Surgical Interventions In Diabetes Mellitus

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ABSTRACT: Diabetes mellitus is a disease caused by deficiency or diminished effectiveness of endogenous insulin.

INTRODUCTION

Diabetes mellitus is a group of metabolic diseases in which a person has elevated blood sugar, either because the pancreas does not produce enough insulin, or because cells do not respond to the insulin that is produced. This high blood sugar produces the classical symptoms of polyuria (frequent urination), polydipsia (increased thirst) and polyphagia (increased hunger).

There are three main types of diabetes mellitus (DM);

Type 1 DM results from the body's failure to produce insulin, and currently requires the person to inject insulin or wear an insulin pump. This form was previously referred to as "insulin-dependent diabetes mellitus" (IDDM) or "juvenile diabetes".

Type 2 DM results from insulin resistance, a condition in which cells fail to utilize the insulin produced which sometimes may be combined with an absolute insulin deficiency. This form was previously referred to as non insulin-dependent diabetes mellitus (NIDDM) or "adult-onset diabetes".

The third main form, gestational diabetes, occurs when pregnant women without a previous diagnosis of diabetes develop a high blood glucose level. It may precede development of type 2 DM.[1]

Other forms of diabetes mellitus include congenital diabetes, which is due to genetic defects of insulin secretion, cystic fibrosis-related diabetes, steroid diabetes (induced by high doses of glucocorticoids) and several forms of monogenic diabetes.[2]

Untreated, diabetes can cause many complications. Acute complications include diabetic ketoacidosis and nonketotic hyperosmolar coma. Serious long-term complications include cardiovascular disease, chronic renal failure, and diabetic retinopathy (retinal damage). Adequate treatment of diabetes is thus important, as well as blood pressure control and lifestyle factors such as stopping smoking and maintaining a healthy body weight.[3]

All forms of diabetes have been treatable since insulin became available in 1921, and type 2 diabetes may be controlled with medications. Insulin and some oral medications can cause hypoglycemia (low blood sugars), which can be dangerous if severe. Both types 1 and 2 are chronic conditions that cannot be cured.[3]

Pancreas transplants have been tried with limited success in type 1 DM; gastric bypass surgery has been successful in many with morbid obesity and type 2 DM while gestational diabetes commonly resolves after delivery.[3]

Diabetes has both surgical and medical treatments.
Surgical treatments include:

1. Pancreas (Islet) transplant
2. Gastric bypass surgery
3. Barriatic surgery

A large body of evidence now demonstrates surgery for type 2 diabetes can achieve up to complete disease remission, a goal almost unheard of in current diabetes care. Evidence collected over decades of bariatric surgery demonstrates the effectiveness and durability of diabetes control gained after gastrointestinal bypass surgeries .[7]"Metabolic surgery" is now emerging as an area dedicated to the establishment of surgical procedures specifically aimed at treating diabetes. This article will focus on the rationale for surgery as a new therapy for type 2 diabetes and explore the various surgical options currently available and those under investigation.[5]

EVIDENCE

In the early 1980s, surgeons realized that many patients with type 2 diabetes who had undergone gastric bypass for the treatment of morbid obesity experienced a complete diabetes remission. This remission proved durable . Since then, there have been many studies confirming the efficacy of bariatric procedures in treating type 2 diabetes [4]. In the meta-analysis of 22,094 patients, Buchwald et al.found diabetes resolution in 98.9% of patients undergoing biliopancreatic diversion or duodenal switch, 83.7% resolution after gastric bypass, and 47.9% after laparoscopic gastric banding[7]

Diabetes control and remission seems to be best obtained with procedures that include an intestinal bypass, as in gastric bypass or biliopancreatic diversion. With a 14-year follow-up, Pories et al.found an 83% resolution of type 2 diabetes in 608 patients after gastric bypass.

The mechanism of diabetes resolution after gastrointestinal bypass

remains unclear but is apparently not related to weight loss alone[3]. In most cases, remission is observed in the days to weeks after surgery before any substantial weight loss has occurred [3] . Furthermore, emerging evidence now shows that these effects may be achievable in the nonobese population as well. Several human studies have shown dramatic diabetes control in patients with BMI <35 kg/m2 (20,21)[5]. Lee et al. showed that 89.5% of diabetic patients with BMI <35 kg/m2 had returned to euglycemia at 1 year after gastric bypass. The mean A1C level was reduced from 7.3% preoperatively to 5.6% at 1 year after surgery.

Given the success of bariatric surgeries in treating diabetes, should we now move toward the establishment of specific surgical interventions to treat diabetes? As with all other surgical procedures, the benefits of surgery must be weighed against the potential risks. In other words, one must consider the possible complications and mortality of surgery versus the probable remission of diabetes and decrease in lifelong diabetes-related morbidity and mortality[7]

DIABETES SURGERY: A NEW DISCIPLINE

While conventional bariatric surgery seems to treat diabetes, many are evaluating procedures specifically geared to treat diabetes on its own[7]. Conventional operations already in practice addressing obesity include laparoscopic adjustable gastric banding, Roux-en-Y gastric bypass, biliopancreatic diversion with duodenal switch, and sleeve gastrectomy[6]. Laparoscopic adjustable gastric banding is strictly restrictive, with the band wrapping the proximal stomach, just below the gastro-esophageal junction. The patient loses weight because he or she feels full early with distension of the banded stomach after a few bites of food. The amount of gastric restriction can be adjusted based on injection or withdrawal of saline from within the inflatable plastic core6. Roux-en-Y gastric bypass provides restriction via a small vertically oriented gastric pouch along the lesser curvature of the stomach. The jejunum is divided and rerouted to reestablish gastrointestinal continuity and allow nutrients to bypass the duodenum and proximal small bowel[6]. The biliopancreatic diversion in its "duodena switch" variant consists of a vertical gastrectomy ("sleeve gastrectomy") and an extensive bypass of the bowel, with a duodeno-ileostomy leaving only a short segment for absorption. The sleeve gastrectomy component of the biliopancreatic diversion with duodenal switch has been recently found to be effective as a stand-alone procedure in many overweight individuals . Because a malabsorptive component is missing, attention is paid to making a narrow sleeve and resecting the ghrelin-producing fundus to limit stomach dilation and weight regain.[6]

Novel operations are geared toward the treatment of diabetes and not necessarily to induce weight loss. Among the most prominent of these operations are the duodenal-jejunal bypass and ileal transposition. Duodenal-jejunal bypass is a stomach sparing bypass of a short segment of the proximal intestine, a gastric bypass without the stomach stapling. Duodenal-jejunal bypass has been shown to improve diabetes in both lean and obese animal models . It is currently being investigated in select early human trials.[6]

Ileal interposition, previously called "transposition," is another procedure being investigated to treat type 2 diabetes. Ileal transposition involves the removal of a small segment of the ileum with its vascular and nervous supply and inserting it into the proximal small intestine. Animal studies of ileal transposition show exaggerated release of the gastrointestinal hormone glucagon like peptide-1. Glucagon like peptide-1 is a potent insulinotropic hormone that improves glucose tolerance, this action being used in drug therapy for diabetes[6]

Another novel procedure is the endoluminal duodenal-jejunal bypass sleeve. This procedure entails the endoscopic delivery and anchoring of a plastic-coated sleeve implant that extends into the jejunum and effectively excludes the duodenum. The device theoretically mimics the duodenal-jejunal bypass, in that nutrients pass throughout the duodenum without contact with its mucosa, while the distal small bowel receives less processed foodstuffs. The endoluminal duodenal-jejunal bypass sleeve is able to do this without disrupting bowel continuity or creating new anastomosis.

SURGICAL TREATMENT FOR COMPLICATIONS OF DIABETES MELLITUS

The chronic complications of diabetes mellitus include the micro vascular and macro vascular complications.

The micro vascular complications include:

1. Diabetic neuropathy
2. Diabetic nephropathy
3. Diabetic retinopathy

Diabetic neuropathy results in loss of sensation to the limbs, mostly the lower limbs ending in diabetic foot ulcer. The treatment for the resulting complications is management and skin grafting by a plastic surgeon especially with the new approach of three dimensional reconstructive procedures.[8]

Diabetic nephropathy occurs with kidney lesions often ending in End Stage Kidney disease. The treatment is management by the nephrologist and if necessary kidney transplantation.

Diabetic retinopathy usually results in macular oedema in which laser treatment has proven effective. Laser coagulation of microaneurisms for focal diabetic macular oedema and in diffuse macular oedema laser photocoagulation is used. In further complications pars planavitrectomy (PPV)is a procedure indicated in some case of vitreous opacity and traction disorders.[8]

The macro vascular complications include:

1. Coronary artery disease
2. Stroke
3. Peripheral vascular disease

Coronary artery disease can be treated by angioplasty, arterial stenting or coronary artery bypass surgery

Diabetic stroke is an ischaemic stroke which is treated surgically by micro catheter based surgical interventions and also the use of clot retrieval devices such as the merci and penumbra retrievers

Peripheral vascular disease caused by diabetes can be treated by angioplasty, vascular stenting, bypass surgery, endarterectomy and in extreme cases especially with gangrene amputation is considered[8]

CONCLUSION

The economic, medical, and social burden of diabetes is immense. Given our current inability to achieve major remission and reduce death rates with medical management, metabolic surgery represents a new frontier in diabetic treatment. Over the past 20 years, bariatric surgery has proven successful in treating not just obesity but also type 2 diabetes. Surgery should now be looked at as a viable therapy for not only the morbidly obese, but also for diabetic patients who fall outside current BMI guidelines. The potential benefits of metabolic surgery are in fact enormous. However, its implementation requires a rethinking of diabetes treatments goals and strategies.

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