THE TREATMENT OF DIABETES.

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In opening a discussion on the treatment of diabetes it might be well to begin by pointing out that no new drug of any real value in the treatment of diabetes has been discovered since 1922 when insulin was introduced; there have, however, been almost hundreds of quack remedies put on the market, which, owing to their skilful advertisement and ease of administration, are still prescribed by some doctors to their diabetic patients. The benefit claimed to have resulted from the use of such drugs is usually due to the restricted diet which is carried out concurrently with the administration of these so-called oral diabetic cures, for if care be taken to see that the diet is kept constant before commencing this treatment and during its course no change in the patient's condition will be observed to occur.

Synthalin, a German preparation introduced in 1926, and neosynthalin in 1930, certainly bring about a reduction in the glycosuria, according to certain authorities by poisoning the liver cells and so diminishing the endogenous production of sugar by that organ; these preparations can be given by the mouth, but local gastro-intestinal toxic symptoms, nausea, vomiting and diarrhoea very frequently result from their administration when given in large doses, so if used at all synthalin treatment should be reserved for the mildest cases only.

Glukhorment (of Von Noorden) is a dried pancreatic extract with small amounts of synthalin added; any effect it has appears to be due to the synthalin present in the preparation. Pankreasmellin and panteric tablets are other products made from the pancreas; it is doubtful if much effect can be obtained from their use.

TREATMENT OF DIABETES BY DIET OR DIET AND INSULIN.

The treatment of a diabetic depends very largely on the severity of the case, that is on the extent of damage of the pancreas, and the amount of endogenous insulin still available. Where the case is a slight one, diet alone will usually be sufficient to control the excess of sugar and ketone bodies in the blood, the patient regaining health and strength when put on a suitably restricted diet without the addition of insulin. This is the method one adopts when such a case occurs in a poor patient admitted to Kasr-el-Aini hospital; but when the expense of insulin is not a consideration,
even mild cases do better on a more generous diet balanced with small doses of insulin.

Where the pancreatic damage is extensive, or in the case of a child where restricted diet is undesirable owing to the importance of not hindering growth, the administration of insulin in addition to dietetic control is essential for the patient's well-being; no attempt should, however, be made to over-fatten diabetic patients, as they usually do better when kept slightly underweight.

If blood-sugar estimations can be carried out the severity of the case can usually be quickly determined and a suitable treatment arranged, but where this is not possible one can usually find out without much difficulty whether a patient can thrive or not without insulin by putting him on a diet of sufficient caloric value to enable him to carry on his usual occupation, say somewhere about 1,500 to 2,000 calories if doing light work, the carbohydrates, proteins and fats being given somewhere in the proportion of carbohydrate : protein : fat 3 : 1.5 : 1, one gramme of protein being given for each kilo of body-weight; the amounts of carbohydrate and fat may, however, require modification, for if ketone bodies appear in the urine, either the fats must be diminished or the carbohydrates increased or both changes may be necessary in order to get rid of the ketosis. The carbohydrates given during this trial should be almost entirely in the form of vegetables low in sugar value so as to obtain the necessary bulk in the food. The patient is kept on this low diet for a week, and if his urine is sugar and acetone free at the end of that time this diet alone should keep him well. If, on the other hand, at the end of the week of restricted diet he still shows sugar in considerable quantities the case is not likely to prove satisfactory on diet alone and insulin treatment should be instituted.

Where insulin is necessary the patient can be fed on all sorts of carbohydrate, protein and fat combinations and when adequate doses of insulin are given with good results, but we may for convenience divide the treatments into three groups:

1. **Low carbohydrate**, 30 to 50 grammes, and moderate protein, with much fat to make up the necessary calories, giving only little insulin; this diet is unsatisfactory to the patient as it is very different to what he is accustomed to take and so is not usually liked by him. Very rarely found satisfactory.

2. **Moderately high carbohydrate**, 100 to 150 grammes, and two doses of insulin, morning and evening, sufficient insulin being given to balance the carbohydrates; the correct dose of insulin is an individual matter to be found out in every case; as regards meat, other proteins, and fats, the patient on this moderately high carbohydrate diet can usually be permitted to eat as much of these as he desires. This method of treatment is usually found satisfactory, the patient is not likely to develop ketosis and coma, he keeps free from infections and his general health is better than when on a very restricted carbohydrate diet.
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(3) **High carbohydrate diet,** 150 to 300 grammes per day; this is equal to the carbohydrates of a normal diet. If the total calories in proteins and fats are kept very low, then such a diet requires very little more insulin than on the diet given under (2); otherwise much more insulin is needed and greater difficulty is experienced in keeping the patient free from perpetual glycosuria and hyperglycaemia on the one hand and hypoglycaemia on the other; another disadvantage is that three injections of insulin a day are often found to be necessary with this diet. Where a diet very poor in fat is prescribed great difficulty is experienced in its preparation from the cooking point of view; furthermore, patients usually complain greatly of the very limited allowance of fats when put on such a diet. It is important to remember that cutting down the fats alone will diminish the demand for insulin, so that when making a reduction in the fats of a diet with a view to increasing the carbohydrates, if high doses of insulin are being used, one must either cut the fats and increase the carbohydrates at the same time, or temporarily reduce the insulin with the reduction of fats until the patient has been put on the increased carbohydrates.

**What is the Effect of Hyperglycaemia in Insulin-treated Patients?**

We all know that patients with excess of sugar in the tissues and blood can feel and keep very fit when given enough insulin to burn sufficient food for their metabolic needs; but here an interesting point arises: are these people likely to develop the same complications as long-standing uncontrolled diabetics, such as arterial degeneration in the legs with gangrene, and in the eyes with retinitis, or are these terrible complications of untreated severe diabetics due to under-nourishment of the arteries, etc., and not directly the result of hyperglycaemia? We don't yet know, so we must go on the principle of trying to control hyperglycaemia as an unnatural occurrence and so possibly harmful.

**Treatment of Diabetic Coma.**

We all know that diabetic coma is brought about by the absence of sufficient insulin to burn enough glucose for the complete destruction of the fats, this allows the products of incomplete katabolism, ketone bodies, to accumulate in the system; but we should not forget that not infrequently coma is precipitated by the presence of some toxæmic or septic condition in the body, and so in cases when coma is present or threatened all sources of toxæmia should be searched for and if possible at once removed.

The treatment of diabetic coma should be divided in the treatment of:

(1) **The precomatosed stage** when we are warned of the danger of coma by finding the patient drowsy, and by the presence of ketone bodies in the urine in considerable quantities, as shown by the ferric chloride test being strongly positive; here the patient can always be rescued by giving enough insulin and carbohydrate, these burning together to reduce the dangerous ketosis.
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(2) The Profound, well-established and Complete Coma where the Patient cannot always be Rescued by Insulin alone.—Here the patients are dehydrated from the previous polyuria and vomiting, and as a result their eye tension is low, the heart and circulation collapsed with pulse rapid and feeble, blood-pressure low, kidney functions poor with albuminuria and casts (always present), oliguria or even anuria, and high blood-urea 60 to 150 milligrammes per cent, all symptoms resembling those found in a case of cholera and requiring similar treatment for their relief.

The treatment for such a case of coma can be considered under three headings:

A.—Treatment of the predisposing cause.
B.—Treatment of the ketosis by plenty of insulin and carbohydrates.
C.—Treatment of the condition of marked dehydration.

As regards A, any gross septic condition present which predisposed the patient to coma, such as an empyema, should be at once dealt with if possible, preferably under a local anaesthetic.

B.—The ketosis should be treated by giving plenty of insulin, perhaps 200 to 300 units in the twenty-four hours balanced by sufficient sugar to bring about complete combustion of the fats and to prevent hypoglycaemia, recollecting that the sugar is quite as important as the insulin in the removal of a severe ketosis.

The most satisfactory way of giving glucose in such severe cases of coma is by the intravenous route, giving glucose and insulin in the proportion of one unit of insulin for each gramme of glucose, using a 10 per cent glucose solution; 500 cubic centimetres of 10 per cent glucose with 50 units of insulin added are therefore run into the vein very slowly, and this is repeated every two hours till the patient recovers from the coma, when 50 grammes of glucose by the mouth and 25 units of insulin subcutaneously are given every three hours till the acetone bodies disappear from the urine, after which the patient can be placed on a suitably balanced diet and insulin.

When blood-sugar estimations are not possible, it is always well to give sufficient glucose to keep some sugar in the urine and so avoid the risk of hypoglycaemia. In the treatment of a case of diabetic coma we should never forget that the administration of large amounts of glucose can do nothing but good provided sufficient insulin is given to activate this sugar; this liberal supply of sugar encourages us to use sufficiently generous doses of insulin. Cases of diabetic coma should, if possible, always be treated in a hospital where blood-sugar estimations can be carried out at frequent intervals. When these facilities are available very large doses of insulin can often be given, and if necessary, repeated frequently without any danger of hypoglycaemia, the patient thus being rapidly brought out of his coma.

C.—Treatment of the dehydration. This is often almost as important as the treatment with sugar and insulin. Cases with only moderate
dehydration may be treated for this by giving fluids by the mouth when the patient can swallow, otherwise by the stomach tube, by rectal enema, and by the subcutaneous route. In all very severe cases, however, where the secretion of urine is markedly diminished and a mounting blood-urea indicates the onset of uraemia, the intravenous method is the only satisfactory means of getting sufficient fluid rapidly into the body; the treatment should be very similar to that for a case of cholera, commencing by giving two litres of hypertonic saline 1:2 to 1:8 per cent intravenously, running in this amount in about half an hour; half a litre of seven per cent gum-acacia solution can often be given in addition with considerable advantage. The hypertonic saline and gum-acacia solutions tend to remain in the circulation better than normal saline, and the additional sodium chloride helps to replace that already lost by the polyuria and vomiting. Recently the administration of twenty-five per cent glucose in normal saline solution has been advocated in cases of severe dehydration with threatened uraemia, the results obtained being very satisfactory. The glucose solution drawing fluid from the tissues into the bloodstream improves the general circulation and so increases the flow of blood through the kidneys, thereby assisting in the elimination of waste products by these organs. Two to three minims of adrenaline solution can with advantage be added to the intravenous infusion for its cardiac effect when the patient's condition indicates this.