1956

The Treatment of juvenile diabetes

Jack Paap
University of Nebraska Medical Center

THE TREATMENT OF JUVENILE DIABETES

Jack Irland Paap

Submitted in Partial Fulfillment for the
Degree of Doctor of Medicine

College of Medicine, University of Nebraska

April 2, 1956

Omaha, Nebraska

Table of Contents

Introduction

Juvenile Diabetes! A rare disease! This is a common thought and granted it is true, however, in the present medical era of increased diabetic longevity with marriage and subsequent increased births and decreased infant mortality, the incidence of diabetes in children is making a rapid rise in present-day medical practice.

It has been stated that the incidence of diabetes in children is one per 2500 children below the age of 15 years. At present there are an estimated 40-60,000 diabetics under the age of 15 years. (44)

In 1949, 3 million births were recorded in the U.S.A., of these there will be approximately 1300 new diabetics before they reach 15 years of age. Add this with the already existing number of diabetic children, then mentally calculate the increased number of diabetics that will be present with the ever increasing birth rate! You will then realize that the treatment of Juvenile Diabetes may be at your doorstep before you realize it.

The treatment of juvenile diabetes is different from the diabetes of older individuals as pointed out by Guild. (22) Diabetes in children is usually a pure

disease, usually no obesity, arteriosclerosis or life long abuse of diet. Juvenile or infantile diabetes is usually inherited. A family history is present in as high as 3 out of 5 cases. It becomes full blown very rapidly and the disease is very "labile" or "brittle." The children's disease is potentially severe as shown by statistics in pre-insulin days when a young diabetic would survive only 1 to 2 years. Dietary requirements for growth and development and maintenance of body weight are ever changing. Regulation and control of juvenile diabetes is difficult due to infection, proneness to acidosis, variation in activity and insulin reactions. The entire family is involved in the juvenile diabetic's problem and the mother as well as the patient must accept the disease. The child must be trained to live with his disease and usually the younger the onset the more easily is training accomplished. Above all, complications are to be avoided in this younger group to provide for a comfortable and happy life in the years ahead.

My interest in the management of juvenile diabetes came during my junior year in medical school at which time I had the opportunity to act as counselor at the Springdale Camp for Diabetic Children.

The management of juvenile diabetics is a contro-

versial subject at present and a satisfactory strict regimen is difficult to establish. There are two leading schools of thought on the management of diabetes.

Tolstoi and Lichtenstein represent the "liberal" school, while White, Jackson, Marble, Duncan, Joslin, and Root represent the "control" group. There are numerous "middle of the roaders" and "radicals" and it is with this in mind that an evaluation of present day therapy will be attempted, if this is possible from surveying the literature.

For simplicity, management will be divided into 1. Insulin. 2. Diet. 3. Exercise. 4. Education and psychology. 5. Diabetic Coma and Insulin Reactions.

HISTORICAL NOTE

The history of diabetes dates back to antiquity. Among the first to relate any medical significance, dates to the years 30 B.C. to 50 A.D. A Roman, Aulus Cornelius Celsus, not a practicing physician, wrote treatises on medicine. He translated Greek medicine of his day and described patients as having a greater discharge of urine than the amount of fluid taken in by mouth.

The first important medical treatise on the subject in the English language appeared in the writings of Thomas Willis, published in 1679, under the title "Pharmacentice Rationalic."

He described the cardinal symptoms of diabetes, including polyuria, polydyspia, and the sweetness of the urine "as if there had been sugar or honey in it."

"The Diabetes, so called from Diabaino, (transeo, to pass through) a swift passing of potulent matter as a great flux of urine."

Willis disagreed with the thought that the cause of diabetes was kidney in origin. He thought the trouble was mainly in the blood along with "nervous juice."

Case reports at that time relate a treatment consisting of a diet of milk with barley water and white bread. Along with remedies of the age, mainly erbs, cypress tops, rhubarb and cowslip water were used. Noted relapses of the disease were thought to be seasonal.

Treatment of diabetes was revolutionized in 1921, by Banting and Best. Since that time various regimens of diabetic control have arisen.

Prior to the discovery of insulin the young diabetic could hope for a life of 1 to 2 years. Since that time great progress has lengthened the average life span to

42 years after diagnosis between the ages of 10 to 15 years of age. (44)

Present day concepts are being evaluated as to etiology, and treatment and as to which form of treatment offers the diabetic the best prognosis for longevity and the least complicating and degenerative changes. Until these factors can have the benefit of "tincture of time" for study and evaluation, each physician will have to adapt the form of treatment to conform with his beliefs as to the best therapy for his patients.

In any controversial subject there are several schools of thought concerning the proper treatment. In juvenile diabetes there are two main pillars of opinion, the "control" group and the "liberal" group.

P. White (66) (67) bases the control of juvenile diabetes on, 1. Insulin. 2. Dietary regulation with measured caloric intake. 3. Chemical standards: a. Urine sugar excretion less that 5% of carbohydrate intake b. Normal blood sugar before meals. c. No ketone bodies in the urine. d. Blood cholesterol below 230mg%.

A. Marble (43) begins the discussion of treatment with this statement, "Less than 100 per cent control is a situation to be tolerated rather than to be sought."

Marble states that with insulin and diet the patient may be free of glycosuria and have a blood sugar not far above normal. Every attenpt should be made to control the diseawe. Easy treatment may cost years of the patient's life.

E. P. Joslin (35), one of the older advocates for a controlled regimen for treatment of diabetes, refers us to pre-insulin days when diet was the only treatment for diabetes mellitus. Then along came the insulin era and relaxation of control allowed unobserved and slowly developing arteriosclerosis. Joslin states that the ultimate end for the patient is governed not by duration of the disease, but by the type of treatment. Joslin quotes Naunyn, "The essential duty of the doctor is and remains to keep the patient alive for a long time in a tolerable condition." Joslin adds, "To strengthen the disturbed function and to halt its further deterioriation. Diabetes is under the doctors' eyes. If we do not make them live longer, then the argument for routine health examination falls flat." Only 54 diabetics in the world have been recognized as perfect after 25 years of the disease.

G. G. Duncan (11) relates a five point program for "good control" of juvenile diabetics. 1. Adequate nourishment. 2. Fasting blood sugar below 150mg% and

postprandial levels below 200mg%. 3. Freedom from "major" or consistent glycosuria. 4. Cholesterol below 230mg%. 5. Normal physiologic and psychologic adjustment and development.

Kelly and Jackson (39) of the control group, regulate diet, insulin, exercise, and place their criteria for control on urinary excretion of sugar, expecially for their patients followed at the clinic.

> Very good control--urine free except for occasional trace. Mild occasional insulin reactions.
>
> Good control--urine free except for occasional minimal glycosuria and occasional mild insulin reaction.
>
> Fair to good control--one-half of specimens free of sugar. Occasional insulin reaction.
>
> Fair control--less than one-half of specimens free of sugar, with varying amounts of sugar in the specimens.
>
> Poor control--urine continuously with sugar.

The forgoing advocates of "control" of diabetes center their therapy around several basic factors, namely, 1. Insulin, 2. Diet, 3. Exercise and education, 4. Chemical methods of determining control e.g. Blood sugar and urine analysis.

Tolstoi (3)(64)(65) and Lichtenstein (42) approach the regulation of diabetes from the "liberal" or clinical view. Tolstoi's criteria are simple and few, mainly

1. Maintain weight with adequate caloric diet. 2. Freedom from all symptoms of diabetes. 3. Absence of ketone bodies from the urine. 4. Glycosuria desired. 5. One dose of PZ insulin to maintain weight. He feels that provided each patient metabolizes a quantity of carbohydrate essential for his particular metabolic needs, the excess may be excreted without damaging results. Tolstoi places the emplasis on "utilization" of carbohydrate and not on how much is "excreted." Some of his patient's spill as high as 100 grams of sugar per 24 hrs. An interesting fact about Tolstoi is that prior to 1936, he was an ardent follower of the "control" group. Since that time he has advocated the liberal regimen, because he feels the outcome is as good as "control" and he does not set up a "do-and-don't" schedule for his patients. He believes his patients are psychologically better off than the "control" patients. Tolstoi stands on the conviction that complications are as a result of the duration of the diabetes and not as a result of hyperglycemia. He states that there is no correlation between hyperglycemia and ketosis if the proper amount of insulin is used. He does not associate any increase in infections due to hyperglycemia and the increase in cardiovascular complications so frequently associated with hyperglycemia are not, in his thinking, significant.

Mosenthal (47) points out that with polyuria from hyperglycemia, some water and fluid is lost and this desiccation associated with an increased blood sugar may be the cause of lens changes in diabetics.

Lichtenstein (42), another "liberal" in management, advocates control of the diabetes by insulin alone. He states that restrictions should be avoided to prevent psychiatric trauma. He advocates a "free diet,"--a diet completely corresponding with that of healthy children. They may eat their fill. Patients may have sugar and sweets in reasonable amounts, the only rule is to avoid overindulgence. He believes that diabetic children should be treated without any dietetic restrictions whatsoever. Insulin is used to cover the intake of food and promote a good general condition, a feeling of well being, increase in weight and growth, a moderate amount of urine and complete freedom from keto-acids in the urine.

Both Tolstoi and Lichtenstein (42) offer 10 year follow-up studies on their patients and present convincing arguments for their treatment. They advocate fewer restrictions on the patient with the hope that he may live a more normal life.

INSULINS

It is the opinion of those who treat juvenile diabetes that no case should go without insulin therapy. (39)(42)(44)(11)(18)(36)(66) Berquist (4) supports the thought that insulin is essential for normal growth in children, and that if the endogenous insulin supply is obviously low, exogenous insulin must be supplied.

The exact action of insulin is not known, however, the following theories have been postulated.

The first and generally accepted theory at present is the permeability or transfer hypothesis. This hypothesis states that at cell surfaces or at the cell, particulate interfaces either physical or chemical barriers control the entrance of glucose to sites of enzyme action. These barriers are influenced by hormones in such a way that insulin becomes necessary for transfer to enzyme sites. (32)

Another theory, the hexokinase theory, postulates the reversing of anterior pituitary and adrenal cortex inhibition on hexokinase by insulin, thereby permitting insulin to promote the activity of hexokinase.

The lipogenesis theory states that insulin is necessary for the conversion of acetyl coenzyme A to fatty acid.

The oxidative phosphorylation theory advocates that insulin increases the rate of oxidative phosphorylation.

The last theory postulates that insulin acts on oxidative reactions of the Kreb's cycle. (32)

Commercially, many different insulin preparations are available today. Each insulin has its place and each individual case of juvenile diabetes may require a selection of one of the insulins best suited for the particular phase of the diabetes being treated.

Insulins may be classed as follows:

Quick acting, short duration

Regular
Semilente

Intermediate in action and duration

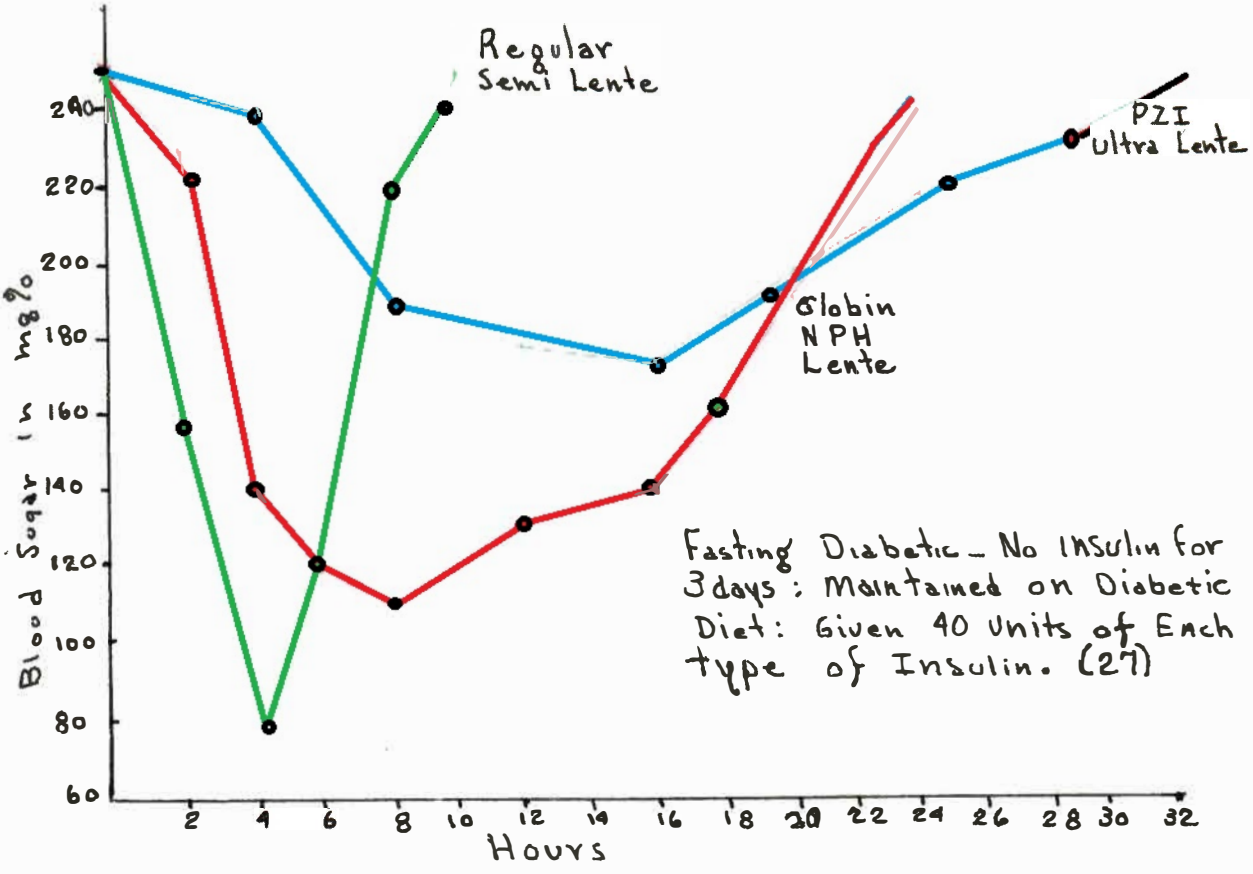
NPH
Globin
Lente

Slow acting, long duration

Protamine Zinc
Ultralente

Their actions can be demonstrated graphically. Regular and semilente have a peak action in 4 hours and total duration of approximately 10 hours. Globin, NPH and lente insulin have peak action in 8 to 10 hrs., and total duration of approximately 24 hours. Globin insulin must not be given IV since it forms a precipitate at the ph of the blood. It is not to be used in the treatment of

diabetic coma. PZI and Ultralente have a peak action in 16 hours with a total duration usually 32 hours.



Globin, Regular, NPH and PZ insulins are relatively well established insulins. Lente insulin, new since 1954, developed in Denmark, offers new and promising factors. An acetate buffer is used instead of the old phosphate buffer with the idea that the PH of the blood will more readily control the activity of the insulin. Lente insulin itself is a 30/70 mixture of semilente and ultra-lente. Clinically its action is the same as NPH insulin.(27)

Lente insulin does not contain a foreign protein substance; therefore, is supposed to offer fewer allergic reactions and no fat atrophy at the sites of injection.

Slayton, Bunows and Marble (62) state that Lente insulin acts the same as NPH. They can see no advantages to Lente over NPH, and at this time can see no advantage in changing patients from NPH to Lente.

Lichtenstein (42) uses PZ insulin almost exclusively in treatment as does Tolstoi. Each may mix regular or crystalline insulin as needed in various brittle diabetics. Using doses of PZI over 40 units gives a danger of nocternal hypoglycemia and it is felt that a quick acting insulin will help control the blood sugar during the day, in conjunction with the PZI.

Gibbs (18) and Marble (44) use NPH insulin with success. The desirability of a single injection daily is not always feasible if the diabetes is to be kept within the limits of "control." NPH insulin tends to regulate the hyperglycemic daytime periods with more satisfaction than does PZI. Frequently multiple insulin injections at different times during the day are necessary, as Jackson advocates (30)(39). Mixing regular or crystalline insulin with other longer acting insulins will often give the desirable insulin coverage for the patient.

In stabilizing a new diabetic, Jackson (30) uses 4 injections daily of regular insulin. After several days of this regimen he graduates to globin insulin and gives separate injections of regular and globin insulin, as needed to keep the urine free of sugar.

Lichtenstein and Tolstoi begin therapy with PZI and regulate the dose as needed for their adequate control.

One of the differences in managing a juvenile diabetic is the variable insulin requirements from day to day and also to provide for the normal growth and development curves. The reasoning of maintaining a good exogenous insulin supply stems from Haist (23) who, by animal experimentation, advocates a preservation or rest of islets cells in the pancreas by fasting, fat-feeding and exogenous insulin administration.

Marble's (44) regulation of diabetes follows a plan as outlined. Insulin doses vary from person to person and with the severity of the diabetes. Single daily insulin doses are desirable from the patient's standpoint, but often more than one injection may be necessary for daily regulation. For a diabetic that requires two types of insulin, NPH insulin is given before breakfast and at the same time some regular insulin may be mixed with the NPH; mixing with a ratio of 3:1 or

2:1. Three or two parts NPH insulin are mixed with one part of regular insulin. No change takes place in mixing NPH and regular insulin. You realize the full effect of both insulins from a single injection. Two daily urine checks are necessary for evaluation of control, one before the noon meal to evaluate the dose of regular insulin and the second before breakfast to evaluate the dose of NPH. In the initial adjustment use NPH insulin alone and check the late afternoon specimen. When satisfied, then stop at that dose. Then start checking the urine before the noon meal and if not satisfied, start 4 to 6 units of regular insulin in the A. M. before breakfast along with the daily NPH dose. If these two urine checks are satisfactory most of the other 24 hour samples will be acceptable. In some patients the NPH will not carry for 26 to 30 hours but diminishes before 24 hours. This may require a smaller dose of NPH given before supper or at bedtime, 4 to 8 units. Marble suggests a urine check 4 times daily with a chart made by the patient for examination by the doctor on office visits. Marble does not use globin insulin because in many patients its duration falls short of 24 hours and a second dose before the evening meal must be given. Protamine Zinc contains excess protamine and when mixed with regular insulin

converts some of the regular insulin to protamine insulin. This decreases the amount of regular insulin available to the patient as quick acting and does not give a known amount of long acting insulin. This uncertain insulin dose may cause trouble during the night fasting period.

Gibbs (18) in his discussion on management of diabetics on an outpatient basis states that when urine tests are done several times daily, absence of glucosuria in 50 per cent or more of the specimens probably represents a minimum satisfactory degree of control. Glucosuria amounting to 10% or less of the total available glucose of the diet seems to be a practical measure of control. His principles of control are 1. Flexible insulin dosage. 2. Minimum number of insulin injections. 3. Measured diet with between meal snacks.

Gibbs states that NPH insulin seems to offer the best control, mixed with regular insulin to suit the particular individual. A mixture of two parts NPH and one part of regular seems to fit most cases. To avoid confusion he mixes the insulin for the patients, thus reducing the chance of error in administration. This also allows him to see the patients every 2 to 3 months.

To manage the flexible insulin dosage a set of rules

is developed which depends on the over-all glucosuria throughout a given day. Urine sugar tests are performed by the patient with clinitest or the new "test-tape" enzymatic indicator tapes. Four tests are run daily. If they are in good regulation and no reason for upsets, the tests are not run every day, but perhaps 2 or 3 days a week. To decrease the insulin dosage, a decrease of 10 to 20 per cent of the total insulin dose is made, starting the next day, whenever 3 or 4, as prescribed, of the 4 urine tests are blue. To increase insulin dosage, a rule of a similar insulin increase upon two tests showing olive or orange is used. The patient fills in a chart of the colors and brings the chart to the office on regular visits. A glance at the chart relates the insulin-food balance. Some addition, decrease, or transfer of food may balance out the picture. (See chart in back)

This flexible insulin pattern provides protection in infections and sudden fluctuations that are so common in children, expecially labile diabetics. A fixed insulin dosage in children is one of the reasons why individuals are discouraged in managing the labile juvenile diabetic. The control seems so hopeless because the variables are so many e.g. diet, activity, infections and growth.

Not only does the day to day insulin dose vary in children, but also the dosage varies in accordance with the growth and development curves of the ever changing youngster. Kelly, Rao and Jackson (39) have made a study of insulin requirements in growing children. They concluded that no significant change in insulin requirements was observed in diabetics due to age of onset. All the subjects they reviewed were normal in growth, weight and height. Insulin requirements are determined or governed by "growth pattern." Insulin requirements did show a gradual increase in amount and in spread with advancing age. Insulin requirements diminished rapidly after diabetic therapy was begun and metabolic restoration was achieved. Then requirements increased more rapidly for another short period for growth of linear nature.

Rothmeyer (42) states that one third of the cases of juvenile diabetes stabilize within 2 months, two-thirds within 6 months and 90% within one year of the disease or less. He also states that all insulin requirements for the second year of the disease are less.

Goodman (19), White (66), Butler (7), Marble (46) agree that inadequate insulin may promote enlargement of the liver as an early reversible clinical indication of poor control. Marble offers this explanation. The

primary cause of enlargement of the liver is usually deposition of fat rather than glycogen. There may be some degeneration of hepatic cells with increased fluid and hydropic swelling. Acute abdominal pain in children is easily explained by retention of water. In Marble's series of 60 patients with hepatomegaly all large livers occured in severe, poorly controlled diabetics. Seventy-nine per cent of these patients showed decrease in liver size after treatment with protamine insulin. The liver size probably decreased because of better control of the diabetic condition.

No discussion of insulins would be complete without a note about the oral administration of insulin. Past experience with oral insulin has shown that hypoglycemia is or was produced, but, that such a reduction in blood sugar was due primarily to liver damage. Lasch (41), a German, states that insulin is absorbable through the intestinal mucosa when it is protected from enzymatic destruction by the addition of organic pigments which are antifermentative substances. However, the doses are 10 to 20 fold the IM doses and extremely uneconomical. By a process of repeated crystallization, a more stable oral insulin may be of some help.

DIET

Until an insulin preparation is developed that will fluctuate its activity in accordance with periodic feedings, it will be necessary for the diabetic to regulate the diet in agreement with the demands of the insulin used.

The fact that diabetes is a metabolic disease manifest by a deficiency in insulin, associated with a decrease in the metabolism of carbohydrate, it would seem logical that food intake would warrant some attention in the treatment of diabetic individuals. "Controlled" diet carries a burdensome label. A "regulated" diet may be more satisfactory. The breaking down of daily intake into quantities of carbohydrate, protein and fats appears to be an endless task, however, with some system as provided by the American Dietetic Association the regulation of dietary intake becomes relatively simple. (3)

In establishing a diet of satisbactory composition a ratio of 2 grams carbohydrate to one gram of protein to one gram of fat is generally acceptable (44)(77). With this distribution of types of foods the ADA diet provides a planning of variable caloric intake with the proper ratios. Total caloric intake is essential in planning the diet for young diabetics, especially in providing for growth and development and activity.

One should make allowances in the individual cases for undernutrition or obesity. (38)

The calculated diet for a diabetic is in every respect a "normal" diet. No special diabetic foods are required. A well-rounded diet influences control and takes out one more variable. An adequate diet which "approximates" the food of the whole family does not impose the feelings of discipline and deprivations. A variety of food choices are possible and encouraged. Substitute meals can be calculated for school and picnic lunches and allowances for between meal snacks can be made.

Butler (7) recommends a diet consisting of 125 to 200 grams of carbohydrate. White (77) suggests 40% of the calories as carbohydrate, 20% as protein and 40% as fat. Marble (43) recommends 140 to 160 grams of carbohydrate, 60 to 80 grams of protein and 70 to 100 grams of fat. Lichtenstein (42) states that the average child regulates himself at approximately 160 to 250 grams of carbohydrate without a measured diet.

Along with carbohydrate, protein, and fat regulation, one should observe adequate amounts of minerals and vitamins.

Wilkins, Ruby, Kelly and Jackson (69) state that in their management, the only difference in the dietary

program for the diabetic and nondiabetic is that the diet is planned so that a predictable intake is given in proper relationship to the type and amount of insulin. They point out also that in anticipated exercise, "do not lower the insulin, change the calories," individualize the caloric needs.

Protein consideration is important in young growing individuals as body building material. Proteins are doubly important to diabetics. High protein diets for diabetics are essential for the decreased rate of muscle protein synthesis. Protein is essential in maintaining an even distribution of sugar in the blood. High protein diets may be valuable in the prevention and treatment of diabetic retinopathy. Many neuropathies have a high incidence in juvenile diabetics on low protein diets. (69) This is verified by Schwarz (60), who, by using high protein diets, 150 grams daily, noted a clinical improvement in diabetics with retinopathy. Similar data are furnished by Schneider (59) in patients with diabetic retinopathy. Diets containing 1 to 1.5 grams of protein per kg body weight are adequate for adults, however, in children a protein content of 2 to 3 grams per kg body weight is recommended.

Vitamins, especially water soluble, such as thiamin may require higher intake in diabetics. (69)

The dietary planning is established. Now! the problem of teaching the patient the importance of the diet and how to simplify the ADA method. Present a "simple" picture to the patient to avoid his discouragement and lack of cooperation. Keeping the diabetic's instructions to a simple and acceptable method is the "doctor's" responsibility. This is where the doctor either makes or breaks his diabetic diet control regimen.

Wilkins (69) suggests having the patient, if age permits, first learn caloric content of different foods, then after this is accomplished have the patient weigh foods with mother. Then learn to extimate foods and finally to use the ADA exchanges. (3)

Wilkins (69), Gibbs (18) and Marble (44) suggest snacks between meals. This is a normal habit for most children and it helps to increase or decrease food intake in relation to physical activity. Marble (44) suggests snacks or 10 grams of carbohydrate in the forenoon, 10 to 20 grams in the afternoon and 10 grams at bedtime. One-fifth of daily carbohydrate at breakfast and two-fifths at noon and two-fifths at supper.

The question of "How many calories are to be allowed for a growing, active younster?" is the next consideration. Marble (43) states that caloric values range

from 1400 to 1900 calories a day. Diets vary with age, weight, sex and activity. Marble (45) noted caloric demands from 1700 to 2614 calories in juvenile campers.

Jacobi (31) writes that in a survey of diabetic campers, all claimed they took over 3000 calories daily while at home, however, while at camp not one took over 2900 calories.

White (67) provides a rough rule of thumb for extimating basic caloric requirements. Beginning with 1000 calories at age 1 year she adds 100 calories per year of age.

Chute (8) gives a basic 1430 calories for 3 to 5 years and 2450 calories for age 16. This includes regular meals and snacks. He adds 200 to 400 calories per day for activity.

Eastland's (14) rule of thumb is that resting caloric demands equal 20 times the ideal weight for height and age, 30 to 40 times the ideal weight for activity.

Lydia Roberts (54) provides the following data from the Food and Nutrition Board of the National research Council:

AGE	CALORIES	PROTEIN
Under 1 year	100/kg	up to 3 to 4 kg
1 to 3 years	1200	40 gm
4 to 6 years	1600	50 gm

	AGE	CALORIES	PROTEIN
	7 to 9	2000	60 gm
	10 to 12	2500	70 gm
Girls	13 to 15	2800	80 gm
	16 to 20	2400	75 gm
Boys	13 to 15	3200	85 gm
	16 to 20	3800	100 gm

White (67) presents other means of estimating caloric needs by weight, 100 calories per kg in infancy, 80 calories per kg at 5 years, 60 calories per kg at 10 years, 40 calories per kg at 15 years. Her estimation by height is 35 calories per inch. By age she estimates calories basic plus 100 calories per year.

An important factor is brought out by Wilkins, Ruby, Kelly and Jackson (69) and that is that many normal children are receiving inadequate diets because they are consuming unessential foods. This type of eating cannot and should not be permitted in diabetics. Jacobi (31) further amplifies this point in his study of home conditions of diabetics. He states that all home diets studied had excess carbohydrate and were insufficient in total calories. Children would compensate for this fact by intakes in excess of their diet prescriptions. Few of the children studied or their parents knew about or had adequate instruction about diets from their physician. Few had little knowledge of carbohydrate values of food and other exchange values. Several felt

that they were close to the diet, but actually they were 1000 to 3000 calories off per day. Children on "control" diets regulated their diets much better and could easily regulate to exchanges.

With the ADA exchanges the day of sending home a list of foods to eat and a list of foods not to eat is over. There is no food that a diabetic, even a well controlled diabetic, cannot eat.

FREE DIET

The free diet requires much less explanation and education--one of the reasons it is used by some individuals in the treatment of diabetes. These factors are considered by their proponents to be important in controlling the diabetic. "Less psychic trauma," they say, "Not so many do's-and-don'ts."

Lichtenstein's (42) "free diet" consists of a diet completely corresponding to that of a non-diabetic child. Patients may eat their fill. Sugar and sweets are permitted in reasonable amounts. The only rule is to avoid overindulgance. He states that children usually adjust themselves to a diet containing 160 to 250 grams of carbohydrate per day. Younger children may consume more. Older children need excess carbohydrate, horever, they may overeat and become obese. Maintaining weight is an

important criterian.

John (33), who advocates a "liberalized" diet, believes it eliminates the feeling of sacrifice and the psychological stress that goes with it. This means more immediate happiness in the patient's life and thus more is accomplished. He only stipulates that the patient "eat with moderation."

Tolstoi's (63)(65) "free diet" differs very little from the rest of the family, as a rule he is permitted average servings. Sweets, candies, cakes, pies, etc. are not the rule, however, they are often permitted. The caloric intake naturally varies with the type of patient. Observation of weight is an all important factor in eating habits and diabetic control. Tolstoi emplasizes "utilization" and not "excretion" of carbohydrates.

EXERCISE

Exercise is essential to building a strong, healthy body. This is an accepted fact. In diabetics this fact does not change. All diabetic therapy is directed towards establishing as near a normal individual as possible and exercise, or physical activity is important for a "normal" diabetic. Exercise helps maintain as near normal physiologic conditions as possible. Jackson and Kelly's (29) studies indicate that

stabilized diabetics tend to tolerate activity much better than diabetics whose blood sugar is elevated prior to exercising. Many individuals regulate food to provide for increased activity. A well-known tennis champion is a diabetic.

Variations in activity over weekends, indoor and outdoor play, vacations, etc. are important factors. Young children are not able to judge their activities and with a low glycogen reserve shocks are more common.

Chute (8) states that carbohydrate is burned with greater economy of insulin during activity than at rest.

Encouraging boys to exercise builds a good sound body. Exercise for girls helps prevent flabby and obese individuals. The basic diet will take care of most minor fluctuations in daily exercise. Snacks provide extra calories for exercise. Jackson (29) emphasizes, "do not lower the insulin dose for exercise, frequently this results in weight loss." The best way is to increase the diet. Exercise varies with age, residence, school, sports and work. Good control while young makes for a more physically and mentally mature individual.

EDUCATION AND PSYCHOLOGY

A diagnosis of diabetes not only adds a complicating disease to the patient's life, it also adds the responsibility of learning about the disease. The doctor assumes the obligation of teaching the diabetic all he should know or is capable of knowing about his disease. Simple beginning instructions as to insulin, dose, injections, care of equipment are not to be overlooked or passed off lightly. The symptoms of insulin shock and diabetic coma and above all the importance of urinary sugar, the testing and interpretation are to be stressed.

Most diabetics, once diagnosed as such, must accept the disease for life and adjust themselves to a life of regulation and certain routines that every diabetic must execute, be he either "free" or "controlled." As the patient grows with his disease there is a natural tendency to seek more knowledge about his disease and better means of control. The doctor can be a source of proper information to the diabetic and at the same time be gaining the confidence of the patient. Educating the parents and other members of the family as to the nature of the disease, the few compensations that may be necessary, may be of immeasurable value to the diabetic psychologically. Proper parent attitude is essential to good control. The doctor's rapport

with the juvenile diabetic may be a determining factor in the success of the control of the diabetes. (17) Rebellion of the patient is a constant hazard in juvenile diabetes, especially during adolesence and later teen ages. The doctor should be a guide, not a punitive judge to the diabetic and a similar attitude by the parents is essential. (40)

Kennedy (40), in regard to diabetic complications and the worries of the patient, states that fears of complications can be used as a stimulation toward co-operation and control. However, parents, doctor and others must avoid exhibition of fears of complications.

Education as to insulin reaction symptoms may save the patient embarassment as well as serious diabetic complications. Kennedy (40) suggests,"never deny a diabetic glucose for the prevention of impending insulin reaction because of peculiar actions; no two diabetics act exactly the same." Judgement of activity and glucose needs in accordance are factors that the diabetic learns through trial and error. Do not limit activity, it is not necessary.

The importance of regular insulin injections, alternating sites for injection and sterile technique, are points that should be stressed with the diabetic.

The use of a simple syringe for injections to avoid errors in insulin dosage is important. By the age of 6 to 8 years the patient should be giving his own insulin. It may be necessary for mother to measure the insulin. The prodedure should be made as easy and brief as possible, using the chemical sterilization method rather than boiling the syringe. By this manner, the time per insulin injection amounts to 45 to 60 seconds. The number of injections should be reduced to as few as possible needed for control. (40)

Urine examination is a basic element in regulation of diabetes, especially with the flexible insulin dosage. The important use of the second voided specimen, for accurate urine analysis, is becoming more and more accepted. This is difficult to obtain in younger diabetics, but should be sought as soon as feasible. (68)

McGavin, Schultz, Peden and Bowen (48) in their studies of intelligence and personality state that diabetics are usually of average intelligence. Diabetes does not have a predilection to seemingly intelligent individuals. They offer the explanation that this may seem so due to the short stature of the diabetic and that he frequently gives his own insulin at an early age and regulates his diet with little if any outside assistance. They also noted that the earlier the child developed

diabetes the more readily he or she accepted it emotionally as part of the growing up process. Those who developed it later tended to rebel against it.

The psychiatric findings of McGavin et.al.(48) in their studies of 43 juvenile diabetics revealed that 32 expressed themselves as feeling different from other children. Underweight and understature made some children feel different. Of 45 interviewed, 24 were more disturbed because of short stature and loss of weight than the fact that they had diabetes. Often these children expressed their reactions as seclusiveness, aggressiveness, boastfulness and show-off behavior.

Factors tending to cause feelings of inferiority are variable. Diabetes itself, was felt as "shame," a "catching disease." Some thought diabetes was "punishment." Girls often felt outside the "marriage market." Some children rebelled against diabetes, some used the disease as a lever to get what they wanted.

Grunberg (21) points out that one of the important factors in childhood management is to avoid overprotection. He states that the patient becomes the dominant figure in the domestic scene and may take advantage of the situation to gain his own ends.

According to Kenndey (40), as the diabetic approaches adulthood, problems of a career and also of marriage and parenthood are important considerations. Can he, the diabetic, compete for a choice career? Should marriage and parenthood be denied? The patient should approach these problems with the thought that when desired, opportunities arise, it is his privilege and his duty to accept them. These opportunities may provide an additional stimulus to maintain control of his disease. Individually, cooperation will allow a relatively normal life for the price of a few inconveniences. He should develope friends, family and himself. He should be convinced that he can be a well-adjusted member of society. The doctor must prove the dividends of control. Successful adjustment requires discipline, will power, self control, integrity and an optimistic attitude.

As another adjunct to educating the diabetic and providing a psychological boost, summer camps for diabetics are becoming more popular. They offer the young diabetic a chance to mix with other youngsters with similar problems. Summer camps give the family a vacation also. The summer camp gives the young diabetic another means of living a "normal" life.

No diabetic is without hazards as Joslin (37) points out;

-All diabetics should have an ID card in their pocket with the differential diagnosis of shock and coma.

-Living alone is a diabetic hazard.

- Diabetes should be acknowledged by those who have it. It is not necessary to be ashamed, usually the disease is not preventable.

-Educate the diabetic and regulate activity.

-Automobile driving is a definite hazard. Never drive unless carbohydrate is taken within 2 hours.

-Patient should know where blood sugars, tests for acidosis and co_2 combining power are done. Capable diabetics should be taught to run blood sugars.

-Do routine urine tests.

-Use the simplest type of syringe for insulin to avoid errors.

-Personal hygiene--clean toes are more important than clean teeth.

Observation of simple rules makes a complicated disease more easily controlled.

DIABETIC COMA

Diabetic coma is a potential hazard to every diabetic. Coma may be promoted by several factors, namely, failure to take insulin, infections or improper diet. Joslin (36) suggests that with good care coma need not be fatal. In 1942, he had 1977 diabetics admitted to Baker clinic of the N. E. Deaconess Hospital with a mortality of 2.33 percent. There were no deaths from diabetic coma.

Duncan (12) quotes figures of mortality varying from 1 to 50 percent. He suggests that the early diagnosis and treatment and familiarity with symptoms of coma account for the lower percentages of mortality.

Harwood's (26) preventative plan of 1. Education of the patient, 2. Good doctor-patient relationship, 3. Early recognition of stages of ketosis--will reduce the incidence of coma.

White (67) states that 40% of all coma cases appear between the ages of 10 and 20 years.

If coma is present early diagnosis is the most important factor. (12)(26)(36)

Basic steps in the treatment of coma are:

-Early diagnosis

-Prompt regular insulin injection

-Fluids-saline immediately

-Gastric lavage

-Supportive measures, warmth, hospitalization

-Lab--CO_2, Blood sugar, urine sugar and acetone

-Later--more fluids and electrolytes, K and alkalies if indicated.

-Look for the cause of the coma. In younger diabetics, infection.

Early diagnosis may be augmented by proper patient-doctor relations and education of the patient and/or mother.

Harwood (26) suggests a history of onset as a tip-off; onset in 2 hours usually shock; onset in 24 hours usually coma. However, this cannot always be used especially if long acting insulins are being used in regulation of the diabetes.

Early regular insulin therapy is considered to be extremely important in prognosis and treatment by Joslin (36), Duncan (12) and Harwood (26). Cases of "insulin resistance" have been fewer when insulin therapy was initiated early in coma. Dosage of early insulin is variable. In children the dosage need not be as large as adults. Infants may be expected to respond to considerable smaller doses. Large doses are not any better than repeated small doses. It is postulated that excess insulin may be excreted via the kidneys, therefore, repeated small doses would be of advantage. (26)

Duncan (12) says "give plenty of insulin,"--100 units initially, 40 IV and 60 sub-Q with 25 units hourly until plasma acetone is less than four plus.

Jones (34) suggests 100 units initially if blood sugar is 300mg%, 300 units if blood sugar is 600 to 1000 mg%, 400 units if blood sugar is 1000mg%.

Harwood (26) suggests 50 to 100 units immediately of crystalline insulin then repeated small doses every 4 hours.

Most authors agree that fluids, saline infusions, are necessary for immediate dehydration. (12)(36)(48)(34)(26) Harwood (26) and Kantrow (38) suggest M/6 sodium lactate for the first 1 to 3 hours with saline. Duncan (12) rarely uses alkali. When the occasion arises he uses only enough to raise the CO_2 10 to 15%, no more because of danger of overcorrection.

Glucose infusions are not recommended until the immediate crisis is well under control. Harwood (26) gives the following reasons for not using early glucose.

- -It increases glucose blood lever, thereby dehydration of cells is more pronounced.
- -It increases blood sugar levels, blood sugar tests are then not a true picture of the patient's condition
- -Potassium is withdrawn from the blood, producing hypokalemia.
- -Studies show that the mortality is higher and slower recovery is noted when glucose is given in early stages.

Harwood suggests glucose by given when blood sugars are near normal. Use glucose to prevent shock and provide calories.

Gastric lavage is a preventative measure. Joslin (36) and others suggest a levine tube to prevent gastric dilitation and shock, also to prevent increased gastric secretion complications.

Supportive measures as hospitalization, warmth and

constant observation are essential. Laboratory studies need not be numerous. Joslin (36) uses CO_2 and blood sugars. Duncan (12) uses plasma acetone, Rothera test. The CO_2, blood sugar and urine sugar and acetone are the most important to observe. Blood sugars may be drawn every 3 to 6 hours.

Potassium levels may be depleted by increased kidney excretion of K in acidosis. EKG may be used in emergencies for evaluation of K levels. Symptoms of muscle weakness, respirations irregular, cardiac disturbances as EKG or murmers with a gallop rhythm, tachycardia and a fall in BP, especially diastolic. If the serum K is below 2.5 to 3meq. a defeciency is evident. (26)(34) If kidney function is adequate, K therapy may be initiated, using 1 to 2 gm of K per liter of clysis fluid; 6 gms being the daily requirement. When the patient becomes conscious, give K orally in the form of fruit juices etc. After therapy is initiated, the cause of the coma should be determined. In younger diabetics infection should be one of the first thoughts, immediate therapy should be started.

HYPOGLYCEMIA

Hypoglycemia or insulin reactions result from a deficient supply of glucose to the brain. This may occur when regular eating habits are disturbed and regular

daily insulin injections given, reactions may occur during exercise or by excessive insulin intake, or during recovery from infection. Viability of the tissues of the CNS depend upon the presence of glucose in the blood. Symptoms have a sudden onset with headaches, dizziness and sweating being the prodromal; progression to unconsciousness, convulsions and death may ensue.

Treatment of insulin reaction is basically the differential from Coma, by time, symptoms and history of activities or illnesses , also:

If conscious: Give orange juice, candy or sugar orally.
If unconscious: Give epinephrin,3 to 5 minims or adrenalin 1:1000, .5 to 1 cc.
-orgive 50% glucose IV, 25 to 50 cc, as needed to get response, which is usually rapid.
-gavage feeding of glucose may be used.

Mosenthal (47) discusses the significance of hypoglycēmia. He states that lesions in fatal cases are severe: petechiae and extensive cerebral hemorrhages, large areas of encephalomalacia and cyst formation. It is self-evident that in diabetics who are subject to transitory hypoglycemia episodes, morphological pathology cannot be determined. In animals this has been done and months later areas of demyelination, encephalogalacia and glial reaction are found. Damage may be slight after each episode, but may be cumulative

with recurrent attacks. Other tissues may be involved also, e.g., egegrounds.

This may be another factor to consider in "degree of control," that is, if constant glycosuria is better than mild insulin reactions often seen under close control.

LONG TERM FOLLOW-UP OF TREATMENT

"It is of use from time to time to take stock, so to speak, of our knowledge of a particular disease, to see exactly where we stand in regard to it, to inquire to what eonclusion the accumulated facts seem to point, and to ascertain in what direction we may look for fruitful investigation in the future."

------William Osler Gulstonian Lestures, 1885

Evaluation of the desired or most desired methods of treatment, that is "controlled" or "free," may be better impressed on the reader by considering the results of continued therapy by one method or the other over a period of years. Tolstoi (53) makes a similar statement as he discusses his logic for "free" control. He broke into the "free" school in 1936 and suggests that the long term follow-up with comparison will be the determining factor as to which method is superior. Advocates of "free diet" believe that complications are a result of duration of the disease rather than control. Tolstoi (63) evaluated 35 patients, ages 22 to 47 years whose diabetes

was from 10 to 29 years duration. Two had 4 plus albumin, 8 had trace and 6 had retinal changes and none had hypertension.

Dolger (10) is of the opinion that the duration of the diabetes, rather than the hyperglycemia is the all important factor contributing to the development of retinopathies, hypertension and albuminuria. Dolger states that repeated examination of eyegrounds over a 25 year period revealed that none of the diabetics escaped eye damage regardless of control. Retinal hemorrhage was the predominent lesion.

Lichtenstein (42) in his 10 year follow-up, 1934 to 1943, reports 169 cases, all patients at least 21 years of age, with no diatetic restrictions. Total mortality was 4.7%. He reports no increased blood pressures, no confirmed arteriosclerosis, one slight unilateral cataract, and numerous patients with transient enlargement of the liver. He states that the essential conditions for satisfactory results are firstly for a good insulin therapy from the onset and secondly a careful continuous control with no dietetic restrictions.

Engleson (16) evaluated 217 adults and 42 juvenile diabetics, both of free diet. All the patients had diabetes from 5 to 25 years. In the adults with diabetes

before 40 years, nephropathy was seen in 65%, retinopathy in 60%, and hypertension in 65%. Nephropathy always occured as the first change. In the diabetics of over 10 years duration, only 7% were free of vascular complications. Forty percent of Engleson's juvenile diabetics, 42 in number, 19 boys and 23 girls, showed liver parenchyma involved. Liver complications appeared 5 years after onset of diabetes and 30% of the time liver involvement was seen in combination with moderate retardation of growth. Thirty per cent of this group were seen with vascular complications. Many showed liver function impaired and also impaired adreno-hypophyseal activity. He concluded that unrestricted diet is not the treatment of diabetes. Dietary restrictions should be observed in the management of diabetes, especially as a prophylactic measure against long term diabetes.

Berquist (4), whose paper was concerned with growth and weight of juvenile diabetics, observed a group of diabetics for an average of 5 to 3 years. He does not believe that undernutrition is a major cause of retarded growth due to the fact that many dwarfs had adequate nutrition. Deficient control of the diabetes state often in growth curve variations. His control of the studied group was poor. He postulates that retardation of growth of diabetics studied could be connected with a less exact control and dwarfs caused by extremely poor

control. Insulin appeared to be a necessary synergist for the effect of somatotrophins on growth. He also postulates gonadal function deficiency causing growth disturbance in boys. He offers this criteria for treatment of diabetes. 1. Adequate insulin. 2. As close to normal blood sugar as is possible. 3. Avoid glucosuria. 4. Do not restrict calories to the extent that insulin doses must be lowered.

White's (67) figures indicate that complications appear generally after age 20 years. This usually gives pediatricians a false sense of security about the well being of the diabetic child. Ninety-three percent of her poorly controlled group showed vascular complications after having diabetes over 30 years. Eighty-five per cent of this group had retinal arteriosclerosis, 75% retinal hemorrhage, 70% calcified arteries, 55% nephritis, 7% angina and 2.5% CVA. Retinal hemorrhage was the most common lesion in young diabetics.

O'Brien and Allen (52) in their study of 555 young diabetics found 23 patients with retinal pathology. All the patients were under 31 years of age. Of 260 other young diabetics, 43 had lens changes. In 6 of the 23 cases of retinopathy, the changes were transitory; they were observed after a period of 6 months to one year of poor control and disappeared within one to two

months after strict control was instituted.

Root (56) rates arteriosclerosis as the predominant cause of death of diabetics. Neuropathies involve the autonomic and central nervous systems rather than the peripheral nerves alone. Diabetic nephropathy, including Kimmelstiel-Wilson syndrome, and diabetic retinopathy are directly related to the severity, duration and control of diabetes.

Root, Pote and Frehner (56) in a series of 135 diabetics, evaluating the triopathy of diabetes, found neuropathy to appear first, then diabetic retinitis and then nephropathy. They concluded that the degree of control prolonged life and in good control the complications were much reduced.

Rundel (58) states that neuropathy, retinopathy and hepatomegaly are signs of inadequately controlled diabetes.

Hall (24) describes the kidney lesion, glomerulosclerosis, as almost specific for diabetics as a complication.

Dunlop (13) evaluates 50 diabetics on free diet for 5 years duration and 167 patients on control diet for 15 to 31 years.

Of the free group, 6 patients showed progressive worsening of diabetes. Two had insulin reactions and

39 were satisfactory at the end of 4 years. Only 9 were still in good shape at the end of 9 years.

Of the "control" group, all required at least 20 units of insulin.

Classes:
Good--no long periods of glycosuria were seen or even a short period of severe ketosis.
Poor--hyperglycemia and glycosuria were very common and ketosis not infrequent.

Five main complications were: TB, retinopathy, cardiovascular disease, nephropathy and neuropathy. Twenty-seven patients of the control group were entirely free of complications. It was 4 to 5 times more common in the good group.

Cardiovascular complications--63% of all patients
Good 46% Fair 62% Poor 72%

Retinopathy--60% of all patients
Good 44% Fair 47% Poor 79%

Neuropathy--59% of all patients
Good 23% Fair 53% Poor 81%

The incidence of neuropathy is determined almost entirely by neglect of diabetic control. Dunlop concluded that careful control and aggressive treatment of the disorder over the years is a most important factor in preventing or postponing of complications.

Jackson (28) studied 208 juvenile diabetics, all had the disease 10 years or more. Seventy-five were used for the study, 40 males and 35 females, the average

age being 22 to 29 years. Fifty per cent had the disease for 15 years, 11 over 20 years. All were on diets of 1.5 grams of protein daily and 35 to 40 calories per pound of theoretical weight. Insulin dosage averaged 50 units per 24 hour period, using regular only prior to 1944, then globin or zinc:

Retinopathy	46%	Hypertension	4%
Cataracts	14%	Nephropathy	4%
Calcif. of B.V.	16%	Abnormal EKG	0

Chi square related that retinopathy was associated with level of control and with duration of disease. Cataracts were found most often in patients who had suffered short periods of marked non-control including acidosis. Calcification of peripheral arteries showed a correlation between level of control and duration. Growth--poor control showed less than the expected gain. Erratic growth was frequent in fluctuating control.

Wilson, Root and Marble (70) made a study of 247 diabetics having the disease for 10 to 34 years. With onset between 18 months and 30 years, 25% or 62 of the 247 showed evidences of nephropathy. Thirty-seven of the 247 who had adequately controlled their diabetes by insulin, diet and regular physical examination plus routine urine tests, none of these showed any nephropathy.

Eighty-nine patients in the excellent or good control group showed no demonstrable retinitis after periods of 20 to 34 years of diabetes. Of these patients that showed

no retinitis, 35 had diabetes for more than 20 years.

Eighty cases of poor or fair control did show severe degenerative lesions such as calcified arteries, retinitis and nephropathy.

Diabetic retinopathy was found to be one of the earliest degenerative lesions constantly observed in young diabetic patients.

After 20 years 80% of the "free-diet" group showed advanced lesions. Forty-four percent of the "control" group showed advanced lesions. No patient on "free-diet" regimen showed both normal retinae and absence of calcified vessels after 20 or more years of diabetes, whereas 8% of those in the controlled group did. After 20 to 34 years 57% of the "free-diet" group showed advanced degenerative changes. Only 25% of the controlled group had such lesions.

They concluded that continuous, aggressive treatment directed toward maintaining a physiologic condition including normal levels of blood sugar is the best treatment. Control of diabetes is more important than any known factor such as duration or severity in preventing degenerative complications.

Eisele (15) studied the physical, economic and social status of the juvenile diabetic patient surviving 20 years. All had the disease before the age of 15 years.

He warns that the report is unfavorable because the onset of the disease was in the pre-insulin era. Average age of onset was 9 years. Positive hereditary history was obtained in 62%. Average duration of disease was 21.9 years. The group was without insulin 2.8 years. Average insulin dosage was 52 units of either single or combined types. Fifty-one patients were on weighed diets; 20 were on free diets. Two patients were not taking insulin. Thirteen, or 1 out of 6 were classified as dwarfs. Almost twice this number fell in the category of infantilism.

Some of these were treated with pituitary and thyroid supplements. Thirty-five per cent had enlarged livers. Arteriosclerosis was noted at the average age of 29 years. Fifty-five per cent showed retinal arteriosclerosis. Seventy per cent had hypertension or albuminuria or both at age 29 years.

Of the psychiatric problems there were two headings, psychoneurosis, of which 5 patients were classed and depression having 3 patients. Each of the 3 depressions attempted suicide at least once.

Education was probably one of the most striking features of the study according to Eisele. Thirty-one patients or 42% attended college. (Average 7% of Americans 21 years of age and over in 1934 had attended college.)

Economic and social status studies showed that control

of diabetes paralleled the economic level. Economic status was important in control. Occupations were extremely varied.

Certainly these follow-up studies cannot be taken lightly in evaluating which method of treatment offers the best prognosis.

SUMMARY

The treatment of juvenile diabetes offers two varied methods, the "controlled" and the "free."

An attempt is made to present a few of the salient points of each method of treatment. The "free" method advocating unrestricted dietary intake covered by insulin with glycosuria offering no particular problems to the patient. The "control" group presents an outline of therapy based around an adequate insulin supply, a moderate acting insulin alone or with a rapid acting insulin, with a calculated caloric intake for the individual and as near normal blood sugar as possible. Glycosuria in the "control" group is to be tolerated rather than sought and then only in moderation.

Long term follow-up of both methods of treatment, periods of 10 to 20 years at best, indicate that the "control" method offers the best prognosis for the diabetic over a period of years, as far as longevity and freedom from complications are concerned.

Dietary regulation is a major controversary. Free diet with no restriction is sought by some to avoid the psychic trauma of being regimented.

Control diet offers at first a mechanical spooning of weighed foods then gradually a mental evaluation of caloric intake, to coincide with the insulin being used for regulation. The necessity of insulin for growth is also brought out.

"Free" regulation uses a long acting insulin as PZI, occasionally mixed with regular insulin, by single dose daily. "Control" groups use NPH or Globin, usually NPH, very effectively mixed with a quick acting insulin in order to maintain a near normal blood sugar during the 24 hour period. Urine sugar is a guide to the amount of insulin needed. Some advocates of "control" postulate more than one insulin injection daily, however, a single daily dose is sought. A flexible daily insulin dosage is a satisfactory control of diabetics on an outpatient basis.

The not to be overlooked factors of psychiatric influence by either method of control are to be weighed by those proposing the treatment for young individuals. The role of the doctor should be as a guide and not as a judge. Proper education of the diabetic about his disease and its complications is important in

obtaining as good control as possible.

The encouragement of exercise and of a "normal" life is to be sought by those treating the young diabetic. Summer camps for diabetics are becoming more popular and will allow the diabetic to enjoy even more of the "normal" activities of a youngster.

An outline of control can be simple:

- -Insulin--Selection of insulin with a mixture of single injection depending on the severity of the diabetes. NPH being recommended, along with a flexible insulin dosage.
- -Diet--Calculated or measured caloric intake with 3 regular meals and 3 between meal snacks in accordance with insulin.
- -Urine examination--4 times daily if indicated, with 50% of analysis blue for good control.
- -Proper rapport between doctor and patient with education of parents and patient about diabetes.
- -Encouragement of diabetic to lead a "normal" or as near "normal" life as possible. A few inconveniences will offer years more of happiness.

CONCLUSION

The evidence for "control" of juvenile diabetes indicates a better prognosis.

Regulation of insulin, most generally NPH and regular insulin, or as best suits the individual case, on a daily flexible dose schedule.

Dietary regulations with estimated caloric intake in accordance with weight, height and age and the

proper distribution of a 2:1--2:1 carbohydrate, protein, fat ratio. Along with adequate vitamins and minerals.

Proper guidance from the doctor may determine the outcome of the treatment. Through simple education of the patient about his disease, better control can be expected. Encouragement to lead a "normal" life is essential.

The production of a strict regimen for the treatment of juvenile diabetes is far from practical or feasible. The individual case dictates the degree of control; however, certain goals should be sought in the treatment of juvenile diabetes. The most important goal is the welfare of the patient under therapy. This decision is in the hands of the attending physician when a young diabetic is placed in his hands for care. The easy regimen may not be the best.

RULES: Test urines 4 times a day ____ days a week (every day if not entirely well).

If ____ out of 4 tests are blue, decrease insulin ____ units starting next day. (IF INSULIN REACTION OCCURS, FEED SOME CARBOHYDRATE IMMEDIATELY AND CONTACT A DOCTOR.)

If ____ out of 4 tests are orange, olive increase insulin ____ units.

DATE	INSULIN	URINE TESTS				SPECIAL NOTES
*	*	Before Breakfast	Before Lunch	Before Supper	Bedtime	*

BIBLIOGRAPHY

1. Allan, F. N., "The Writings of Thomas Willis," Diabetes, N.Y. 2:1 Jan.-Feb., 1953, p. 74-76.

2. Allan, F. N., "Current Judgements on Metabolic Control and Complications in Diabetes," New Eng. Jour. of Med., 248:133 (1953).

3. Beheman, Deaconess Maude., "Dietary Instructions for the Diabetic," Diabetes, N.Y. 2:4 July-Aug., 1953, p. 271-275.

4. Berquist, Nils., "Growth of Juvenile Diabetes," Acta Pediatrica, Feb. 1954, 15, p. 133-165.

5. Bloch, Fritz., "Retinopathy in Juvenile Diabetes Mellitus," Arch. Ophth., 28:891 (1942).

6. Bondy, P. K., "The Office Management of Diabetes," Gen. Prac., 9:4, April, 1954, p. 63-69.

7. Butler, A. M., "Treatment of Juvenile Diabetes Mellitus," New Eng. Med. Jour., 223:900, (1940).

8. Chute, A. L., "Management of Diabetes in Children," Pediatrics, 9:4, April, 1952, p. 505-506.

9. Colwell, A. R., "Treatment of Diabetes, Selection of Technic According to Severity," Diabetes, N.Y., 2:4, July-Aug., 1953, p. 262-267.

10. Dolger, Henry., "The Clinical Evolution of Vascular Damage in Diabetes Mellitus," Bulletin of N.Y. Academy of Med. 22:482, (1946).

11. Duncan, Garfield G., Diabetes Mellitus--Principles and Treatment, W. B. Saunders Co., Philadelphia and London, (1951).

12. Duncan, Garfield G., "Diabetic Coma--A Therapeutic Problem," Annals of Int. Med., Vol 37, No. 6. Dec., 1952.

13. Dunlop, D. M., "Are Diabetic Degenerative Complications Preventable?" British Med. Jour., Vol. 2, p. 382, (1954).

14. Eastland, J. Shelden, M.D., "General Management of Diabetes Mellitus," Maryland State Med. Jour., 2:363, (1953).

15. Eisele, H. E., "The Juvenile Diabetic Patient Surviving Twenty Years," J.A.M.A., 120:188, (1942).

16. Engleson, G., "Studies in Diabetes Mellitus," Acta Pediatrica, 43:389, (1954).

17. Farber, G. B., "The Juvenile Diabetic," Gen. Prac., 13:1, Jan. 1956.

18. Gibbs, Gordan E., "A Study in Outpatient Management of Juvenile Diabetes," The Nebr. State Med. Jour., Vol. 40, No. 11, p. 300, (1955).

19. Goodman, J. J., M. D., F.A.C.P., "Hepatomegaly in Diabetes," Annals of Int. Med., 39:1077,(1953).

20. Grishaw, W. H., West, H. F., and Smith, B., "Juvenile Diabetes Mellitus," Annals of Int. Med., (1939).

21. Grunberg, A. and Blair, J. L., "Social Aspects of Diabetes Mellitus," Diabetes, N.Y., 2:4, July-Aug., (1953).

22. Guild, H. G., "Juvenile Diabetes," Maryland State Med. Jour., 2:366, (1953).

23. Haist, R. E., Campbell, J., and Best, C. H., "The Prevention of Diabetes," New Eng. Med. Jour., 223:607-615, (1940).

24. Hall, G. F. M., "Factors in the Etiology of Diabetic Glomerulosclerosis," Quat. Jour. of Med., 21, p. 385, (1952).

25. Hartman, A. F. Sr., et.al., "Diabetes Mellitus in Infants and Children," 12th M & R Pediatric Research Conference, (1954).

26. Harwood, Rood, M.D., "Diabetic Acidosis: Prevention and Treatment," Diabetes, Vol. 4 & 5, 398,(1955).

27. Hayes, Daniel W., "Insulin Preparations in the Treatment of Diabetes Mellitus," Louisanna State Med. Soc., 106:387, (1954).

28. Jackson, R. L., "Degenerative Changes in Association with Diabetes in Relation to Level of Control," Proceedings of Am. Diabetes Ass., 9:309, (1950).

29. Jackson. R. L. and Kelly, H. G., "A Study of Physical Activity in Juvenile Diabetic Patients," Jour. of Ped., 33:155, (1948).

30. Jackson, R. L., "Objectives in the Management of Children with Diabetes Mellitus," Wisc. Med. Jour., 47:1, (1948).

31. Jacobi. H. G., "Controlled Diabetes Better," Am. Jour. of Clin. Nutrition, 2:343, (1954).

32. Jacobi, H. P., "Mechanism of Insulin Action," from a seminar.

33. John, H. J., "Further Observations on the Use of Liberalized Diets in the Treatment of Diabetes," Annals of Int. Med., 35:1318, (1951).

34. Jones, Benjamin F., M.D., "Diabetic Emergengies; Pre and Post-operative Treatment," M.S.M.J., 2:368, (1953).

35. Joslin, E. P., "A Reniassance of the Control of Diabetes," J.A.M.A., 61:584, Dec. 25, 1954.

36. Joslin, E. P., "Diabetes Mellitus," New Eng. Jour. of Med., 228:645, (1943).

37. Joslin. E. P., "Diabetic Hazards," New Eng. Jour. of Med., 224:589, (1941).

38. Kantrow, A. H., "Management of Diabetic Children," N. Y. State Jour. of Med., P. 30, Aug. 1, 1953.

39. Kelly, H. G., RAO, P.T., Jackson, R. L., "Insulin Requirements of Children with Diabetes Mellitus Maintained in Good Condition," Am. Jour. of Diseases of Children, 89:31, (1955).

40. Kennedy, W. B., M.D., "Psychological Problems of the Young Diabetic," Diabetes, Vol. 4, No. 1, 1955.

41. Lasch, F., "Bisherige Ergebnisse der peroralen Insulin Therapie--Results of per oral treatment with insulin Z. vitamin-, Hormon-Fermentforsch" 1952, 4/1, 83-93.

42. Lichtenstein, "Treatment of Children's Diabetes," Ten years experience without dietetic restrictions, Adta Ped., 32:554, (1945).

43. Marble, Alexander., "The Treatment of Diabetes with Diet and Insulin," New Eng. Jour. of Med., 224:583, (1941).

44. Marble, Alexander., "The Management of Diabetes in Childhood," Nebr. Med. Jour., 39:455, (1954).

45. Marble, Alexander., "Experiments with 116 Juvenile Campers in New Summer Camp for Boys," Am. Jour. Med. Science, 218:161-171, (1949).

46. Marble, A., White, P., Bogan, I., and Smith, R., "Enlargement of the Liver in Diabetic Children," Archives of Int. Med., 62:740, (1938).

47. Mosenthal, H. O., "Management of Diabetes Mellitus, An Analysis of Present Day Methods of Treatment," Annals of Int. Med., 29:79, (1948).

48. McGavin, A. P., M.D., Schultz, E., Peden, G. W., and Bowen, B. D., "The Physical Growth, The Degree of Intelligence and the Personality Adjustment of a Group of Diabetic Children," New Eng. Jour. of Med., Vol. 223:119, (1940).

49. Nelson, Waldo, E., Textbook of Pediatrics, 6th Ed., W. B. Saunders Do., Phil. and London, 1954.

50. Newcomb, A. L., "Diagnosing and Treating Diabetes Mellitus in Infancy and Childhood," p. 158-9, Miss. Valley Med. Jour., 76:4, July, 1954.

51. Ney, Genevieve J., "The Juvenile Diabetic," A survey of the recent literature, Arch. Pediat. 70:164-84, June, 1953.

52. O'Brien, C. S., and Allen, J. H., "Ocular Changes in Young Diabetic Patients," J.A.M.A., 120:190, (1942).

53. Ricketts, H. T., "Basic Principles in the Therapy of Diabetes," Annals of Int. Med., Vol. 37, No. 6, December, 1952.

54. Roberts, Lydia J., "Scientific Basis for the Recommended Dietary Allowances," N.Y. State Jour. of Med., 44:59, (1944).

55. Robertson, J., "The Management of Diabetes in Childhood," p. 89-92, Postgrad. Med. Jour., London, 31(352), Feb., 1955.

56. Root, H. F., Pote, W. H. Jr., Frehner, A., "Triopathy of Diabetes," Arch. of Int. Med., 94:931, (1954).

57. Root, H. F., "Degenerative Complications of Diabetes," Jour. of Endocrinology, 12:458, (1952).

58. Rundel, R. W., Diabetic Neuropathy," Medicine, 24-III, p. 111-154, (1954).

59. Schneider, R. W., Lewis, L. A. and McCullagh, E., "Plasma Protein Alterations in Diabetic Retinitis," Am. Jour. of Med. Science, 212:462, (1946).

60. Schwary, G. T., "The Question of Protein Derangement in Diabetic Retinopathy," Ohio State Med. Jour., 44:600, (1948).

61. Sherill, J. W., "Diabetes in Children," Some practical and theoretical considerations in management, Texas State Jour. of Med., 49:743-48, (1953).

62. Slayton, R. E., Bunows, R. E., and Marble, A., "Lente Insulin in the Treatment of Diabetes," New Eng. Jour. of Med., Vol. 253, No. 17, p. 722, (1955).

63. Tolstoi, Edward., "Treatment of Diabetes Mellitus, The Controversy of the Past Decade," Cinncinati Jour. of Med., 30:1, (1949).

64. Tolstoi, Edward, and Weber, F. D., "Two Cases with Equal and Unequal Devided Diets, with Comments on Criteria for Treatment," Arch. of Int. Med., 64:91, (1939).

65. Tolstoi, Edward, "The Objectives of Modern Diabetic Care," Psychosomatic Medicine, 10/5, Sept.-Oct., 1948.

66. White, Priscilla, "Diabetes in Youth," New Eng. Jour. of Med., 224:586, (1941).

67. White, Priscilla, "Free is Controlled Regime in Juvenile Diabetes," Jour. of Am. Diabetes Ass., 25:757, (1949).

68. White, P., Guest, G. M., Howard, R., Kennedy, W., "The Young Diabetic," Panel discussion, Diabetes, Vol. 4, No. 4, 313, (1955).

69. Wilkins, S. N., M.S.; Ruby, Do. O., M.S.; Kelly, H. G., M.S.; and Jackson, R. L., M.D., "Nutritional Management of Children with Diabetes Mellitus," Diabetes, Vol. 4, No. 1, p. 25, (1955).

70. Wilson, J. L., Root, H. F., and Marble, A., "Diabetic Nephropathy, A Clinical Syndrome," New Eng. Jour. of Med., p. 245-513, (1951). "Prevention of Degenerative Vascular Lesions in Young Patients by Control of Diabetes," Am. Jour. Med. Science, p. 221-479, (1951). "Controlled versus Free Diet in Management of Diabetes," J.A.M.A., p. 147-152, (1951).