spiration. Before using the mask, the tongue should be well drawn forward, and, if necessary, fixed in this position by an ordinary piece of silk suture run through it, which can be held in the hand of the operator. If in any individual case the mask fails, an intubation tube may be introduced into the larynx. It do not believe it will ever be found necessary to perform a tracheotomy.

Dr. Fell's apparatus consists of a pair of foot-bellows by which air is forced into a receiving chamber, which is connected with an apparatus for warming the air, and a valve which can be opened and shut by a movement of the finger. This valve in turn leads to the tracheal tube. When the valve is opened the air rushes through the chamber into the lungs and expands them; the finger is lifted, the valve shuts, the lungs contract; and so the respiration goes on. I have no doubt that this apparatus is efficient in practice, but it is open to the serious objection of being unnecessarily complex and costly.

A much simpler, cheaper, and probably equally efficient apparatus may consist simply of a pair of bellows of proper size, a few feet of indiarubber tubing, a face mask, and two sizes of intubation tubes. There should also be set in the tubing a double tube, with opening similar to that commonly found in the tracheal cannula of the physiological laboratory, so that it is in the power of the operator to allow for the escape of any excess of air thrown by the bellows. This whole apparatus can be prepared at a very trifling expense, and it seems hardly necessary to point out its probable value in various narcotic poisonings, and other accidents, in which death is produced by a paralysis of the respiratory centres of temporary nature. The proper use of it—at least with the face mask—could be taught to persons without special medical skill, so that it not only ought to form a part of the surgeon's outfit, but might be of great service in life-saving stations, about gas works, etc.

In conclusion, I may be allowed to state that if the results and deductions arrived at in this address are, as I believe, correct, the rules for the proper treatment of accidents during anaesthesia can be summed up in a very few words:

Avoid the use of all drugs, except strychnine, digitalis, and ammonia.

Give the tincture of digitalis hypodermically.

Draw out the tongue, and raise up the angle of the jaw, and see that the respiration is not mechanically impeded.

Invert the patient briefly and temporarily.

Use forced artificial respiration promptly, and in protracted cases employ external warmth and stimulation of the surface by the dry electric brush, etc., and, above all, remember that some at least, and probably many, of the deaths which have been set down as due to chloroform and ether have been produced by the alcohol which has been given for the relief of the patient.

ON THE TREATMENT OF CHRONIC BRIGHT'S DISEASE.

Read before the International Medical Congress, Berlin, August, 1890.

By T. GRAINGER STEWART, M.D.,

President of the Royal College of Physicians; Professor of Practice of Medicine in the University of Edinburgh; Physician in Ordinary to the Queen for Scotland.

It is no easy task to condense into a short speech so wide a subject as that with which I have to deal, nor is it easy to render interesting a subject so familiar. I should certainly not have dreamed of offering to undertake it, and yet when requested by the Committee I could not refuse: for it is clear that at a Congress such as this, not only is there an opportunity for promulgating new views and original discoveries, but for members of different nationalities comparing the results of their experience in regard to the treatment of important maladies.

I agree with the Committee in thinking the treatment of chronic Bright's disease so important as to warrant its discussion even by those who do not propose to present new views or promulgate important discoveries. The masterly speeches of Senator and von Ziemssen at the recent Congress in Vienna are examples of what may be done in this direction, but rather increase the difficulty by showing how impossible it is to tread in their footprints. I am almost tempted to take their speeches as my text, and go

over the ground which they have traversed, indicating in how far my experience leads me to their conclusions, and in how far I differ from them; but this would presuppose a knowledge on the part of all my hearers of what they have said, which might, perhaps, not be justified. I shall, therefore, deal with the subject in the way which commends itself to me.

Under the term chronic Bright's disease I include all those forms of organic kidney disease which belong to the group first defined by Richard Bright, including therefore diseases of the tubules, of the Malpighian bodies and stroma, as well as of the blood vessels; the parenchymatous and the interstitial nephritis or cirrhosis, and the waxy degeneration as well, for all of these, individually and associated with one another, are referable to Bright's disease. I consider a case chronic when it has lasted more than three months. The indications for treatment may be recognised as consisting in:

1. The removal of the cause or causes, or of some individual cause which still remains in operation.

2. The curing, if it be possible, of the morbid action which has occurred, or is still going on in the kidney, or at least the limitation of the action to the part which has been primarily involved.

3. The removal or modification of the various results, whether of the nature of symptoms or complications, which follow upon the renal lesion, as, for example, the drain of albumen, the dropsy, the uræmic symptoms, the gastro-intestinal symptoms, the serous inflammations, and the vascular and cardiac changes consequent upon the process.

In considering the treatment of any disease, one likes to keep in view the climate and the clothing, the diet and the medicinal treatment; and in discussing Bright's disease it might be most satisfactory if one could speak of each of these in relation to each of the indications; to the causes and to the morbid processes, as well as to the various symptoms and complications bringing out the importance of the different elements of management and treatment in relation to each; but this would be too tedious and perhaps too formal for our present purpose. It will therefore be best if I consider first the general hygienic and dietetic treatment, and then say a few words as to the treatment of the morbid processes, and the symptoms and complications arising from them.

Exposure to cold and damp or to sudden changes of temperature is a fruitful cause, not only of the initiation, but of the prolongation, of kidney disease. Much advantage flows from residence in warm climates and scrupulous avoidance of exposure to cold. Residence in Southern Europe, in Algiers, in Egypt; a voyage to the Cape and a sojourn there, or a similar trip to Australia or New Zealand, or to some of the West Indian Islands, often promotes recovery or hinders the increase of disease. I have no doubt that many patients were formerly sent from home whose cases were really referable to the category of what we now term functional albuminuria, but such a mistake is not likely to happen now with our better knowledge of these conditions, and I have known some of these cases return absolutely uninfluenced by the change of climate.

All will agree that patients suffering from Bright's disease should avoid cold, and especially variable climates, and winter in the South if possible. The remark applies both to the tubular affection and the cirrhotic process, and, seeing how liable the amyloid disease is to be complicated by these, it, of course, applies to it also.

Practitioners who have experience of treatment of phthisis in high altitudes tell us that it is useless to send there patients who suffer from albuminuria as well as phthisis; and while it may be argued that if the albuminuria were simply due to waxy disease, which in its turn is caused by the pulmonary malady, it would be a wise course to treat the kidney by influencing the lung affection. Still experience shows that the practitioners are right; and while the waxy process itself might be benefited, the inflammatory changes which so often attend upon it must be aggravated.

I have seen a good many cases in which malarious influences had to do with the renal disease, and in which, accordingly, it was essential to insist upon removal from the insalubrious districts in which the patients habitually resided, and to keep in view the use of quinine, arsenic, or other antimalarious remedies.

The clothing of patients ought always to be such as to protect from cold and to favour the action of the skin. Woollen under-clothing should be regularly used, and should be changed whenever it is damp from perspiration, and light warm wraps should be carried about, so as to be thrown on if occasion arises. It is

specially important to see that the loins are well protected, and a flannel band should be worn round that part of the body.

The dietetic treatment is of great importance, at once in relation to causation, to the morbid process itself, and to its results. I have satisfied myself from experiments and observations that in many individuals it is possible to induce a degree of albuminuria by administering a specially albuminous diet. Not only does white of egg injected into the blood vessels or into the rectum suffice to induce albuminuria, but in some individuals at least, when it is introduced into the stomach in large quantity, a like result occurs. If this be so, it is clear that a highly albuminous diet must favour the occurrence of albuminuria when the kidneys are diseased, and make the renal lesion more severe and persistent. It is very difficult to arrive at precise results as to the action of different diets upon the secretion of the kidneys; for if we determine the daily amount of urine—the daily output of albumen and of urea—it is surprising how much they vary from day to day, even under the same conditions. For example, I have found an individual under the same diet and general conditions during seven consecutive days vary as to total quantity from 35 to 70 ounces, and pass 443, 457, 346, 341, 420, 325, and 459 grains of albumen; and I have seen the urea discharge during seven successive days amounting to 491, 479, 692, 730, 538, 584, and 617 grains.

Still, if one is familiar with renal disease and watches the individual cases closely, it is possible to arrive at very definite conclusions in this matter. I have, during past years, made many observations, and have selected certain dietaries modified from those in use in the Royal Infirmary of Edinburgh. These dietaries are:

Ordinary Diet.

	Albu- minates. Grains.	Carbo- hydrates. Grains.	Fats. Grains.	Salts. Grains.
8 ozs. meat	966	—	540.7	103.25
12 „ bread	420	2583	78.75	68.25
12 „ potatoes	105	1102.5	8.4	52.5
24 „ milk	460	552.96	426.24	80.64
1 „ butter	1.3125	—	398.1825	variable.
1 „ sugar	—	422.1875	—	2.1875
	1942.3125	4660.6475	1452.2725	306.8275
=	4.665 ozs.	10.65 ozs.	3.32 ozs.	0.701 ozs.

Large Diet.

16 ozs. meat	1912	—	1081.4	206.5
16 „ bread	525	3228.75	98.44	85.3
12 „ potatoes	105	1102.5	8.4	52.5
2 „ sugar	—	844.375	—	4.375
24 „ milk	460	552.96	426.24	80.64
1 „ butter	1.3125	—	398.1825	—
	3003.3125	5728.585	2012.6625	429.315
=	6.86 ozs.	13.07 ozs.	4.6 ozs.	0.9 ozs.

Milk Diet.

80 ozs. milk	3.2 ozs....	3.84 ozs....	2.96 ozs....	0.56 ozs.
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Low Diet.

12 ozs. bread	420	2583	78.75	68.25
24 „ potatoes	210	2205	16.8	105
4 „ sugar	—	1688.75	—	8.75
24 „ milk	460	552.96	426.24	80.64
1 „ butter	1.3125	—	398.1825	—
	1091.3125	7029.71	919.9725	262.64
=	2.494 ozs.	16.06 ozs.	2.102 ozs.	0.6 ozs.

I tried these diets in carefully selected cases, and though it was difficult to keep patients strictly to them, I think that I have been warranted in arriving at certain pretty definite conclusions.

1. As a rule the second diet table (large diet) increased the amount of albumen and also the amount of urea. 2. The purely milk diet increased the flow of urine, diminished the discharge of albumen, and in some cases, at least, increased the discharge of urea. 3. The best results as to the kidneys and the general well-being of the patient were obtained by the combination of milk diet with the low diet, No. 4. 4. That in some cases the milk diet manifestly disagrees and rather aggravates the renal symptoms, while at the same time rendering the patient uncomfortable and dyspeptic.

As to the effects of these diets on the different varieties of Bright's disease, the milk is conspicuously useful in the cases of inflammation of the tubules. It is rather less suitable in proportion to the increase of interstitial disease, mainly, I believe, because with that increase anæmia, gastro-intestinal and other disturbances are so commonly associated. In regard to the waxy disease the milk diet also suits well; of course its diuretic action

is scarcely required, but the importance of avoiding renal irritation is as great here as it is in the other form. In order to see why a diet largely of milk is so suitable we must consider what the indications are in regard to diet.

First, it is essential that the diet be of good nutritive quality; secondly, that it be easily digested; thirdly, that it shall not of itself be irritating to the kidneys nor be likely to evolve chemical products of an irritating character. Now milk meets all these indications better than any individual article of diet which we could name; and it is in addition possessed of diuretic properties which are of the greatest value wherever there is much blocking of the tubules and dropsy. The disadvantages of an exclusively milk diet are that it is often disliked by the patients, and that it is apt to produce catarrh of stomach, with functional disturbance of liver and constipation. These results may to a large extent be avoided if it is judiciously administered, and the rules which I generally follow are to let the quantity be from 4 to 7 pints in the twenty-four hours; never to give it in large quantity at a time; always to dilute it with water, hot or cold, or with aerated water, or to add to it lime water in any case where the bowels tend to be loose, or fluid magnesia in cases in which the bowels are constipated. Sometimes I use it as fresh as can be got from the cow; sometimes, especially when the liver is apt to be disordered, as skimmed milk, sometimes as butter milk; and, where the digestive power is impaired, I peptonise it. As I have said, the pure milk diet has not in my hands brought out the best results; rather a diet composed largely of milk, but also with some pudding, fruit, and a little white meat.

Alcohol.—Among the causes of Bright's disease few are more important than excessive indulgence in alcohol, and few tend more to keep up renal irritation when it has been established. I have sought for evidence as to the effect of alcohol in the different forms of chronic Bright's disease, and have found that, apart from its slow or gradual influence, the administration of a full dose in a case of ordinary inflammation of the tubules rather increased the quantity of urine and slightly the amount of albumen, while the urea remained practically unchanged. In cirrhosis I am not so certain as to the result. In the waxy or amyloid disease I have seen a full dose of alcohol produce a distinct fall in the urea, unattended by increase of albumen. There are many cases of Bright's disease in which, for reasons apart from the kidney, alcohol is eminently desirable, but the minimum that will suffice should be given, and that always well diluted with water or milk.

In selecting the stimulant suitable for individual cases it is best to avoid the habitual use of those that tend to irritate the kidneys, and in particular of gin, while, on the other hand, its use is sometimes followed by excellent results in tubular inflammation. But such stimulants as gin, whisky, or brandy must always be well diluted. Rhine wines and sparkling wines—particularly some of the Hungarian varieties—may be occasionally used with advantage, when a patient requires at the same time a fillip and a diuretic; but, on the whole, wines, and especially the sweet and heavy varieties, should be avoided. With regard to malt liquors, I find it best to avoid them altogether, and very rarely to allow a light and pure German beer, but only when specially indicated, and never for habitual use.

The next point to which I shall allude is whether we can modify the morbid action in the kidneys. In waxy degeneration I believe that it is sometimes possible to improve the condition of the organ, if we can get rid of the cause. If a syphilis or carious process, or other chronic suppuration, can be cured the waxy degeneration may cease, but even when the cause is removed not infrequently the result is found incurable. Except in this way, I know of no means of influencing the waxy process.

As to the cirrhotic or the interstitial process, when it is far advanced it is absolutely hopeless, and must, sooner or later, cause death; but I have seen evidence that in an earlier stage the process may be arrested—not that fibrous tissue which had advanced to the shrunk atrophic condition recovered—but that the disease ceased to spread. This effect was mainly brought about by rest, the regulation of the diet on the principles already explained, and the cutting off of the supply of alcohol, which had previously been excessive, along with the resorting during the winter to the Mediterranean, to Egypt, or to India; returning to Scotland only during the warmer part of the year. I do not think that it can be claimed that medicines—although medicines were given—were of much effect in the case, excepting in so far as by influencing the digestive organs, they probably hindered the production of irri-

tating materials which would otherwise have been absorbed and acted upon the kidneys.

With regard to the inflammation affecting, or mainly affecting, the tubules, treatment can effect one great result, namely, the clearing out of the blocked tubules; this not only permits the absorption of dropsical fluids, but of the production of a new and healthy epithelium in the tubules which had been inflamed—a process which could never occur if the inflammatory products were absorbed molecule by molecule, the walls of the tubule falling in as it advanced. For this purpose our great aid is again the diet (and it is here that the milk diet achieves most), but rest in bed, favouring the action of the skin, regulating the condition of bowels, and administering diuretics, all contribute towards this end. I wish I could say that I feel sure that any of the medicines in use can influence this inflammatory process. So far as I have seen, there is no sufficient evidence that any of them can. Local depletion, although of service in some acute inflammations of the kidney, is of little or no value, and would often be injurious in the chronic cases.

Turning now to the results of the morbid action, we ask to what extent a drain of albumen from the blood is a source of danger. At one time the importance of this was exaggerated. Perhaps now the pendulum has swung the other way, and some seem inclined to consider it never of any importance. It is true that many cases of Bright's disease show albumen distinctly enough, although they are only losing some 10, 20, or 30 grains in the twenty-four hours. Such a loss is of no importance, but it is a very different matter when a patient is losing 400 or 500 grains in the twenty-four hours, for that is an ounce of albumen, and the ordinary allowance of albuminous food is from four to five ounces daily. Such a patient then is losing the equivalent of one-fourth or one-fifth of his total albuminous food. But it is to be remembered that not all the albumen taken becomes blood albumen, and much of the albuminous food never reaches that stage. If we calculate the amount of blood relatively to the weight of the body and the amount of albumen in the blood serum, we find sometimes that a patient is daily passing by the kidneys the equivalent of a twelfth part of his blood. The seriousness of such a drain is obvious to anyone. How are we to meet such a drain? On the one hand, by giving albuminous foods, and especially milk, in larger quantity. As a pint of good milk contains somewhere about an ounce of albumen and casein, an extra pint should atone for the loss if the patient is able to digest it.

Do we possess any medicine which has the power of restraining the discharge of albumen? The observations which I have made lead me to doubt whether any of them is distinctly possessed of this power. Certainly tannic acid and tannate of sodium, ergot and iodide of potassium have failed in my hands, and the only two which seem to me to have proved useful in any measure are the tincture of the perchloride of iron and the hydrochlorate of rosaniline-fuchsin. In the great majority of cases these also fail, but I have in some instances found that without influencing the quantity of urine or the output of urea, they did appear to diminish the discharge of albumen.

The deterioration of blood in respect of the corpuscles sometimes demands special attention, and here, as in other similar conditions, iron and arsenic constitute our best remedies. Some practitioners have found iron prove injurious by inducing constipation or hepatic disturbance, but this can be easily corrected by the addition of glycerine or chloride of ammonium.

Dropsy is an important symptom of the disease of the tubules, and sometimes proves fatal. It is not necessarily present, either in the pure cirrhotic process or in the waxy or amyloid degeneration; but whenever the tubular inflammation becomes super-added to either of these, it soon arises and often becomes severe and persistent. For its treatment it is of the first importance that the patient should rest in bed, and should be put upon a milk diet with an abundant allowance of diluent drinks, keeping the skin in free action by warmth, and by the internal or subcutaneous use of jaborandi or pilocarpine or other diaphoretic medicines, combined with hot-air or vapour baths. Sometimes, also, the dilatation of capillaries by the use of small doses of nitroglycerine appears to favour the action of the skin. The free action of the bowels may also do good on emergency, but, while constipation should never be permitted, it is better to avoid the use of hydragogue cathartics, because they are debilitating, often irritate the stomach and bowels, and during their action are apt to expose the patients to risk from cold. But the main reliance is to be put on diuretics. If a free flow of urine can be established, not only is

the dropsical effusion removed, but the condition of the kidneys is bettered in the way I have already explained. The diuretics employed must, of course, be non-irritating. Water and milk are among the best, but medicinal diuretics—especially digitalis—alone or in combination with squill, carbonate of ammonia, acetate of potash, acid tartrate of potash, spirit of nitrous ether, broom tops or other remedies, are often followed by the most brilliant results. I may be permitted, in passing, to refer to the interesting diagnostic hint often afforded by the relationship of diuresis to dropsy. If in a chronic state copious diuresis is established and yet the dropsy does not disappear, it is probable, or almost certain, that waxy disease of the kidney exists in addition to the tubular inflammation, and that the result must in the end be fatal.

Other mechanical plans of treatment, besides the rest in bed to which I have already referred, help us in the treatment of dropsy. Much benefit accrues from kneading or rubbing the swollen parts, also from careful and judicious bandaging; and sometimes mechanical relief by tapping is demanded. In cases of general dropsy I find it safest, and often very effectual, to tap the pleura. Such withdrawal of fluid not only relieves symptoms directly, but favours the action of the diuretic remedies, and if performed with due caution is absolutely free from danger. It is my constant practice, both in cardiac and renal dropsies, to draw fluid from the pleura, and I have even done it with the greatest benefit to the patient when acute pericarditis complicated the dropsy. The removal of ascitic fluid in a similar way is often demanded, and sometimes it is necessary to drain the subcutaneous tissue of the legs by means of Southey's tubes. These tubes give in many cases most excellent results, but the strictest antiseptic precautions must be carried out when they are used, and, seeing that even with such precautions erysipelatous inflammation occasionally occurs, I never have recourse to them unless it is absolutely necessary. I find in looking at the records in my department at the infirmary, that the proportion of deaths from dropsy is exceedingly small.

Uremia is the most common cause of death in my cases, and it is one of the most important and alarming results of Bright's disease. In most instances it results from the retention of waste products which the diseased kidneys failed to eliminate. We seem gradually to be approaching towards a knowledge of the precise substances which act as poisons, such researches as those of Bouchard and Landois tending greatly to clear up the subject.

I am confident that many cases of so-called uræmia are in some measure due to alterations of the circulation and of the nutrition of the brain substance. In the last-named group, when there are minute hæmorrhages and degenerative changes, treatment is of little service, but in the circulatory and in the poisoning cases great good may be done. The best treatment is by acting freely upon the skin and bowels. A hydragogue cathartic is, in such a case, generally admissible; but whether it is used or not powerful diaphoretics must be employed. The subcutaneous injection of pilocarpine—say one-sixth of a grain—packing the patient well round with hot bottles, covering him up with blankets and eider-down quilts, and administering, if it be possible, copious draughts of warm fluid usually suffice to bring out copious perspiration. With its appearance the uræmic symptoms often begin to subside. The use of the hot-air bath and occasional repetition of the diaphoretic medicine will generally keep up the action of the skin and carry the patient through the time of danger. At the same time the kidneys themselves must not be neglected, digitalis, strophanthus, and other diuretics being administered so as to establish a free flow of urine. In some cases, and especially in those connected with pregnancy, blood-letting is to be strongly recommended, may be from the arm, or locally by cupping, or by leeches over the kidneys. It is in the course of inflammation of the tubules that we get our most striking results by this treatment, but in the more sudden varieties of uræmia occurring in the course of cirrhosis it is also very striking. A patient who has had his attack precipitated by indulgence in alcohol may be rapidly relieved in this way, but the administration of bromides or chloral or a little chloroform often helps materially. It is to be noted also that when the uræmic attack is associated with constipation, and perhaps due to reabsorption of materials from the intestinal tract, free purgation is obviously indicated.

Inflammations of the gastro-intestinal mucous membranes, and particularly of the stomach, are of frequent occurrence in the later stages of the disease. They may often be relieved by careful dieting and the use of such combinations as bismuth, bicarbonate

of soda, rhubarb, and aromatic powder. Not infrequently cholagogues are required, and a few doses of calomel or blue pill free the patient from a tinge of jaundice, clean the tongue, and restore the appetite and digestive power.

Pleurisy and pericarditis, particularly the latter, often usher in the fatal result in cases of chronic renal disease, but much may be effected by judicious treatment. If we watch for the commencement of pericarditis, and as soon as its presence is indicated by local or abdominal pain, and by the physical signs, we apply leeches over the part, we very frequently succeed in checking the process. The same treatment is serviceable in pleurisy. The application of mustard or other counter irritants, avoiding, of course, those which irritate the kidneys, often does great good. If much effusion be poured out into the pleura one should use the aspirator, just as is done in a simple pleurisy, and that even though pericarditis coexists. I have not seen evidence that any internal medicine markedly modifies the inflammatory process. But in cases of pericarditis we should be guided by the state of the heart to the use of cardiac tonics, such as digitalis, strophanthus, or caffeine, or cardiac sedatives, such as iodide or bromide of potassium.

Increased vascular tension, whether arising comparatively early or late in the course of the disease, may be benefited by nitro-glycerine or the nitrites; even small doses of nitro-glycerine often sufficing to give the most marked relief. I have not seen any injury follow its use, but it must be employed with caution in any case where there is excited cardiac action and degeneration of vessels lest extravasation of blood should occur. If such a condition exists, it is better to use the iodide or bromide of potassium, for they often improve the state of vessels, and at the same time quiet the action of the heart. Sometimes the application of cold over the heart is desirable. But far more frequently, as the case advances, degenerative changes set in in the muscular substance of the organ, and the patient is distressed by dyspnoea which may be partly uræmic, but is mainly of cardiac origin. In such a case cardiac tonics are indicated—digitalis, strophanthus, caffeine generally proving the best.

Such are, according to my experience, the most important points in connection with the treatment of chronic Bright's disease; and while they leave so much to be desired, a review of them still affords some satisfaction to those of us who are able to look back through a period of twenty or thirty years. I hope that we shall one day be able to combat the causes with a success that we do not dream of now; that we shall one day find remedies capable of directly influencing the nutrition of the kidneys, and restoring them, when diseased, to the healthy condition, or at least means of treatment, by which we may so rest the organs as to give their tissues time and opportunity of returning to the normal type. This would represent in the language of modern science what our predecessors were wont to speak of as the *vis medicatrix Nature*. I hope, also, that we shall find means of dealing much better than we now can with the various dangers which result from the morbid processes preventing the drain of albumen, or supplying what has been lost; securing elimination by other channels; neutralising within the system the poisons which have been produced, and, perhaps, even by a process analogous to dialysis, removing them from the system as they are formed.

ON THE PRINCIPLES OF THE TREATMENT OF DIABETES MELLITUS.

Read before the International Medical Congress, Berlin, August, 1890.

By F. W. PAVY, M.D., LL.D., F.R.S.

THE first point to be considered in discussing the treatment of diabetes is the rationale upon which it should be conducted. A certain deviation from health resulting in the escape of sugar with the urine constitutes the condition that has to be combated, and something requires to be said regarding the nature of the deviation before we are in a position to approach the question of how it should be treated.

The observable phenomena are that, whilst in the healthy subject the food ingested is disposed of in such a manner within the system as not to lead to the exit of sugar from it, in the diabetic subject the food fails to be similarly disposed of, but in part passes out as unconsumed and wasted material with the

urinary excretion. It is with the carbohydrate principles that the faulty action lies. These, instead of passing in the direction that results in their consumption and utilisation and thus disappearance within the system, as occurs in health, do not follow such a course, but remain in the state of carbohydrate, and are eliminated as such. The chemistry of the body with regard to these principles is at fault. The proper changes do not take place to lead to their being employed as they ought to be, and thereby lost sight of. Represented in other words, through defective assimilative action these principles do not pass on, it may be said, to their proper destination.

Thus much is learnt by simply looking at the matter through the light of ingress and egress.

There is no theoretical consideration involved in stating that the carbohydrates in the system of the diabetic fail to undergo those right chemical changes which, in health, lead to their disappearance, and that consequently, whether ingested from without, or formed from the splitting up of nitrogenous matter within, they become disposed of by egress with the urine.

It may further, I consider, be stated that, as a result of the faulty action, the carbohydrate, in the form of sugar, reaches the general circulation in a manner it ought not. No one with any ground of support can contend that the sugar eliminated is formed by the kidney. Whatever appears in the urine has previously existed in the blood flowing to the organ, and osmosis suffices to account for the escape that takes place. I am of opinion it has satisfactorily been made out that healthy urine contains a certain small amount of sugar, and this stands in accord with what is observed as regards the condition of the blood under natural circumstances.

With regard to the presence of sugar in ordinary urine, I conducted a series of observations some years ago, in which I precipitated the sugar by means of lead acetate and ammonia, after previous separation of the uric acid by lead acetate alone. The compound of sugar and lead oxide was then decomposed by sulphuretted hydrogen, and the sugar estimated gravimetrically by boiling with the copper test liquid, collecting the precipitated cuprous oxide, and subsequently, by the aid of a galvanic current, depositing the copper upon a weighed platinum cylinder. The amount found varied from 0.096 to 0.533 parts of sugar per 1,000 parts of urine.

The condition of the blood, as regards sugar, can be with precision defined by the application of a satisfactory analytical procedure which exists at our command. There is no difficulty, with the exercise of proper attention, in securing the full extraction of whatever sugar is present in a given specimen of blood, and afterwards expressing its amount. From a large number of observations, I may state that the quantity of sugar in blood taken under natural conditions does not amount to more than from about 0.5 to about 0.8 per 1,000. Under deviations from the natural state the quantity may be quickly made to rise higher, and this, it may be said, should be borne in mind in looking at results where larger quantities are mentioned by investigators as having been found. I have made analyses of the blood obtained from persons suffering from diabetes, and have a record of seven instances. A general agreement is distinctly recognisable between the amount of sugar escaping with the urine and that found in the blood. Taking one instance, where 750 grammes of sugar were eliminated with the urine in the twenty-four hours, the blood contained 5.763 per 1,000; whilst in another, with 27 grammes in the urine for the twenty-four hours, the amount in the blood was 1.543 per 1,000. These are the examples giving respectively the highest and lowest figures of the series, both for urine and blood. It is correct to state that the condition of the urine as regards sugar affords an index of that of the blood. This is only what might be expected, seeing that sugar is a diffusible substance, and that therefore in proportion to its presence in the blood so may it be looked for in the urine. As its presence to more than an exceedingly minute extent is abnormal to the urine, so the same may be said of the blood, and its presence in the blood to the extent occurring in diabetes means the existence of an unnatural state of this fluid, which induces a deviation from healthy action throughout the system. In proportion to the extent of this deviation from the healthy state—that is, in proportion to the amount of sugar reaching the general circulation and thence passing out through the kidney—so will stand the measure of severity of the symptoms of diabetes. Looked at broadly, it may certainly be stated that the larger the amount of sugar eliminated with the urine the worse, in every direction, is the condition of the patient suffering from diabetes.