Physiology and Pharmacology in Diabetes Mellitus: Guiding the Diabetic Patient Through the Surgical Period

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Surveys in recent years in various parts of the world have shown that the frequency of diabetes mellitus ranges from 2 to 3 per cent in the general population,\textsuperscript{1, 2} with an even higher rate among older people. It has been a common finding that 40 to 50 per cent of persons found to have diabetes have been unaware of its presence. Diabetes, therefore, is a relatively common condition, and from time to time every surgeon and anesthetist will be confronted with diabetic patients. The problem may be one unrelated to the disease such as repair of a hernia, or it may be a complication directly related to diabetes, such as gangrene of the foot. Regardless of the reason for operation, the diabetic patient presents a special challenge, not only because of impairment of the homeostatic mechanism for glucose with the danger of developing keto-acidosis if undertreated or hyperglycemia if overtreated, but also because of the possibility of the presence of generalized vascular disease of a degree more pronounced than would be expected for the chronological age. Consequently, prior to operation, be it elective or an emergency, the patient should be seen and evaluated by a physician acquainted with the special problems presented in diabetes mellitus.

It is important to keep in mind that every patient for whom operation is planned, especially those in older age groups, may have undiagnosed diabetes. Another item of diagnostic value is that the vomiting and abdominal pain of keto-acidosis may simulate appendicitis or other acute surgical conditions. One takes it for granted that an analysis of the urine will be carried out preoperatively for all patients scheduled to undergo operations. It would also be desirable to obtain, routinely, a determination of the blood sugar at one or two hours after a regular meal. This method of "screening" for diabetes is recommended for two reasons: (1) especially in older persons, the "renal threshold" for sugar may be above the average level and the blood sugar may be abnormally high even though the urine is sugar-free, and (2) in "mild" diabetes the blood sugar may be normal in the fasting state and rise to abnormal levels only after ingestion of food.

The following discussion will include a review of the acute metabolic derangements in diabetes with reference to stress situations such as operation and anesthesia, and an outline of the treatment of diabetic patients during the period of operation.

The Diabetic State

Diabetes mellitus is characterized by hyperglycemia, usually accompanied by glycosuria. The basic defect is a lack of metabolically effective circulating insulin. This results in an elevation of blood glucose because of deficient utilization in peripheral tissues, mainly muscle and fat, and because of increased output of glucose by the liver.\textsuperscript{3} The sources of excess glucose are dietary carbohydrate, liver glycogen and glucose formed from protein and fat. Protein from muscle is broken down to aminoacids and transported to the liver where further catabolism takes place with the formation of 2- and 3-carbon fragments, and the waste product, urea. Free fatty acids are released from adipose tissue, bound to serum albumin, and transported to the liver. The metabolic end product of fatty acids is aceto-acetate (diacetic acid), which by hydrogenation gives