

## THE PRESENT DAY TREATMENT OF DIABETES\*

INDICATIONS AND CONTRAINDICATIONS FOR  
VARIOUS THERAPEUTIC MEASURES.

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In the last three or four years the treatment of diabetes has been greatly simplified, and the introduction of insulin has enabled the general practitioner to treat diabetes with a considerable degree of success. Yet there still appears to exist some confusion as to the indications and contraindications for certain well established therapeutic measures in the management of diabetes. It is the purpose of this paper to offer some suggestions which may, in some degree, clarify this confusion.

### INSULIN

It has been frequently asserted that insulin has a definite metabolic value in terms of glucose, to wit, that one unit of insulin can metabolize one to two grammes of glucose in the body. On the basis of this assumption it has been claimed that the dosage of insulin in human diabetes can be determined mathematically, when the patient's tolerance is estimated in conjunction with his total glucose requirement in the maintenance diet. That is to say, a patient whose glucose requirement is one hundred grammes and who has a tolerance of only sixty grammes (as shown by the excretion of forty grammes of glucose in the urine), will require approximately twenty to forty units of insulin a

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day to keep sugar-free on his maintenance diet. Whatever merit there may be in the theoretical considerations involved, in my experience it was not found possible to apply any such mathematical determination of insulin dosage in the practical management of human diabetes. This appears to be due to the fact that both the patient's glucose tolerance and the metabolic value of the insulin unit are variable factors.

In attempting to determine the glucose tolerance in uncomplicated cases of diabetes mellitus, it is found in nearly every instance, when the patient is kept on a maintenance diet without insulin, that the tolerance for glucose shows a definite tendency either to increase or to diminish. In the chronic well-nourished or mild diabetic, the administration of a carefully balanced maintenance diet generally results in a continuous daily improvement in the tolerance, with a gradual clearing of the glycosuria. On the other hand, in the acute youthful and under-nourished diabetic, a definite tendency to downward progress is noted with a rapid lowering of the tolerance and a continuous increase in the urinary glucose.

The metabolic value of insulin in human diabetes is likewise a variable factor. The accompanying table gives the results of two experiments which tend to show that the effect of insulin upon the blood sugar level in diabetes varies with different patients. In each experiment two patients of approximately equal weight and whose fasting blood sugars were of nearly the same level were chosen. Both patients in each experiment respectively received exactly the same dose of insulin. The blood sugar

**EFFECT OF INSULIN UPON THE BLOOD SUGAR  
LEVEL IN DIABETES**

Patients	A	B	C	D
Fasting blood sugar level.....	.540	.510	.326	.353
Units of insulin given.....	10	10	20	20
Blood sugar ½ hour after in- sulin .....	.465	.300	.317	.....
Blood sugar 1 hour after in- sulin .....	.395	.265	.260	.166
Blood sugar 1½ hours after insulin .....	.387	.200	.202	.102
Blood sugar 2 hours after in- sulin .....	.353	.168	.198	.....
Blood sugar 2½ hours after insulin .....	.342	.....	.....	.111

A and B represent two patients of approximately the same weight examined in Experiment 1. C and D represent two patients of approximately equal weight examined in Experiment 2.

was then determined at half hour intervals. As may be seen from the tabulated results, the effect of the insulin per unit varied markedly in each instance. It is apparent from the above considerations that an estimation of insulin dosage, based on two such variable factors as the patient's supposed tolerance and the metabolic value of insulin, is apt to be quite misleading.

The method for gauging insulin dosage followed at this clinic is very simple and has proved quite satisfactory. At the outset the cases of diabetes are separated roughly into two groups, (1) the mild, well-nourished or so-called chronic group which includes most patients at or above middle age, and (2) the severe, undernourished or the so-called acute group which includes most patients under middle age. Patients in the first group are generally treated without insulin. Depending upon the degree of overnutrition, these patients receive a basal or a subbasal diet, a slight loss of weight being

sought. As the urinary and blood findings return to normal and the desired loss of weight is accomplished, the diet is gradually increased to a maintenance level. The results obtained with this class of patients are generally most gratifying.

The management of the cases in the second group presents a more difficult problem. These patients, already undernourished, are placed on maintenance diet from the outset, and insulin is administered at once. No time is thus lost in an apparently useless attempt to determine the glucose tolerance. Depending upon their blood sugar level and upon the degree of acidosis present, these patients are given from ten to forty units of insulin before each meal during the first twenty-four or forty-eight hours.

The subsequent insulin dosage is determined by examinations for urinary glucose before each meal and by determining the fasting blood sugar level once or twice a week. Thus, while the patient is kept on a maintenance diet, sufficient insulin is given to keep the urine free from sugar throughout the day, and the fasting blood sugar at a normal level. The appearance of a trace of sugar before any meal serves as an indication for increasing the dose of insulin (generally by five units). On the other hand, a fall of the fasting blood sugar below the normal level, or the development of symptoms of hypoglycemia at any time during the course of the treatment serves as an indication for diminishing the dose of insulin. This plan has proved very satisfactory, and it was frequently found possible to reduce the insulin dosage in a given patient, as his tolerance appeared to increase, from twenty or

thirty units three times a day to ten or twenty units once a day and finally discontinue the insulin altogether.

#### STARVATION AND UNDERNUTRITION

Aside from its historic interest, starvation no longer has a place in the therapeutics of diabetes. Its sole function (rendering an obstinate case sugar free) is now more easily and far more profitably accomplished by the use of insulin. The principle of undernutrition, however, is just as valuable today as it was at its first introduction by Dr. Allen ten years ago. But, like other therapeutic measures, its greatest usefulness is realized only when employed upon proper indications. It has already been pointed out that diabetes patients may be divided roughly into two groups: the undernourished, and the obese. In the former group are included most of the cases of diabetes in the young, especially children. The latter group is composed largely of patients at middle age or over, with a tendency to a mild and chronic course. It is in this group of patients that a subbasal diet leading to a moderate degree of undernutrition brings the best results. In this type of patient practically complete cure may in some instances be obtained by dietary measures alone, by a judicious application of the principle of undernutrition. On the other hand, in the young and already undernourished patient the prolonged application of the principle of undernutrition is apt to lead to disastrous results.

#### THE MAINTENANCE DIET

The maintenance diet is the ultimate goal in all cases of diabetes. In the undernourished group and

in practically all cases of juvenile diabetes the maintenance diet must be instituted from the beginning, the process of desugarization being accomplished by the use of insulin, rather than by further increasing the state of undernutrition. The maintenance diet in any given case is determined at the outset by estimating the patient's basal caloric requirement and adding to it twenty to thirty per cent of the total calories, depending upon the patient's activities. The number of grammes of protein in the diet is determined by the patient's weight (from  $\frac{2}{3}$  to 1 gramme of protein per kilogramme of body weight for the adult patient, and from  $1\frac{1}{2}$  to 2 grammes of protein per kilogramme of body weight for children). The number of grammes of fat and of carbohydrates are determined by the Woodyat method. The inability to administer such a maintenance diet to a diabetic of the undernourished group, or to any diabetic at the end of the course of treatment without causing glycosuria, constitutes a rational indication for the use of insulin.

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