Proceedings of The New York Diabetes Association

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"Surgical Treatment of Hyperthyroidism in Diabetes"
. . . Charles Gordon Heyd, M.D., New York Post-Graduate Hospital
Discussion: Charles G. Child, III, M.D., New York Hospital; Elliott P. Joslin, M.D., Boston, Mass.

"Preliminary Report on Amputation Below the Knee in the Diabetic"
. . . Samuel Silbert M.D., Mt. Sinai Hospital
Discussion: Thomas J. O'Kane, M.D., Morrisiania City Hospital; Elliott P. Joslin, M.D., Boston, Mass.

"The Medical Pre and Post Operative Treatment of Surgical Diabetics"
. . . Elliott P. Joslin, M.D., Boston, Mass.

"Experiences with Penicillin in Diabetic Gangrene"
. . . Francis D. Moore, M.D., Boston, Mass.
Discussion: Edward Tolstoi, M.D., New York Hospital; Louis Bauman, M.D., Presbyterian Hospital; George E. Anderson, M.D., Brooklyn Hospital.

Dr. Beverly Chew Smith, Chairman of the Committee on Surgery, presiding.

Dr. Smith:

THIS meeting is the annual meeting of the Surgical Section of the New York Diabetes Association. The first paper to be presented will be given by Dr. Charles Gordon Heyd of the New York Post-Graduate Hospital entitled "Surgical Treatment of Hyperthyroidism in Diabetes".

"Surgical Treatment of Hyperthyroidism in Diabetes", Charles Gordon Heyd, M.D.

Diabetes mellitus and hyperthyroidism, either primary or secondary, are two separable and distinct disease entities. The two conditions many times simulate each other clinically but each is adversely affected by the other. The normal individual has an adequate amount of insulin supplied by his own pancreas. The diabetic patient cannot produce sufficient insulin and there is an insulin deficiency. The hyperthyroid patient does produce sufficient insulin but has an excess of thyroxin. Therefore, when the two conditions, diabetes and hyperthyroidism, are combined we have two clinical entities fundamentally different in chemistry and mutually antagonistic. Hyperthyroidism with its elevated basal metabolism and increased glycogenolysis imposes an added burden upon the inefficient carbohydrate metabolism of the diabetic.[1]

Hyperthyroidism will not initiate a true diabetes but it will greatly exaggerate a pre or co-existing diabetic state because thyroxin is an active glycogenolytic agent and also stimulates gluconeogenesis—the production of carbohydrate from non-carbohydrate sources, e.g., protein.

Some of the beneficial effects of insulin are due to its inhibitory action on both glycogenolysis and gluconeogenesis. It follows that the action of insulin and thyroxin are antagonistic. Hence, insulin lack—diabetes mellitus and thyroxin excess, hyperthyroidism, are basically different.

It would seem that an adenomatous goiter with hyperthyroidism is a diabetogenous factor. Regan and Wilder[2] found that 5.6 percent of all patients with secondary hyperthyroidism (adenoma) had diabetes which is over three times the incidence of diabetes in all new patients at the Mayo Clinic. In contrast only 1.7 percent of the patients with adenomatous goiter but wihout hyperthyroidism had diabetes. This is the same incidence of diabetes as in all new patients registered and almost identical with the percentage of patients with primary hyperthyroidism (Graves' disease or exophthalmic goiter) who had diabetes. Diabetes is complicated by adenomatous hyperthyroidism three times more frequently than by exophthalmic hyperthyroidism. Since adenomatous (secondary) hyperthyroidism is of much longer duration than exophthalmic hyperthyroidism, Regan and Wilder make the comment "the longer the duration of the hyperthyroidism the greater the incidence of diabetes."

Glycosuria in some degree and at some time or other will probably be present in almost every patient with hyperthyroidism. This glycosuria is sequential to a preceding hyperglycemia and is the result of the depletion of the liver glycogen stored by the excess thyroxin of the hyperthyroid state. In the presence of hyperthyroidism glucose is rapidly absorbed from the gastrointestinal tract. Furthermore, under the influence of thyroxin there is a rapid depletion of the glycogen in the liver thus increasing the hyperglycemia. In addition, there is a constant production of new carbohydrate from non-carbohydrate stores; this again leads to an increase in the hyperglycemia. Hyperthyroidism frequently produces an abnormal sugar tolerance curve which closely resembles that of the diabetic. There is, however, one striking difference between the sugar tolerance curve in the diabetic as compared to the hyperthyroid patient. In diabetes mellitus the fasting or control blood sugar is usually distinctly elevated above the normal, whereas in hyperthyroidism a normal fasting blood sugar is the rule, even though the tolerance curve may be abnormal.[3]

An individual with hyperthyroidism has a marked acceleration of combustion and demands an increased intake of food. If that individual has a normal pancreas, there will be no diabetes although glycosuria will be present at some time. If, however, the hyperthyroid patient has a diseased pancreas or abnormal insulinogenic mechanism there will be accelerated combustion with insulin deficiency. The combination of excess thyroxin and diminished insulin activates a latent diabetic and projects a mild diabetic into a severe diabetic. These two conditions essentially distinctive should not be allowed to exist or to continue in the same patient. Insulin effect is destroyed by thyroxin and large diet, and insulin cannot control a diabetic with hyperthyroidism.

Mrs. C.J.W., aged 43, in September 1929 had an infected finger, and sugar was found in her urine. Fasting blood sugar 167 mg. per 100c.c. On a diet containing 80 gm. of carbohydrate, 60 gm. of protein and 140 gm. of fat, the urine remained free from sugar without the use of insulin. In July 1932 she exhibited a nodular goiter, auricular fibrillation and a basal metabolic rate of plus 42. The fasting blood sugar was 227 mg. per hundred cc. A diagnosis of hyperthyroidism complicating diabetes mellitus was made. After hospitalization and insulin therapy the patient had a subtotal bilateral resection on October 5, 1933. The immediate postoperative course was difficult but after a few days became normal and the patient was discharged from the hospital seventeen days after operation. On October 25, 1933 the basal metabolic rate was normal and the patient free from sugar on a diet of 100 gm. of carbohydrates, 70 gm. of protein and 90 gm. of fat, plus 45 units of insulin daily. From October 1933 to date the patient's condition has been satisfactory, with normal weight, regular pulse of 78, urine free from sugar on a diet of approximately 150 gm. of carbohydrate, 70 gm. of protein and 90 gm. of fat (total calories 1690) and with an insulin dosage of 44 units daily.

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Meeting at N. Y. Academy of Medicine.

In the course of our thyroid and general surgical experience, we have been impressed with three clinical associations: 1) the question of the potential diabetic—that individual with a low liver glycogen threshold; 2) the activation of the hyperglycemia into a true diabetic as the result of infection or hyperthyroidism; 3) a basic biological deficiency in certain females, to wit, obesity, fibroids, gall stones, adenoma of the thyroid and diabetes. If and when, one or more of these biological factors operate in such an individual with a basically insufficient insulin production, diabetes is the logical expectation.

In hyperthyroidism uncomplicated by diabetes the fasting sugar is normal but the body metabolism is markedly accelerated; the tempo of catabolism is increased, and the body requires an additional fuel intake. In diabetes mellitus there is a pancreatic insulin deficiency and therefore a diminished ability to catabolize a normal fuel intake. Furthermore, there is always variation from the normal in the behavior of a hyperthyroid patient to his carbohydrate metabolism. "The patient must receive carbohydrates if the function of the liver is to be supported and insulin must be taken if the carbohydrates are to be utilized."[4] Under conditions of normal metabolism a tissue cell receives a given quantity of glucose and requires for its catabolism an adequate amount of insulin. If the tempo of metabolism is increased by an excess of thyroxin as exhibited by an elevated metabolic rate then an additional amount of insulin will be required even if the quantity of glucose is constant. The higher the basal metabolic rate the more insulin will be required. The increased cell oxidation in hyperthyroidism destroys insulin effect much more rapidly than in the non-complicated diabetes. "Hyperthyroidism exhausts the store of liver glycogen and keeps on exhausting it."[5]

The occurrence of hyperthyroidism in diabetes demands a close association between the internist and the surgeon. The hyperthyroidism is the most immediate problem and should be corrected surgically at the first opportune occasion. It is not necessary to have the urine sugar free. Indeed, many times it will be impossible to accomplish this desirable end. The treatment of the diabetic should be the concern of the internist and the surgeon should proceed to carry out the preoperative and surgical therapy for the hyperthyroidism. The preoperative treatment in surgery is exactly the same as for hyperthyroidism in the non-diabetic, and the fact that the hyperhyroidism is so eminently linked with the diabetes is under no circumstances a contra-indication to modern thyroid surgery. Experiments and experience demonstrate that hyperthyroidism is ameliorated by the administration of iodine preparations. The surgical therapy or surgical intervention should be for the purpose of carrying out an adequate resection of thyroid tissue in sufficient amount to produce a more or less semi-permanent minus basal metabolism.

The preoperative treatment of hyperthyroidism in the diabetic requires:[6]

1) Bed rest.

2) A rational diabetic diet.

3) An adequate amount of insulin.

4) Overcoming dehydration by an adequate water intake by intravenous solutions of normal saline, Ringer's solution or distilled water plus the addition of 5-10 percent dextrose.

5) Preoperative iodine control by Lugol's solution, 7 minims, t. i. d., in a full glass of water one hour after each meal, or adding sodium iodid, gr. xv to one of the intravenous infusions.

6) Preoperative sedation by paraldehyde 1 cc per ten pounds of body weight in 150 cc of starch water by rectum, one hour before operation and morphine gr. 1/6, scopolamine gr. 1/150th, one-half hour before operation.

7) Ethylene or general anesthesia.

Conclusions:

1) In every suspected case of diabetes and hyperthyroidism the diabetes must be established as a true diabetes. "For the present and therefore to avoid premature diabetic cures we have raised the standard for a diagnosis of diabetes in hyperthyroidism to a blood sugar of 0.15 percent fasting or 0.20 percent or more after meals in addition to glycosuria."[7]

2) Diabetes is not cured by a successful resection of the thyroid but an active destructive condition—hyperthyroidism—is eliminated.

3) The correction of hyperthyroidism, either primary as in Graves' disease, or secondary as in adenomatous goiter by adequate surgical resection of the thyroid diminishes the intensity of the co-existing diabetes and renders the diabetes more amenable to diet and insulin.

4) The hyperthyroidism in the diabetic patient differs very little from hyperthyroidism in the non-diabetic but the diabetes is intensified because the hyperthyroidism "reduces the ability of the diabetic patient to utilize carbohydrates and decreases the efficiency of the unit of insulin."[8]

5) In the presence of the two conditions, diabetes and hyperthyroidism, attack the hyperthyroidism first.

6) In a diabetic a non-toxic goiter has no influence upon the diabetes either before thyroid resection or afterward. Excess thyroxin destroys available insulin, and it is the insulin factor that determines the intensity of the diabetes.

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Dr. Smith:

The discussion of this paper will be carried on by Dr. Charles G. Child of the New York Hospital.

Dr. Child:

I think that Dr. Heyd has very fairly presented the present status of the problems involved in treating patients who present a combination of diabetes and hyperthyroidism. When I was asked to discuss his paper it became of interest to me to find out in general what had happened to these individuals in our institution during the last ten years. I found that during this period 1200 patients had been admitted with toxic goiter. In eighteen of these there was an associated diabetes. Briefly the significant details associated with these individuals are as follows:

There was one death on the second postoperative day, presumably due to coronary thrombosis. In four patients the diabetes was sufficiently mild to be controlled successfully by diet alone. In this group the one death occurred. In seven patients there was no change in the pre and postoperative dietary and insulin requirements. In six patients there was a reduction in the insulin requirements after operation. This group was somewhat difficult to evaluate for in each instance there was also a reduction in the carbohydrate intake in the postoperative period. In one patient there was a progressive increase in the insulin requirements in the year following operation at which time the insulin dose was stabilized. In studying the types of goiter encountered it was found that fifteen were adenomatous while only three were diffuse. As might well have been expected, the largest group, sixteen in all, fell between the ages of 45 and 65. There was one juvenile goiter with a severe diabetes.

From the study of these patients it has been our conclusion at the New York Hospital that the combination is not as serious as the textbooks would lead one to suspect. The dire warnings must be a hangover from the pre-insulin days when certainly these patients must have been most difficult to man-

age. The only worse situation that I can imagine must have been prior to the use of insulin and also prior to the surgical treatment of hyperthyroidism itself. In following the modern methods, however, as Dr. Heyd has outlined them, this combination of diseases may now be handled with a rather certain degree of safety.

I would perhaps differ from Dr. Heyd in a few points. First, I think we would employ local infiltration with procaine as the anesthesia of choice in these patients, for it makes the management of the diabetes far easier during the first few postoperative days. Second, I believe that it is impossible to attack either one or the other of the problems first; both must be handled together. Unless the diabetes is carefully controlled, it may be difficult to establish a preoperative gain in weight, one of the most significant criteria for when a patient is ready for operation. Third, we still feel that in the majority of patients it is unnecessary to divide the strap muscles in the course of thyroidectomy. Adequate exposure can be obtained by separating them in the midline.

One other factor was of interest, namely, that in preparing these patients for operation the time required was approximately 15 percent longer than in those uncomplicated by diabetes.

It has been a pleasure to hear Dr. Heyd's paper, and to present this discussion in the light of our experiences at the New York Hospital.

(Further discussion of Dr. Heyd's paper will be found below under remarks of Dr. Elliott P. Joslin.)

Dr. Smith:

The second paper of the evening "Preliminary Report on Amputations Below the Knee for Gangrene in the Diabetic" will be presented by Dr. Samuel Silbert of the Mt. Sinai Hospital and Montefiore Hospital.

"Amputation Below the Knee for Gangrene in the Diabetic—Preliminary Report," Samuel Silbert, M. D.

The operative mortality in thigh amputations for gangrene in the diabetic as reported in many recent papers on this subject remains appallingly high. Combining the most recent statistics of twelve representative metropolitan hospitals, a total of 637 thigh amputations were done in diabetics with 300 deaths, a mortality of 47 percent. (Table 1) I have omitted from this summary the figures published by McKittrick from the New England Deaconess Hospital of Boston as his mortality is not representative of the experience of most large general hospitals. Since the technical procedure of a thigh amputation is simple and requires no great skill, the only conclusion that can be drawn from a consideration of these figures is that this operation is too severe for the average patient with diabetes.

It is readily apparent why this is so. The patient with diabetic gangrene is usually a poor operative risk. He is past middle age, and often has complicating arteriosclerotic cardiorenal or cerebrovascular disease. His vitality may have been reduced by prolonged suffering and by absorption of toxic products from his gangrenous or infected foot. To relieve pain he has received considerable quantities of narcotic drugs. It has been difficult properly to control the diabetes because of the diminished effectiveness of insulin in the presence of infection and gangrene. Such a patient should be subjected to as little operative trauma as possible. The operative procedure should be brief, profound anesthesia should be avoided, and amputation should be carried out as far distally as possible.

It has been taught for many years that amputations should be done through the thigh in order to insure adequate circulation for healing. This widespread belief has been proven incorrect by numerous surgeons in the past few years. McKittrick, Beverly Smith, Maes, Crossman, and others have advocated amputations below the knee, and have reported good results following this procedure. My own experience likewise indicates that amputations can be performed safely below the knee in diabetic patients, even when the popliteal artery is closed and oscillometric readings indicate a serious deficient circulation.

In an effort to find the simplest and quickest operative procedure which would relieve this group of patients, I have for the past four years done mid-leg guillotine amputations, shortening the bones, and leaving the stump wide open to heal by secondary granulation. This procedure has been carried out in all patients without selection, regardless of whether femoral

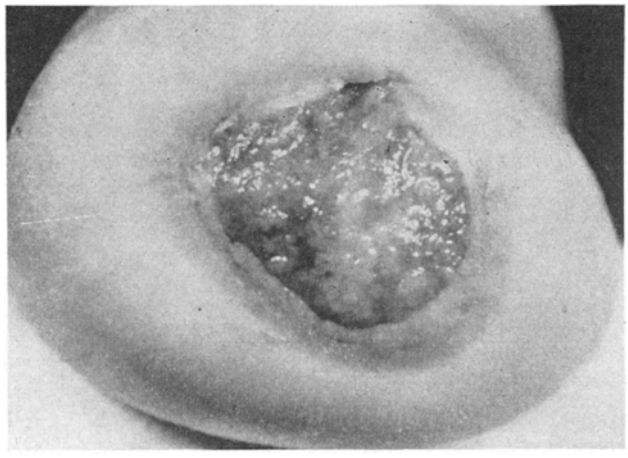

FIG. 1
Early stage of healing. Note skin drawn over end of stump by contracting scar tissue.

or popliteal arteries have been open or closed, and whether or not infection was present. In the first few cases a tourniquet was used around the thigh to expedite the operative procedure. Three patients developed gangrene of the leg stump and required secondary thigh amputations. The use of a tourniquet was therefore abandoned. Since then over 75 consecutive cases have had mid-leg guillotine amputations without the use of a tourniquet. Healing in all these patients has been surprisingly good and in no case has a higher amputation been required. In a very few patients minimal necrosis of the skin margin has developed, but this has never interfered with a satisfactory end result.

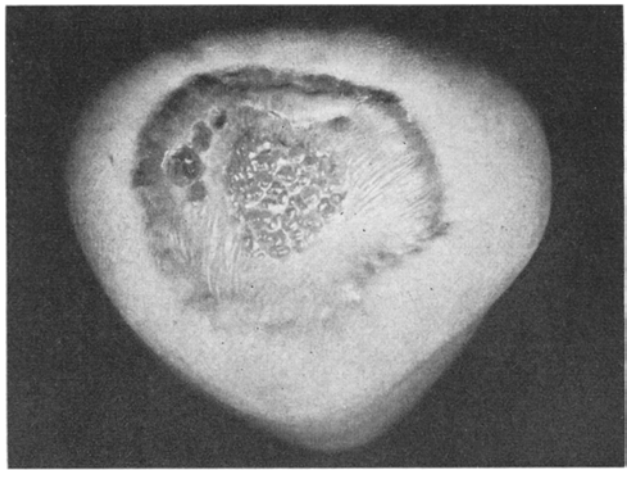

FIG. 2
Later stage of healing. Small granulating wound in center of contracting scar.

The process of healing presents some surprises. As soon as a rim of scar tissue forms at the periphery of the wound, contraction of the scar tissue begins and gradually pulls the skin down over the end of the stump (Fig. 1 and 2). This process continues until healing is complete, and the final scar is frequently so small that it can be covered with a 25 cent silver coin (Fig. 3, 4, 5). It is not necessary to apply any form of traction to the stump to accomplish this result. The pull of the contracting scar tissue is sufficient. Complete healing usually requires from 10 to 12 weeks. Patients are allowed out of bed the day after operation in most cases, and

can leave the hospital on crutches 4 to 6 weeks after operation.

Eighty-two patients with diabetes and extensive gangrene of a foot have now had amputation by this method. Many of the operations were done by members of the house staff under my supervision. A few of the cases included were patients seen in consultation and operated upon by colleagues.

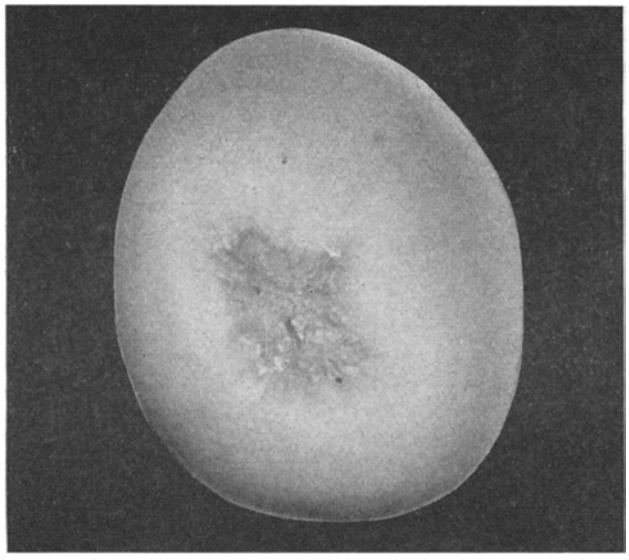

FIG. 3
Well healed stump. Note relatively small area of scar to circumference of stump.

There have been five deaths, a mortality of slightly over 6%. In addition, 12 non-diabetic patients with arteriosclerotic gangrene have been similarly treated with one death, making a total of 94 cases with 6 deaths. Forty of these have been ward patients at the Montefiore Hospital with 4 deaths. Fifty-four have been patients seen in private practice with 2 deaths. I might point out that, in general, patients admitted to the ward service at Montefiore Hospital are old and decrepit, and the hazards of operation are maximal in such a group. In an effort to evaluate the operative risk, all patients were graded as A, B, C, or D risks, depending on age, degree of coronary involvement, hypertension, toxicity due to spreading gangrene or infection, and degree of vascular impairment. Graded in this manner, only 6 of the 82 diabetic patients could be regarded as A risks, 24 as B risks, 31 were C risks and 21 were D risks. The significance of these figures is clear. It is not necessary to have a high mortality in amputations for gangrene in the diabetic. When the severity of the operation is reduced to the limited endurance of the patient, this mortality can be reduced to slightly over 6%.

Certain other advantages of the low amputation should be stressed. The use of an artificial limb is greatly facilitated if the patient retains his knee joint and about six to eight inches of his leg. Such patients are frequently able to walk without the use of a cane or crutches, and with scarcely any perceptible limp. On the contrary, when amputation is done through the thigh, experience has shown that almost none of the women and only about half of the men ever accustom themselves to the use of an artificial leg. Many of the 94 patients in my present series, including one man and one woman over 80 years of age, have been fitted with and are wearing artificial limbs. The stumps which result from the operation have stood up well under use with artificial legs. I know of no instance where a well healed stump has broken down and required further surgery.

It is worth recording that none of the below-knee stumps have been persistently painful. Pain in *thigh* stumps is common, and is one of the most distressing complications of amputations of the lower extremities. Every surgeon has had such patients with intractable pain who were not relieved by injections or reoperations on the sciatic nerve or sympathetic nervous system. In a recent article published in the Journal of the American Medical Association, White discusses this unfortunate complication, and suggests that cordotomy or even excision of parts of the cerebral cortex are justified in an attempt to relieve such pain. I do not know why *leg* stumps are painless, but I call your attention to this great advantage of the low amputation.

A brief description of the operation may be of interest. The patient is placed on the table face down, as his position permits flexion of the leg, and makes the operation much easier. Spinal anesthesia, using less than 100 mgm. of novocaine, or light general anesthesia is employed. A tourniquet is not used. A circular incision is made through the skin and fascia at a level 8 inches below the patella. Flaps of any kind are avoided. The muscles are divided at the level of the retracted skin. As soon as the superficial layer of calf muscles is sectioned the posterior tibial vessels and nerve are exposed, lying on the deep layer of muscles. The vessels and nerve are ligated and divided and the nerve is injected with alcohol. The leg is then flexed and the anterior tibial group of muscles is sectioned, exposing the anterior tibial vessels and nerve near the interosseous membrane. These structures are then ligated and cut, thus controlling the major sources of bleeding. The leg is again placed horizontal and the deep layer of muscles on the posterior surface is sectioned. The muscles are then separated for a few inches from the bones and the bones are sawed through, the tibia about one inch and the fibula about two inches above the level of the skin incision. Periosteum and bone are cut at the same level. The anterior edge of the tibia is then beveled by an oblique saw cut. Any muscle that has been damaged during the procedure is trimmed away, and careful hemostasis obtained. The wound is thoroughly irrigated with a pitcher of sterile water. This completes the operation. The wound is left wide open and is dressed with a combination of paraffin mesh and vaseline gauze. A posterior molded plaster splint is applied and the dressing is not changed for a week. Thereafter the wound is dressed with cod liver oil ointment every 3 days until it is

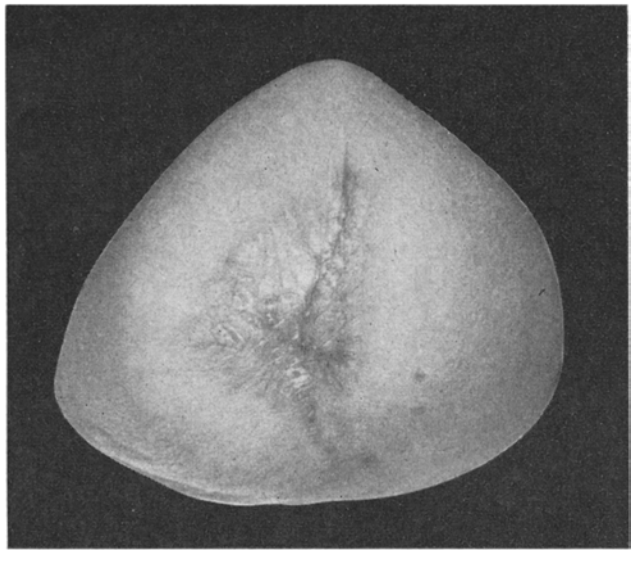

FIG. 4
Characteristic small scar at end of well healed stump.

healed. There is frequently considerable secretion from the wide open wound and usually some superficial slough of damaged tissue for the first two or three weeks. Then the wound gradually becomes a clean granulating surface in the center of a rapidly contracting scar. Infections of the stump or other complications are extremely rare. The postoperative course is usually smooth and painless.

It is important to continue the use of the posterior molded splint until the wound is well on the way to healing. Con-

tracture at the knee takes place readily unless a splint is used, and such a contracture is difficult to overcome.

Are there any contra-indications to the mid-leg amputation? In my opinion there is only one group of cases that is not suitable for this procedure. These are the patients who have had a recent thrombosis of the femoral artery, and gangrene develops wihin a few weeks of onset. Such cases are readily

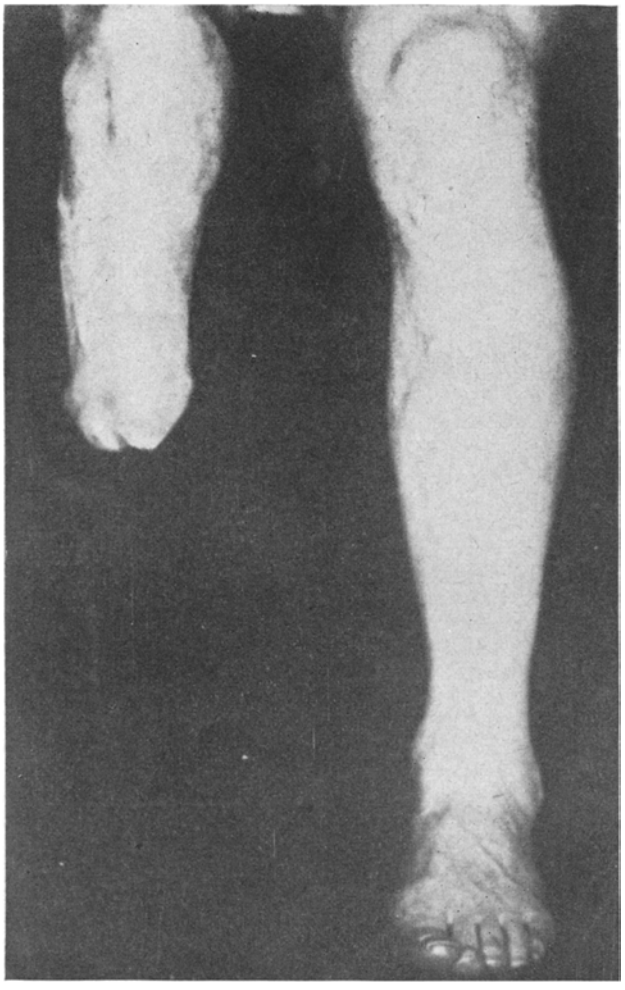

FIG. 5
Well healed stump after guillotine amputation. Preservation of knee joint and upper part of leg greatly improves ability to walk with artificial leg.

identified, as they give a history of abrupt onset of pain without preceding intermittent claudication. Unless there has been an interval of at least three months after the arterial occlusion, there has not been time for an adequate collateral circulation to develop to the mid leg, and it is not safe to amputate below he knee. It has been my experience that such cases are relatively few.

The diabetic patient with progressive gangrene of the foot, with or without infection, has a condition which threatens his life. Amputation of the part cannot be avoided. It has been gratifying to me to find that the simple operation described accomplishes this purpose with a minimal loss of life. Additional advantages are that the patient is left with a functioning knee joint and a comfortable stump.

Dr. Smith:

The discussion of this paper will be carried on by Dr. Thomas J. O'Kane of the Morrisania City Hospital.

Dr. O'Kane:

The paper we have just heard symbolizes a large forward step in the treatment of a condition which up until a comparatively few years ago was sadly neglected. A condition in which the mortality when analyzed at many large voluntary and municipal hospitals in the City of New York was

TABLE I

Mortality Following Amputations for Gangrene in the Diabetic

Hospital	*Cases*	*Deaths*	*Period*	*% Mortality*
Philadelphia General	130	73	1926-1933	56
Philadelphia Episcopal	56	27	1926-1935	48
Mary Immaculate (Jamaica)	24	12	1930-1935	50
Montefiore	17	10	1932-1936	59
Massachusetts General	36	12	1916-1926	33
Mount Sinai	68	26	1926-1936	38
Morrisania	45	27	1931-1935	60
Bellevue, 1st division	40	21	1931-1935	52
Bellevue, 2nd division	35	22	1931-1935	63
Bellevue, 3rd division	70	26	1931-1935	37
Bellevue, 4th division	24	18	1931-1935	75
Lenox Hill	13	5	1935-1939	46
St. Luke's	34	9	1934-1938	27
New York	33	9	1932-1940	27
Roosevelt	12	3	1935-1939	25
Totals	637	300		47%

apalling. Dr. Silbert cites a mortality of 47% among 637 thigh amputations. The figure is undoubtedly correct, and I know that before ten years ago it was much higher and in fact, almost double that figure. The efforts of such organizations as the New York Diabetes Association have unquestionably done much to bring about a change. Nevertheless it must be remembered, that, included in estimating this mortality are cases in the older age groups, having kidney, heart, cerebral, liver, and general damage, in whom no other operative procedure but thigh amputation was warranted. But there is no doubt that many thigh amputations were performed and are being performed unnecessarily and without regard to the proper indications for such an operation. It was with this point in view that Dr. Williams and I formulated our classification as a guide to surgery in the diseases of the extremities in diabetics and also attempted to outline a clinical method of estimating the circulatory status of the limb disregarding oscillometric and other instrumental procedures. Recognizing this, since 1932, I have used the modified guillotine amputation below the knee, as advocated by Dr. Beverly Smith, with increasing frequency.

I discarded the use of a tourniquet, not because I had seen any disastrous results from its use actually, but because I felt theoretically it may do damage and because I found it unnecessary, there being rarely any circulation in the larger vessels of these legs. This has been further confirmed by the necessary use of the tourniquet in refrigeration anesthesia which it has been my custom to use in preference to any other type of anesthesia in the past two years. I have used this type of anesthesia in well over 50 cases, and have seen no ill effects or stump gangrene that could be ascribed to the tourniquet.

Dr. Silbert's results in allowing spontaneous healing to occur following the guillotine amputation are undoubtedly good, but we feel that this is unnecessary because it prolongs hospitalization and convalescence. By means of the Smith modification of the guillotine, primary closure is affected in non-infected cases, and in infected cases secondary suture in four to seven days is practiced successfully. This is easily done. This shortens convalescence by ten to sixteen days to complete healing.

Our experience with the use of the artificial limb in thigh amputees coincides with that of Dr. Silbert. We often find the artificial limb relegated to the closet after a few attempts at use.

The occurrence of pain in the amputation stump is very much less in below-the-knee amputations. We found that infection in the stump is a large factor contributing to postoperative pain.

A very much larger number of below-the-knee amputa-

tions can be done in the older age group where sufficient time has elapsed to develop adequate collateral circulation. As a matter of fact, the majority of these cases have had little or no blood supply through the main vessels of their limbs for years, as is evidenced by lack of bleeding from the main vessels at operation when no tourniquet is used.

Dr. Silbert has shown that given proper and adequate diabetic care it is possible to apply thoughtful and rational surgical treatment to this problem and to remove the awful spectre from extremity surgery in diabetes.

While I may differ in detail, I agree thoroughly with Dr. Silbert. I would like to ask him a question since he did not speak of his diabetic control. What was the medical cooperation in his cases?

I wish to thank Dr. Silbert for this opportunity of hearing and discussing this excellent presentation.

Dr. Silbert:

Diabetic control is not as a rule a difficult matter in these patients since their diabetes is usually not severe. I handle the diabetic control myself in the patients I am treating privately, unless there is some unusual complication. The patients at Montefiore Hospital are taken care of by the house staff. It is best to have a sugar-free urine, and patients are given as much insulin as may be required to accomplish this result. Once the leg is off, the diabetic control becomes rather simple. Rarely is it necessary to use more than 50 units of insulin a day in these patients.

It might be pointed out that the majority of these patients have closed popliteal arteries; most surgeons would, therefore, have done thigh amputations. In my opinion, this is not a criterion for surgery above the knee.

My experience with the tourniquet is that it is very detrimental in certain cases. It promotes sloughing. An attempt has been made to evolve a procedure without its use. In most of these patients you are inviting trouble when the wound is closed. Primary union, with closed popliteal arteries, cannot be expected. I, therefore, leave these amputations open.

(Further discussion of Dr. Silbert's paper will be found below under remarks of Dr. Elliott P. Joslin).

Dr. Smith:

On behalf of the Surgical Section of the New York Diabetes Association, I want especially to thank the next speaker for coming to address us. He came on behalf of his colleague, Dr. Howard Root, who is ill and unable to be present. Dr. Elliott P. Joslin of Boston needs no introduction. He will speak on "The Medical Pre and Post Operative Treatment of Surgical Diabetics".

Dr. Joslin:

Dr. Root had a bad time of it with virus pneumonia and he was in the hospital for several weeks but he is now much better. It has been a great pleasure to come here tonight.

Discussion of Dr. Heyd's paper continued

In regard to the papers already presented, I should like to refer first to the one by Dr. Heyd on the thyroid complication. The diabetic patient with thyroid complication demands the closest cooperation beween the medical man and surgeon.

I remember two cases that drove that home to me. One whom I saw about thirty-five years ago died in coma. The second patient and the one that stands out above all the others in my mind was a patient of Dr. Lahey who came in one night at about ten o'clock. That patient changed all the rules of the hospital for then no routine urinalysis was done at midnight. In the morning when the laboratory was open the patient was in diabetic coma. This is what the combination of diabetes and hyperthyroidism really means, a rapidly changing condition. Since this occasion it has been a rule of the hospital that a urinalysis be done on every patient coming in regardless of the time of admission. Lahey and his group have formulated a principle which holds with all of the surgeons and us, that is, the surgeon does just what he wants to for the patient; it is our job to keep the patient from the diabetic standpoint alive. We have never, and I can honestly say that, gotten into any trouble about orders because we have things so arranged that the surgeon writes down what orders he wants and they are carried out. We never change their orders; there is the closest cooperation among us.

I see Dr. Mosenthal in the audience and I should like to ask him about his experiences with hyperthyroidism — do these patients have less arteriosclerosis than other people? I should like to see some statistics on this because my feeling is that people with hyperthyroidism generally have very good arteries. I believe this is true and I wish there might be more said about it.

We see a great many simple adenomas in our diabetics. Many patients with adenoma do not have any hyperthyroidism but I do feel that unless there is something definitely against it, these adenomas should come out. My opinion on that goes back to one of the Mayos who pointed out the occasional cancer of the thyroid developing in an adenomatous gland. This is a terrible thing to see. I do think we should take advantage of good surgery and attack these adenomata of thyroid more frequently than is commonly done. I agree thoroughly with all that Dr. Heyd has said.

During 1942 and 1943 thirty-four operations on the thyroid gland were performed by the Lahey Clinic on our patients with no mortality. Preceding the operation the diet has been one high in carbohydrate and calories, particularly if hyperthyroidism either primary or secondary to adenoma has been present. Prior to operation it is the rule for patients with hyperthyroidism to remain in bed four days and then gradually to get up and about until operation on the tenth day. Lugol's solution is prescribed after the first metabolism test and until the day of operation. The second metabolism test is done on the seventh day. Phenobarbital, grains 1½, is given on the night before operation, and if the patient has been toxic, ¼ or ½ grain is given three times a day previous to operation.

Thiouracil is still in an experimental stage. A paper from the Lahey Clinic is appearing shortly in the Journal of the American Medical Association but Dr. Lahey emphasized at our staff meeting that it is not without danger and is thus in marked contrast to the use of Lugol's solution. I may add that our group see such good results from the management of thyroid cases by the Lahey Clinic that we never institute treatment without a consultation with them.

Patients with simple adenomas may be in the hospital only one or two days before the operation is performed.

Recently, concealed or latent hyperthyroidism has been discovered in a considerable number of our diabetic patients who failed to do well. In these patients careful studies disclosed the hyperthyroidism, and its cure by operative measures has led to extraordinarily good results. I cannot emphasize too strongly the idea that if a diabetic patient does not improve by methods which should bring this about, one must invariably hunt for a complication such as hyperthyroidism.

Discussion of Dr. Silbert's paper continued

The surgical status of the patient rules, and the surgeon decides when to operate. The task of the physician is to keep the patient alive and to adapt treatment to the surgical emergency. How well Dr. Silbert has recorded the wonderful improvement for operations on the lower extremities and, in particular, has shown how small the mortality may be for amputation below the knee when intimate correlation exists between the surgeon and internist! Especially deserving of attention is the circumstance that these operations were not always done by him but by a group working along the same lines. I feel that his low mortality in comparison with the previously high mortality in a group of scattered hospitals in various cities should not be interpreted as evidence to favor amputation below the knee for safety's sake, but rather should be taken as evidence of good surgery under the careful direction of one surgeon who is particularly interested in diabetes, rather than surgery performed by a group of surgeons, excellent though they may be, who are without special interest and experience in diabetes.

Major amputations at the New England Deaconess Hospital numbering 767 between 1932 through 1942 showed a mortality of 12.3 percent, but major amputations for the three years 1941, 1942, and 1943, numbering 132, were performed with 5 deaths, a mortality of 3.8 percent. In the beginning these amputations were under the supervision of Dr. Daniel Fiske Jones, but for many years have been under that of Dr. Leland S. McKittrick and a group of his associates.

I should like to ask Dr. Silbert to watch his cases and note how many ultimately will have to have the other leg off. Of 100 of our major amputations, 39 at a later time had to have amputation of the other leg.

With regard to surgery in obstetrics, Dr. Priscilla White will soon make a formal report. To the 125 diabetic pregnancies and deliveries already reported by Dr. White, she now has added 51 more cases, making a total of 176 patients whom she has followed through the greater part of the course of their pregnancies. I think one of the secrets of the success obtained is due to the fact that there has been the same doctor, obstetrician, anesthetist, pediatrician, and, in fact, supervising nurse. The series includes 52 normal cases with 50 living babies; 89 abnormal cases treated with hormones and under careful supervision with 81 living babies; and 35 abnormal cases untreated or poorly treated with 17 living babies, making a total of 176 cases with 28 deaths. The fetal mortality—16 percent.

In general, the diet throughout the pregnancies varied from carbohydrate 180, protein 90, fat in variable amounts, to carbohydrate 200 and protein 120. Salt was restricted after six months. In the management of these pregnant women one always must remember their tendency to renal glycosuria and to acetonuria, the latter in my experience, particularly if the carbohydrate falls under 100 grams daily. One does not attempt to get these patients sugar-free with insulin.

Crystalline insulin and protamine zinc insulin have been administered before breakfast, and almost invariably additional doses of crystalline insulin later in the day. Insulin is given 24 hours before a surgical delivery but no additional later during the day before or on the morning of delivery. After delivery, the insulin has been resumed up to or less than the usual dose of crystalline and protamine zinc insulins. Tests of the urine are also made at 11:30 a.m. and 4:30 p.m. and 8 units of crystalline insulin added if red, orange or yellow test with Benedict's solution. One is careful to exclude a test of urine first voided after intravenous glucose.

1000 cc. of 5 percent glucose in water is given intravenously starting before and continued during operation, and 1000 cc. of 5 percent glucose in saline some hours postoperatively. The carbohydrate up to 100 to 200 grams in all, including that intravenously, is given as hot liquids, tea with sugar, malted milk with water, and gradually one works back to the regular preoperative diet.

No preoperative medication was given. Spinal anesthesia was employed, but the dose was smaller than the usual dose and always with ephedrine. Oxygen is given to the patient during cesarean section for sake of the baby. Pantopon is injected as soon as the baby is delivered. Emphasis is put on giving no preoperative medication.

Remember one is dealing with a potentially atelectatic baby. Extra care, therefore, is necessary for the infant with special effort made to see that the child is drained, suctioned, and mechanically stimulated, often every hour. Many of the babies during pregnancy are exposed to extra fluids (hydramnios). The rule has been for the baby to be put into the incubator for 24 hours routinely, and especially so lately because of the shortage of nurses. The mature appearance of the baby should not deceive the doctor. The infant should be treated with as much as or greater care than a premature infant.

I should like to present something a bit new in our group and I brought a statement with me which I think is thoroughly applicable to the operation below the knee. This was written by Dr. Francis D. Moore who is with McKittrick and Pratt and who was the first one from Boston to be decorated for operating at Guadalcanal. This statement which deals with *"Experiences with Penicillin in Diabetic Gangrene"* I shall read.

"When a virulent infection increases the local metabolic requirements of tissues in an arteriosclerotic limb and decreases the blood supply by edema and venous thrombosis, a situation arises in which the loss of the part from gangrene may result. It is in this group of cases that penicillin may conceivably make its greatest contribution; namely, in those patients with an absent dorsalis pedis pulsation or with poor collateral circulation, who, prior to the onset of infection, have maintained a fairly adequate extremity, in whom a virulent invasive infection has severely embarrassed the local blood supply. In such cases an effective anti-bacterial substance might control the infection and again allow the circulation to be adequate for the limb."

"Our experience now comprises the use of penicillin in seven patients. In five of these penicillin has been administered to control infection, and a local surgical procedure has been successfully carried out, rather than resorting to the low thigh amputation which would have been necessary under previously accepted methods of treatment."

"The results thus far have been satisfactory. Using penicillin, it is possible to control local infection, and if penicillin is used locally as well as systemically, the wound may be sterilized. We have not yet found much alteration in the wound flora if the drug is only administered systemically."

"Using penicillin, the open wound of drainage or of metatarsal amputation appears to granulate much more rapidly and and much more cleanly than under previous methods of treatment, allowing the usage of multiple pinpoint grafts to close the operative defect. This later method has been used in several cases and the unsuccessful 'takes' of the pinpoint grafts have been quite unusual for a pulseless foot."

"In order to reduce the circulatory factors in the distal part of the foot to a minimum, a procedure is being developed in which a transmetatarsal amputation is carried out, removing the entire distal part of the foot, and leaving the proximal portion which has more adequate arterial supply. Penicillin has been applied locally and systemically, and as soon as the wounds granulate, multiple grafts are placed, and the wound is thus closed."

"Our experience with this group of cases under penicillin treatment is still very limited and the transmetatarsal amputation has only been used in two cases."

"It is much too soon to report any definitive results, but it is safe to say that this extremely effective antibacterial agent may come to occupy a place of importance in the treatment of diabetic gangrene."

Pre-Operative Treatment. It is preferable to have the diabetes controlled, but no delay should ensue in case of an emergency. Thus in several instances acidosis and appendicitis have co-existed, but the time of the operation has seldom been delayed over six hours. As a matter of fact, usually in most cases the diabetes is quite well controlled before operation unless fulminating infection exists such as a carbuncle, and even then surgical preoperative treatment for a few days allows for the treatment of the diabetes. However, I still remember a standard saying of Daniel Fiske Jones that if the patient cannot survive the hazard of going to bed for twenty-four hours, the chances of a successful surgical operation in that period are dubious. Naturally this would not hold in a case of active appendicitis.

At 6:00 p.m. of the preoperative day surgical patients receive a soap suds enema even though the operation is quite trifling. They have a routine supper, but coarse vegetables are avoided. At least for five hours before operation the patient receives nothing by mouth, and I have noticed that this period has been lengthened often to twelve hours. Recently several patients have received Nembutal and some, morphine one and a half hours and one hour respectively before operation, but as a rule most patients receive no preoperative medica-

tion at all because of the danger of inducing vomiting—20 percent of patients will vomit as result of morphine alone.

Insulin is withheld on the morning of operation until the patient returns to the ward. Thereafter, the customary dosage is administered, and later in the day before noon, before night, and in the late evening, additional crystalline insulin is given according to the formula $\frac{R \quad Y \quad G}{8 \quad 4 \quad 0}$.

Post-Operative Treatment. The minimum carbohydrate during the first twenty-four hours after operation is about 100 grams. Usually 1000 cc. of 5 percent glucose in saline is given intravenously on return to the ward, and in case the patient cannot begin to take simple liquids, a second 1000 cc. of 5 percent glucose in distilled water is administered In operations on the gastro-intestinal tract vitamins are given intravenously with the glucose or saline.

The regular preoperative diet is gradually resumed, and all of us have felt that if the patient is kept without food for a considerable period prior to operation, the diet can be increased much more rapidly than when the patient has received even such simple liquids as orange juice or ginger ale five hours before the time of operation.

Insulin nearly always can be reduced within a few days after the operative procedure. No attempt is made to keep the patient sugar-free for the first one or two days because so frequently glucose is given parenterally. Never expect to get the patient sugar-free right after an operation. The nurses are instructed not to give insulin by the fraction formula described above on the first urinary test following intravenous medication. Even if the patient became sugar-free after a few days, insulin is maintained in small doses when the fasting blood sugar is 140 mg. or more, or the blood sugar after food exceeds 170 mg. In many instances, patients can omit insulin, but these are dangerous cases because, as my son has taught me, if the patients do not prick themselves each morning, they are apt to forget they have diabetes. We often say that the diabetic who omits insulin causes us more worries than the diabetic who consistently takes a small dose, even 8 or 10 units.

Following operation patients especially with major amputations are turned on the side every two hours. Rubber sheets are avoided; Balkan frames are invariably used so that the patient can move about by himself, and a narrow pillow is placed under the ankle of the sound foot, so that the recovering patient in moving about the bed will not injure the heel.

Routine rounds in every surgical case demand 1) examination for bed-sores, which seldom nowadays are encountered; 2) recognition of the possibility of an impaction; 3) search for a distended bladder; and 4) critical clinical observation of the physical status of the patient and his blood and urine to differentiate between the possibility of an insulin reaction and surgical shock.

Anesthesia. Spinal anesthesia has been the almost invariable rule in nearly all major amputations.

Sulfadiazine has been administered prophylactically (when time allows) for two to three days before the operative procedure. The first dose would be 2 grams followed by one gram every four hours It is rare, however, that more than six grams have been given for more than one day; subsequently, the usual dose is four grams. Alkalies have not been given with the sulfadiazine, and we have depended on the laboratory levels for sulfadiazine, on care that the urinary output reaches 1200, preferably 1500 cc. in twenty-four hours. Observations are made on the state of kidney function. Repeatedly this past year the question has arisen as to whether we should use alkalies as a routine, but we feel our results have fully justified our avoidance of this additional medication.

I always enjoy coming down to New York and I shall not soon forget about the 94 cases as reported by Dr. Silbert.

Dr. Smith:

The discussion of Dr. Joslin's presentation will be opened by Dr. Edward Tolstoi of New York Hospital.

Dr. Tolstoi:

I think all of you will agree with me that Dr. Joslin's sketchy presentation is more stimulating, more erudite, and more chockful of experience than another man's deliberated presentation. However, as interesting and stimulating as his remarks were to me personally, I experienced a feeling of embarrassment, because it was my lot to discuss the paper on the program entitled "The Medical Pre and Postoperative Treatment of Surgical Diabetics." Naturally, I assumed that Dr Joslin would devote most of his time to that thesis. Some of his remarks were pertinent, but most consisted of comments on the other papers which have been read this evening. I am, therefore, somewhat in the position of the young student who most carefully learned the names of the twelve apostles for his final examination. He was told that it would be the only question. When he appeared at the examination, much to his dismay, he was asked to differentiate between the major and minor prophets. This was quite a blow, but he recovered and wrote, "Far be it from me in my humble capacity to differentiate between such great men, but the list of the twelve apostles is as follows." Profiting from his experience I will, therefore, tell you my ideas about the diabetic patient requiring surgery.

Number one, hydration is very important. The patient must be wet before the operation. Number two, glycogenation—the liver must be rich in glycogen.

The patient must be given ample fluid, with a substance which will bind it. Salt is ideal. Preoperatively, I recommend one gram of salt in tablet form, every two hours, followed by a glass of water. This may be started twenty-four hours preoperatively. The patient need not be disturbed at night. Fluid may also be given as saline by clysis or intravenously, the former for the patient over sixty or anyone suspected of cardiac insufficiency, the latter for the young patient.

Now as to the second principle that of glycogenation The only efficacious means of enriching the liver glycogen in a diabetic patient is by means of carbohydrate and insulin. The patient may be given a 5% glucose solution simultaneously with the saline and about 25 units of regular insulin. This permits a coverage of one unit of insulin for each two grams of glucose. The amount of the fluid administered at any one time is 1000 cc. and this should be repeated as needed.

Food is withheld the morning of the operation and the fasting preoperative blood sugar is not done, as I feel it is not very helpful.

The control of the post operative glycosuria is not emphasized, as it has been my experience that wounds healed by primary union even though the patient reveals a glycosuria of as much as 70 to 100 grams in 24 hours.

When we have a patient whom we expect to be under anesthesia for a long time, we insert a mushroom retention catheter and connect it to a receptacle at the bed so that we can draw off urine for analysis every two hours. The urine is then examined for sugar and acetone and the insulin requirements adjusted accordingly. It is more prudent to keep the insulin a little below actual needs rather than run the hazard of hypo glycemia.

Dr. Joslin mentioned that he likes to keep salt low. That is at variance with our concept, and I would appreciate if he would elucidate a little more.

I find that the surgical diabetic presents no great problem. The general principles of preparation are the same as in any other patient, and now that insulin is available, ketosis is not too great a hazard.

Thank you. I am grateful for this opportunity to discuss.

Dr. Smith:

The discussion will be continued by Dr. Louis Bauman of the Presbyterian Hospital.

Dr. Bauman:

Hyperthyroidism complicated by diabetes:

Surgeons favor a high carbohydrate diet during the preoperative period of toxic goiter; when diabetes is associated, a large amount of insulin may be necessary to control carbohydrate metabolism. After operation when the caloric requirement has decreased, regulation is easier at first.

I was impressed by the ameliorating effect of partial thyroidectomy on the severity of the diabetes, but later experience did not always confirm this early impression.

The treatment of diabetes complicated by surgical conditions.

During ordinary existence it is possible and desirable to obtain accurate regulation of the diabetes but this is rarely possible during infections or immediately following a surgical operation.

On the day of operation, per oral feeding is interdicted. Usually a clysis of 1500 cc. of 5 per cent glucose in saline is given and this is preceded by about 15-20 units of uncombined insulin. If possible, the urine is tested every two hours thereafter and the dosage of insulin graded to the excretion of sugar (i.e., 10 units for 4+ or 3+, 5 units for 2+ or 1+ glucose). If the urine specimen is not obtained, a finger blood sugar will be of even greater value, for in older people hyperglycemia may exist without glycosuria. We have recently seen a typical diabetic retinitis in an elderly man without glycosuria but with hyperglycemia. As soon as possible, fluids are given by mouth, and later the previous diet and insulin are resumed.

The diabetic is extraordinarily sensitive to the products absorbed from wounds on infected areas. The dramatic lessening of the severity of the diabetes after amputation of an infected foot is a good illustration.

The following slide illustrates the preoperative treatment of severe acidosis occurring in a diabetic man of sixty with a large carbuncle of the neck.

Date 1944	Diet grams C	P	F	Blood Sugars mg. % 11:30 a.m.	4:30 p.m.	Insulin units Standard	Protamine	Globin
1/4	150	100	75	408	301	22		
1/5	"	"	"	312	306	35		25
1/6	"	"	"			30		35
1/7	"	"	"	346	140	30		50
1/10	"	"	"	135	107	35	15	55
1/11	200	100	80	125	192	5	15	60
1/19	"	"	"	69	61		15	60
1/20	"	"	"	155	73		10	55
1/24	225	100	125	305	161		10	55
1/26	"	"	"	108	62		15	75
2/5	275	100	150					
2/16	275	100	175	236	127		5	50
3/8	"	"	"	306	157		10	60
3/15	"	"	"	63	60		15	65
3/29	"	"	"	76	48		15	65
4/4	"	"	"	125	68		15	65
4/5	"	"	"	404	444		15	65
4/6	"	"	"	285	67		15	65

The table includes some of the diabetic data.

It is evident from the table that the severity of the diabetes varied from day to day and this was due to the variable absorption from the infected focus. The relatively good control, though, on a diet of over 3,000 calories was obtained by a morning dose of 15 units of protamine and 65 units of globin insulin.

Dr. Smith:

The discussion will be continued by Dr. George E. Anderson of the Brooklyn Hospital.

Dr. Anderson:

It has been a great pleasure for me to be here this evening. It is always stimulating to hear a paper by Dr. Joslin, and this evening's has been no exception. I am in the same quandary as Dr. Tolstoi. There is possibly some excuse for "ad-libing" and I shall proceed.

I feel we might attempt to find common denominators which are applicable to all surgical diabetics. One of these is the age of the patient. Prima facie, the diabetic of eight or ten years' duration must be considered, so far as his cardiovascular system is concerned, to be ten years older than his chronologic age. Thus, the man of 58 years, by virtue of his diabetes, is really 68 years of age from the standpoint of surgical risk. He cannot be expected to withstand the "wear and tear" of surgical shock as would a younger person. He must be prepared for

Time	Fluids Given I.V. -cc-	PO	Carbohy. grams	Sugar	Urine Diacetic	Blood Sugar	CO_2	Insulin Units	Sid. Bicarb. grams
Feb. 15									
4:00 p.m.	1000			4+	0	.46	14	50	3
6:00 p.m.				4+	4+				
8:00 p.m.	1000							50	3
9:00 p.m.				4+	4+				3
11:00 p.m.				4+	+		19.5		
12:00 Mid.								20	
Feb. 16									
1:00 a.m.		100	10	3+	0				
4:00 a.m.		100	10	+	2+			20	
7:00 a.m.							31		
8:00 a.m.	1000			0	0	.085	36		3
12:40 p.m.		200	20	0	0	.151		15	
1:30 p.m.	1000								Operation

The treatment consisted in the administration of salt solution, insulin and moderate amounts of sodium bicarbonate rather than sugar.

The next slide is a record of the progress of a girl of fourteen who had diabetes for eleven years and was transferred from another hospital where she had been for two months for osteomyelitis of the lower half of the femur, staphylococcus aureus septicemia, pericarditis, and pneumonia. She had received about 1,200,000 units of penicillin during this time and regular insulin to control the diabetes. The osteomyelitis of the femur dominated the picture when she entered the Presbyterian Hospital where she remained for about four months. Three senior surgeons favored amputation at the hip joint but with the help of large doses of penicillin, drainage, and removal of sequestra, she recovered and left the hospital a week ago.

his ordeal with this in the mind of the medical attendant, and this leads to a second common denominator which is pertinent to all diabetics facing surgery. Ordinarily, the diabetic lacks facility in polymerizing liver glycogen. This mechanism can be further embarrassed by faulty dietary prescription and insulin administration.

I like to think of the liver as a glycogen reserve, not in a pool sense as the gall bladder for bile, but rather in the nature of a commercial bank where the assets are represented by a dynamic balance between intake and output.

Glycogenic and glycogenolytic processes are constantly going on, and simultaneously. The urgent need is to attain a temporary over-balance of formation over breakdown of glycogen during the preoperative and the critical operative and

postoperative periods.

It is well known that a large dose of insulin in the non-diabetic will result in glycogen breakdown. A small or optimal dose of insulin in the diabetic favors liver glycogenation, but even in the diabetic, an excessive dose of insulin will cause glycogen breakdown and an abnormal carbohydrate mechanism. Witness the lack of sugar control after an episode of insulin shock, possibly as result of the compensatory suprarenal response. If you send the surgical patient to the operating room at a time when he is on the verge of insulin shock, what can you expect of him when he adds to this surgical shock?

In the Brooklyn Hospital, it is our habit to withhold insulin on the morning of surgery, at least, regular or crystalline insulin. It may be feasible to give 50% of the usual potamine zinc insulin for its postoperative effect. We reduce P.Z.I. on the day before operation, so that this insulin effect will not "catch the patient" on the table. We depend in the main on rapidly acting insulins postoperatively in frequent small doses.

Secondly, it has been shown by Cori and others that the liver glycogenizes better from a high blood-sugar level than from a low. It is, therefore, our policy to keep blood-sugar in the surgical candidate at the highest level which is consistent with negative or reasonably small output of urinary sugar. Under these circumstances, we worry very little about the glycosuria provided obligatory fat metabolism is avoided. An attempt is made to keep blood-sugar somewhere near the threshold level or slightly above.

In the Brooklyn Hospital, the patient receives his usual supper on the night before surgery; before retiring, he is given 8 oz. of milk and four crackers (about 32 gms. Cho.) for nascent glycogen formation thru the night. In the morning, on awakening, he is given 8 oz. of orange juice (24 gms. of glucose in rapidly available form). During surgery, the patient receives from 25 to 50 grams of glucose intravenously and slowly throughout this period. Postoperatively, we aim to supply from 100 to 200 grams of glucose in 24 hours by whatever route is most feasible.

The essential point from the internist's angle is to glycogenize by adequate preoperative carbohydrate prescription and cautious judicious use of insulin. Too often, as we have learned from sad experience, shock on the table or delayed shock is attributed to the surgical procedure rather than being placed in the internist's lap where it belongs. The quest for textbook normal blood-sugar and urine may have dire consequences. On the other hand, insulin properly administered has made of the surgical diabetic, a relatively normal surgical risk.

I wish to take this opportunity to thank the Surgical Committee for a very fine meeting and to express our thanks to the speakers of the evening.

Dr. Smith:

I should like to call on Dr. Mosenthal to comment on Dr. Joslin's question about hyperthyroidism and arteriosclerosis.

Dr. Mosenthal:

Most of the hyperthyroid cases are rather on the younger side before you really expect them to have arteriosclerosis. Another side of the story that may be of interest is that arteriosclerosis is often benefited by small doses of thyroid even though the arterioclerotic does not exhibit the slightest sign of hypothyroidism. Old age, among other things, manifests a deficiency in thyroid and so you ease them along. The arteriosclerosis that occurs with too little thyroid is just a general sign of degeneration that comes with advancing years thru all the organs of the body.

Dr. Smith:

I should like to call on Dr. Joslin for any closing remarks he might wish to make.

Dr. Joslin:

I am glad that Dr. Tolstoi brought up the point of having these patients protected from dehydration. I think the idea of giving some patients salt solution before operation is often desirable (if they don't exhibit albumen, high blood pressure and edema). I would like to emphasize that we must be careful with these patients for if one gives them too much intravenously, they get so much salt that it might be more than you would want. The idea of giving some of them salt before the operation is good.

How are blood transfusions handled here in New York? So many of these patients get many blood transfusions—sometimes four or five. We are trying now to get these patients who come to the hospital to bring their own donors and it thus doesn't cost them anything. We feel that when the patient is brought in and it is expected that an operation is to be done, the friends or relatives who brought the patient in should give blood. When people come to the hospital from a long way off, we are going to try to see if we can't get their local blood banks to give us some blood.

Dr. Smith:

I wish to thank the speakers for their participation this evening. This meeting is now adjourned.

Dietary Factors in the Treatment of Cirrhosis Without Jaundice

By

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IN RECENT years the results of treatment for cirrhosis of the liver have become more promising. This is due mainly to a better understanding of the underlying disturbed physiologic and pathologic processes. Up to a few years ago cirrhosis of the liver was considered an intoxication, alcohol being most often considered the offending agent. Animal experiments and clinical observations in recent years, however, seem to indicate that liver cirrhosis is a deficiency disease. Various studies point to a deficiency of some unknown fraction of the vitamin B complex as the cause of hepatic cirrhosis in experimental animals. [1, 2, 3, 4] Gyorgy and Goldblatt,[5] on the basis of a large number of experiments, believe that a deficient intake of protein brought on by the anorexia of vitamin B deficiency, is the actual cause of the cirrhosis in experimental animals. The protein deficiency, with its attendant lack of lipotropic amino acids which are necessary for the fat turnover in the liver, leads to increased fat deposition. Of the lipotropic amino acids methionine is the most important one. If methionine is not present in the food it may be formed in the body if sufficient labile

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