus.

The intensity of the acid reaction of urine in health is continually undergoing change at different periods of the day. Dr. Owen Rees and Dr. Bence Jones have made numerous highly interesting observations, which prove that the acidity of the urine alternates with that of the gastric juice. When the largest quantity of acid is being set free from the stomach, the acidity of the urine is at its minimum; and when the secretion of gastric juice is diminished, the urine exhibits a most strongly acid reaction. The urine passed just before each meal, or a long time after taking food, is intensely acid, while that which is secreted during the digestive process, for about three hours after a meal, is very slightly so, and in many instances it is decidedly alkaline. It is especially important to bear in mind the existence of these variations in the acidity of the urine in a state of health, and not to refer the intensely acid reaction of urine secreted while no food is taken, to a morbid process requiring the exhibition of large doses of alkalis (*On Animal Chemistry*, by H. Bence Jones, M.A., M.D., F.R.S.). Dr. Beneke has made upwards of one hundred experiments upon healthy and diseased persons without being able to confirm Dr. Bence Jones' observations. In only one case did he find the urine alkaline after meals. Sometimes the acidity was less, but this was not invariably the case. Nevertheless, he admits that the acidity of the whole amount of urine passed varied considerably, although he could not discover the cause. It seemed to be independent of the quantity passed, and was not affected by exercise or food (*Archiv des Vereins für gemeinschaftliche Arbeiten zur Förderung der wissenschaftlichen Heilkunde*, 1 Band. 3 Heft.). Vogel's researches confirm the former results, inasmuch as he found that urine passed during the night was more acid than that secreted during the digestive process.

The intensity of the acid reaction is readily determined by ascertaining how much of a graduated solution of carbonate of soda is required to neutralise the acid in a given quantity of urine.

Alkaline Urine. The alkaline reaction of a specimen of urine may be due to the existence of carbonate of ammonia, in which case the blue colour produced by testing it with reddened litmus is destroyed by the application of a gentle heat (*volatile alkali*); or it may depend upon the presence of an alkaline carbonate, as carbonate of soda, or a neutral salt having an alkaline reaction, like common phosphate of soda, in which cases the application of heat does not restore the red colour of the litmus paper (*fixed alkali*).

Volatile Alkali. The development of carbonate of ammonia in urine depends upon the decomposition of the urea by the action of the mucus or some animal matter, which acts the part of a ferment. In some diseases of the mucous membrane of the bladder, and in cases of paraplegia, where the muscular coat of the organ is paralysed, and consequently the secretion is retained for a long time, this change is very liable to occur, and gives rise to pain and great distress, which are much relieved by washing out the bladder thoroughly with tepid water. A mere trace of urine which has undergone this change is capable of exciting a similar decomposition in a very large quantity. It is important to notice that if pus be present in such urine, it becomes converted into a viscid glairy mass, which is removed from the bladder with the greatest difficulty. This action of the volatile alkali on the pus precisely accords with that which occurs if ordinary liquor potassæ be added to a specimen of pure pus out of the body. Pus thus rendered glairy, forming a viscid adhesive mass at the bottom of the vessel containing the urine, is usually called *mucus*, but, as I have said, it really consists of altered pus. If this action on the pus only occurs after the urine has left the bladder, it is unimportant, but when it occurs before its expulsion, it is always necessary to interfere, and if the change cannot be entirely prevented, owing to the existence of certain mechanical impediments to the escape of the urine, we must try to render the urine acid, and thus prevent its occurrence, by giving very large and frequently re-

* This error has been corrected by Mr. Ackland, of Messrs. Horne and Thornthwaite's, where accurately graduated instruments may be obtained.

peated doses of nitric acid, unless this treatment is contra-indicated by other symptoms, which I shall have occasion to refer to in a future lecture.

Whatever causes prolonged retention of the urine in the bladder, in the ureter, or pelvis of the kidney, will excite this change, and as a consequence, roughening and ulceration of the mucous membrane ensue, with the precipitation of phosphate of lime and ammoniaco-magnesian phosphate. More pus is formed, which effects the decomposition of the urea and aggravates the mischief already produced, and unless relief be afforded, complete disorganisation of the mucous membrane results. Volatile alkali is never detected in healthy urine.

Fixed alkali. Urine, however, often exhibits an alkaline reaction due to the presence of an alkali which is not volatile by heat, and this reaction is often to be met with in a state of health. When an alkaline carbonate is detected in the urine, it usually results from the decomposition of salts of certain organic acids in the organism. Salts of tartaric, racemic, citric, and under some circumstances, those of oxalic and acetic acids, become resolved into carbonates in their passage through the organism, just as by the influence of a red heat, they are converted into carbonates out of the body. The urine may always be rendered alkaline, and very quickly so, by giving such salts in sufficient quantity; and their administration is of great advantage in cases where benefit is likely to be derived from alkalies, especially where strong alkalies do not agree with the digestive organs. I believe that in many cases the alkali thus formed in the organism exerts a more beneficial influence than the exhibition of alkalies or their carbonates. The value of the juice of oranges and lemons in various conditions is to be attributed to this change.

If the alkaline reaction of the urine is due to the presence of carbonate of ammonia crystals of triple phosphate (*Illustrations*, pl. ix, fig. 1; xxi, figs. 1, 3), and a deposit of phosphate of lime in a granular state, or in the form of globules or minute dumb-bells will be present; if, on the other hand, it depends upon fixed alkali, only the latter deposit without the crystals will be detected.

Before resorting to a minute examination of a specimen of urine, it is important to ascertain the *quantity* passed in twenty-four hours, to notice its *colour*, *smell*, *consistence*, *clearness* or *turbidity*, and the presence or absence of a *deposit*, and to ascertain its *specific gravity* and *reaction*.

In the next lecture, I propose to allude to the characters of the organic constituents of *healthy urine*, which are not volatile at ordinary temperatures, but which are completely destroyed by exposure to a red heat.

Inventions and Appliances

MEDICINE AND SURGERY.

BOURJEAURD'S PATENT MUSHROOM OR PYRAMIDAL PESSARY.

A NEW pessary, which has been patented by Mr. Bourjeaurd, is shown in the annexed woodcut.

The pessary is formed of smooth India-rubber, and is, after being introduced into the vagina, inflated by a tube to such an extent as may be necessary. When the apparatus is properly distended, the neck of the uterus rests on its summit. The depression seen towards the upper part of the figure represents the commencement of a cylindrical canal, which is continued through the stem, and through which any discharges may escape. The apparatus is secured by elastic bands, which may be fastened to a narrow abdominal belt. This apparatus seems well calculated to fulfil the objects of a pessary; and two of its advantages are, the possibility of regulating its size, and the non-production of irritation.

LETTERS AND COMMUNICATIONS.

Letters or communications for the JOURNAL should be addressed to Dr. WYNTER, Coleherne Court, Old Brompton, S.W.

Letters regarding the business department of the JOURNAL, and corrected proofs, should be sent to 37, Great Queen Street, Lincoln's Inn Fields, W.C.

British Medical Journal.

SATURDAY, APRIL 16TH, 1859.

DRINKING FOUNTAINS.

It certainly is passing strange, that just in proportion as we recede further from the primitive type of living in this country, and boast our cooperative strength in great towns, so we neglect some of the first wants of life. The shepherd or the husbandman is enabled to quench his thirst at every gushing hill stream or pebbly brook he meets; the villager is always plentifully supplied with the pure element in his mossy well, and the smallest country town boasts its public pump in the market-place, where water can be had for the drawing. Alas! how stands the case in large cities? Of old, we had our public conduits in the great metropolis, which were possibly pure enough, as the water was often brought from distant streams in pipes; now these conduits, if they exist at all, exist in the form of parish pumps, which derive their streams, not from the far-off thyme-fields, but from the surface-water of a great city, flavoured in all cases with the matter of our drains, and perfumed with the escaped essences of our gas-pipes. The water of one of the favourite city pumps owes its sparkle to the nitrates it receives from the decomposing bodies in a neighbouring churchyard!

When the cholera comes, we meet the grim monster more than half way. During his last visit, the inhabitants of Broad Street and the Golden Square district toasted his advent in the water of their favourite pump; and lo! in three days they were decimated in consequence.

There is plenty of water, it is true; huge pipes ramify in every street, but not for the poor, who, like the Ancient Mariner, see around them

"Water, water every where,
But not a drop to drink."

How the poor have gone on so long without any adequate supply of so necessary an article, even for drinking purposes, passes our comprehension. Perhaps the explanation is, that they have been taught to drink beer and gin; and, as for water for their ablutions—why, as a matter of course, they go dirty.

A great want, however, is sure to be remedied sooner or later; and we rejoice to find that a movement has set in, which promises to supply to the poorer denizens of cities the privileges the peasant enjoys of quaffing without stint the pure element. It is scarcely two years since some humane individual, noticing the eagerness with which crowds collected to drink at the public pumps in hot weather, conceived the idea of a public fountain, to be supplied from a comparatively pure source. No sooner was this simple note struck, than its waves of vibration rapidly spread through the country. No fewer than two hundred and fifty public drinking fountains have