

Attitudes and Concerns of Diabetic Patients towards Bariatric Surgery as Treatment of Diabetes

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Abstract

Introduction: Bariatric surgery is increasingly recognised as an effective treatment for type 2 diabetes that significantly improves glycaemic control, even achieving remission. This study examined perceptions and concerns of diabetic patients towards bariatric surgery as a treatment option for diabetes. **Materials and Methods:** A total of 150 patients were recruited from a specialised diabetic outpatient clinic and completed a questionnaire (items were rated on a Likert scale from slightly important [lowest score of 1] to extremely important [maximum score of 5]). Logistic regression was performed to identify factors influencing decision for surgery. **Results:** The 74 males and 76 females had mean age of 50 (range 20 to 78) and body mass index (BMI) of 29.6 kg/m² (range 18.1 to 51); 61% considered surgery favourably. Predictive factors for interest in surgery: higher educational levels (OR = 2.3; 95% CI, 1.2 to 4.4), duration of diabetes (OR = 0.4; 95% CI, 0.2 to 1.0) and use of insulin (OR = 2.1; 95% CI, 1.1 to 4.1). Reasons for surgery: desire for remission (Likert scale 4.7 ± 0.7), to prevent complications (Likert scale 4.5 ± 0.9) and to reduce medications (Likert scale 4.3 ± 1.1). For those not keen on surgery, main reasons were fear of surgery (Likert scale 4 ± 1.5) and satisfaction with current therapy (Likert scale 3.7 ± 1.6). **Conclusion:** Many diabetic patients would consider surgery as an option to improve their metabolic disorder (greater interest in patients with higher educational levels, currently using insulin and with shorter duration of diabetes). Surgical complications, length of recovery and duration of benefits were the main concerns.

Ann Acad Med Singapore 2016;45:495-506

Key words: Metabolic surgery, Patient perception, Remission

Introduction

The world is currently facing an epidemic of type 2 diabetes mellitus and obesity.¹ Type 2 diabetes is one of the fastest growing diseases with nearly 366 million people affected worldwide and 450 million people are forecasted to have diabetes by 2030.² Current standard therapy includes oral hypoglycaemic agents and insulin, with varied success. Diabetes is known to be a chronic progressive disease, which may unfortunately lead to end organ dysfunction or failure, despite oral hypoglycaemic agents, insulin or even an intensified combination.³ There has been great interest and excitement regarding bariatric surgery such as gastric bypass and sleeve gastrectomy, as another line

of treatment for type 2 diabetes. The National Institute for Health and Care Excellence (NICE) guidelines in the United Kingdom for bariatric surgery are for patients who have tried all appropriate non-surgical measures but are unable to achieve clinically beneficial weight loss. These patients include those with body mass index (BMI) greater than 40 kg/m² (37.5 kg/m² in Asians); or BMI of between 35 and 40 kg/m² (32.5 to 37.5 kg/m² in Asians) together with significant disease that could be improved. There should also be expedited assessment for bariatric surgery to those with BMI of above 35 kg/m² (32.5 kg/m² in Asians) with recent onset type 2 diabetes. Those for consideration of surgery are patients with BMI of 30 to 34.9 kg/m² with

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recent onset type 2 diabetes (27.5 to 32.5 kg/m² in Asians).

Bariatric surgery has achieved diabetes remission in up to 75% to 95% of patients, and significant improvements in glycaemic control, together with hypertension and hyperlipidaemia over medical therapy among morbidly obese patients.^{4,5} These results, whilst slightly lower, are also seen in patients with BMI of <35 kg/m².⁶ International Diabetes Federation issued a position statement in 2011 that recommended bariatric surgery to be “considered earlier in the treatment of eligible patients to help stem serious complications that can result from diabetes”, calling it an effective, safe and cost-effective therapy. Hence, the term “metabolic surgery” is commonly used.

The clinical benefits of bariatric surgery versus medical therapy has, however, only been conclusively proven in diabetic patients who are obese as defined by a BMI of 27 to 43 (Schauer, NEJM 2012) in a Western population, and in practice, is mainly indicated for patients with BMI of 35. The benefits, safety and cost-effectiveness of bariatric surgery in non-obese diabetics remain controversial in the absence of definitive clinical data.

This study was conducted with a view to examine the perceptions diabetic patients have towards bariatric or metabolic surgery and to find out about their concerns.

Materials and Methods

Approval for this research was sought from the Institutional Review Board of National University Health System, Singapore.

Participants

From 1 January 2013 to 30 April 2013, 150 patients who were on a follow-up at a specialised diabetic clinic in a tertiary centre in Singapore were interviewed without looking at their clinical charts or history. The first 15 patients in the clinic were approached and consented for interview, for 10 consecutive days. Informed consent was sought. Participants were first given an information sheet about diabetes and current metabolic surgeries (laparoscopic gastric bypass and sleeve gastrectomy), and their associated risks and benefits (Appendix 1). They then independently completed the questionnaire in the presence of an interviewer (Appendix 2). The interviewer is a resident in the department, whose role is to answer any questions the patients might have regarding the questionnaire and to ensure that all sections are answered.

Questionnaire

The questionnaire was in English, but the interviewer was available to explain the content in Mandarin to those

who required that. The first section aimed to ascertain demographic factors of participants, the duration of diabetes and current therapy they were on. Information on the impression of their diabetes control and latest glycated haemoglobin (HbA1c) levels were also included. The next section asked if participants had heard of bariatric surgery before, and whether they would be interested in it. The last section with factors for and against surgery was listed for participants to rank in order of importance, based on a 5-level Likert scale from “Slightly important” to “Extremely important”. All participants, regardless of interest in surgery, were asked to rank factors that they would consider for an elective surgery. They also had to write down the minimum duration that they would like to reap the benefits from any elective surgery. The first draft of the questionnaire was pilot tested with 10 participants from the same clinic.

An accompanying patient information sheet (Appendix 1) describes the scientific background and states that bariatric surgery has shown utility in obese patients with diabetes but does not define the BMI that defines obesity in this context.

Statistical Analysis

The characteristics of the sample were presented by descriptive statistics. The relationship between the individual factors and interest in surgery were first evaluated by univariate logistic regression. With backward elimination process, multivariate logistic regression was conducted to identify the significant factors for predicting interest in surgery. T-test was used to explore the reasons why patients were keen for surgery. All analyses were performed using IBM Statistical Product and Service Solutions (SPSS) version 19.

Results

Characteristics of the participants are shown in Table 1. The mean age of participants was 49.7 (20 to 78) years and mean BMI was 29.6 (18.1 to 51) kg/m². Almost an equal number of males and females were polled.

Twenty-two (14.7%) participants had heard of bariatric surgery prior to the survey, and 92 (61.3%) participants were keen to consider surgery as treatment of diabetes. Table 2 illustrates the important reasons for surgery, which included desire for remission, to prevent complications and to reduce medications; 61.3% (n = 50) of those keen for surgery selected gastric bypass as the preferred option, and the rest, 38.7% (n = 42) selected sleeve gastrectomy. For the 58 patients who were not keen on surgery, the reasons were fear of surgery and satisfaction with current therapy (Table 2).

Table 1. Demographics of Sample

	n	%
Age (years)*	49.7 (20 – 78)	
Gender		
Male	74	49.3
Female	76	50.7
Education		
Below diploma	88	58.7
Diploma and higher	62	41.3
BMI (kg/m ²)*	29.6 (18.1 – 51)	
Duration of diabetes (years)		
<10	113	75.3
≥10	37	24.7
Current treatment		
Lifestyle changes only	5	0.3
OHGAs only	60	40
Insulin analogues only	45	30
Both OHGAs and insulin	40	26.7
Perception of diabetes control		
Satisfactory	120	80
Unsatisfactory	30	20
Latest HbA1c levels		
<7%	33	22
7.1% – 9.9%	68	45.3
≥10%	49	32.7
Microvascular complications		
None	71	47.3
1 organ	39	26
>1 organ	40	26.7
Macrovascular complications		
None	124	82.7
1 organ	21	14
>1 organ	5	3.3
Heard of surgery for diabetes		
Yes	22	14.7
No	128	85.3
Keen to consider surgery		
Yes	92	61.3
No	58	38.7

BMI: Body mass index; HbA1c: Glycated haemoglobin; OHGA: Oral hypoglycaemic agents

*Values are mean (range).

Comparing the 2 groups of patients, those not keen for surgery were more worried about length of recovery ($P = 0.022$) and wanted a longer duration of benefits than those who were keen ($P < 0.001$) (Table 3). Those who were keen

Table 2. Factors Influencing Decision for Surgery

Decision for Surgery	Mean (Likert Scale)
A) Keen for surgery (n = 92)	
Hope to prevent complications	4.5 ± 0.9
Hope for diabetes remission	4.7 ± 0.7
Keen to stop/reduce medications	4.3 ± 1.1
High cost of current therapy	2.3 ± 1.3
Having many complications now	1.8 ± 1.3
Recommendations from doctor	2.5 ± 1.4
B) Not keen for surgery (n = 58)	
Fear of surgery	4.0 ± 1.5
Satisfied with current therapy	3.7 ± 1.6
Cost of surgery	2.1 ± 1.1
Unconvinced of efficacy of surgery	1.7 ± 1.1

Table 3. Factors for Consideration of Surgery (n = 150)

	Mean (Likert Scale)	P Value
Risk of surgery		
Keen for surgery (n = 92)	4.5 ± 0.9	0.855
Not keen for surgery (n = 58)	4.4 ± 1.2	
Length of recovery		
Keen for surgery (n = 92)	2.4 ± 1.3	0.022
Not keen for surgery (n = 58)	3.0 ± 1.6	
Minimum duration of purported benefits of surgery		
Keen for surgery (n = 92)	6.1 (years) ± 2.3	<0.001
Not keen for surgery (n = 58)	8.7 (years) ± 2.2	
Cost of surgery		
Keen for surgery (n = 92)	2.6 ± 1.4	0.292
Not keen for surgery (n = 58)	2.4 ± 1.3	

for surgery wanted a mean of 6.1 years for benefits of surgery to last, whilst those who were not keen wanted 8.7 years.

By univariate analysis, groups that were more likely to be interested in surgery included: male gender, those with education levels (diploma and higher), respondents who feel they have poor glycaemic control, those having HbA1c >10% and those who have heard of metabolic surgery before. Respondents with longer duration of diabetes and suffering from macrovascular complications were less likely to be interested (Table 4).

Table 4. Factors to Predict for Interest in Surgery (Non-Adjusted)

	Odds Ratio	95% CI	P Value
Age	1.0	(0.95, 1.0)	0.03
Gender			
Female compared to male	0.5	(0.3, 1.0)	0.06
Education			
Diploma and higher compared to below diploma	3.0	(1.5, 6.1)	0.003
BMI	1.0	(0.99, 1.1)	0.135
Duration of diabetes	0.4	(0.2, 0.9)	0.029
Current therapy of diabetes			
OHGA only	1.6	(0.4, 1.6)	0.543
Insulin only	0.8	(0.8, 3.0)	0.192
Perception of diabetic control			
Unsatisfactory compared to satisfactory	2.4	(1.0, 6.1)	0.059
Latest HbA1c levels			
<7% (reference)	1.0		0.114
7% – 9.9%	1.6	(0.7, 3.7)	0.263
≥10%	2.7	(1.1, 6.7)	0.038
Presence of macrovascular complications	0.5	(0.2, 1.1)	0.084
Microvascular complications			
None (reference)	1.0		0.41
1 organ	1.0	(0.4, 2.2)	0.943
>1 organ	0.6	(0.3, 1.3)	0.205
Heard of surgery			
Yes compared to no	4.5	(1.5, 13.3)	0.007

BMI: Body mass index; CI: Confidence interval; HbA1c: Glycated haemoglobin; OHGA: Oral hypoglycaemic agents

By multivariate analysis, educational levels (diploma and higher), usage of insulin and shorter duration of diabetes were independent predictors of interest in surgery (Table 5).

Discussion

To our knowledge, this is the first study of its kind undertaken in Singapore to systematically examine the perceptions of diabetic patients towards surgery as an alternative treatment of diabetes. Our study showed that although only a minority of diabetic patients had heard about surgical options for diabetes, over 60% of them were keen in surgery after brief descriptions were given. They hoped for remission of disease, prevention of complications and reduction in medications. Independent predictors of interest in surgery include higher education levels, usage of insulin and shorter duration of diabetes.

Table 5. Independent Predictors for Interest in Surgery

	Odds Ratio	95% CI	P Value
Education	2.3	(1.2, 4.4)	0.012
Diploma and higher compared to below diploma			
Use of insulin	2.1	(1.1, 4.1)	0.03
Duration of diabetes	0.4	(0.2, 1.0)	0.043

CI: confidence interval

There is increasing interest in surgical treatment for type 2 diabetes due to the success of bariatric surgery. Bariatric procedures are becoming more commonplace; an estimated 350,000 bariatric procedures were performed globally in 2008 compared to fewer than 5000 procedures in the 1980s.⁷ Now, 90% of procedures are performed laparoscopically, with Roux-en-Y gastric bypass, sleeve gastrectomy and adjustable gastric banding, amongst the most performed. Mortality for such surgery is also acceptable at 0.3%.⁸ Bariatric surgery not only treats obesity, but also reduces cardiovascular risk factors and deaths,⁹ by treating all components of metabolic syndrome including type 2 diabetes mellitus. Several randomised controlled trials have also shown positive results of bariatric surgery achieving remission in up to 75% to 95% of patients or a significant improvement in glycaemic control, hypertension and hyperlipidaemia over medical therapy among obese patients.⁴⁻⁶ In a recently published paper from the Swedish Obese Subjects study, both short- and long-term results have been extremely encouraging and exciting. Surgery achieved not only remission rates of 72.3% at 2 years follow-up (compared to 16.4 % in the control group), the remission rates at 15 years was 30.4% versus 6.5% in the control group.¹⁰ Similarly, microvascular and macrovascular complications were much reduced in patients in the surgery group.

In this survey, patients who attained diploma or tertiary educational levels were more interested in surgery. It is likely that those with higher educational levels have a better understanding of metabolic surgery and awareness of the complications from diabetes mellitus, thus making them more inclined to be interested in considering surgery. Those who are currently on insulin therapy were also more interested to undergo metabolic surgery for remission of the disease and to stop the use of insulin.¹¹ The effectiveness of diabetic therapy is dependent on compliance of usage, and studies have shown that many patients are poor compliers with treatment, including oral medications and insulin. This is especially so for insulin injections, where there are many steps to learn, starting from storage to injection of insulin, and learning about coping with hypoglycaemia.¹²

Many have developed phobia for insulin injections, with resultant reduced compliance rates.¹³ These reasons may explain why those on insulin therapy are keen for metabolic surgery. Those with shorter duration of diabetes might be more interested in surgery as they are still relatively healthy. Diabetes is a chronic medical condition and the longer the duration of diabetes, the more likely patients have complications. As such, patients are keen to find a way to retard progression of diabetes, prevent complications and even cause remission. Recently, a study looking at patients who underwent laparoscopic gastric bypass found that those with shorter duration of diabetes (less than 5 years) and the mildest form on diet control had the highest rates of remission, suggesting that surgical intervention early on increases likelihood of remission of diabetes.¹⁴ Other authors have also shown better results and benefits of surgical intervention in patients with early-stage diabetes, suggesting earlier surgical intervention in overweight patients (BMI of <30) with early-stage diabetes may be advocated.¹⁵

Amongst all respondents, risk of surgery was a major concern. Even with a laparoscopic approach, surgery is still an invasive treatment. Bariatric surgeons need to maintain the safety of these procedures and strategies such as accreditation, multidisciplinary approach and clinical pathways which are essential for quality assurance of such surgery.^{16,17} It has been reported that perceived risks of metabolic surgery are overestimated, not only amongst the general public, but also healthcare professionals, including family physicians.¹⁸ Currently, the overall mortality risk of metabolic surgery is estimated to be below 0.5%.¹⁹ Introduction of the idea of metabolic surgery alongside accurate estimates of its risks and benefits can be put in place.

Many patients yearn for remission of diabetes, to reduce medications, attain better control and reduce complications and are open to the idea of surgery as another arm of therapy. Other physicians could be informed about the concept of metabolic surgery. As it is now with obesity surgery, referrals are low although primary care physicians and subspecialists like cardiologists and endocrinologists see a high proportion of obese patients who could benefit from surgery. Despite having a perception of high surgical effectiveness, the referrals for surgery are relatively low because many are still unfamiliar with morbid obesity management and surgical referral guidelines.²⁰

There are limitations in our study. The study has only sampled a select population of diabetic patients in a specialised clinic in a tertiary hospital, in the public healthcare system in Singapore. These patients who require specialist care for diabetes may have more labile glycaemic controls than the majority who are seen in primary care settings and are able to attain stable glycaemic control. To improve generalisability, the same study can

be done on a wider population in the primary care setting. Whilst a lot of encouraging results showing the benefits of surgery compared to medical therapy have been shown in randomised controlled trials,^{4,5} long-term results from randomised controlled trials are still lacking. Respondents have also expressed a wish for the effects of surgery to be long lasting. High quality comparative studies with long-term results are highly desirable to establish standards.

Conclusion

Our study shows that the majority of diabetic patients are keen to consider surgery. They hope to achieve remission of diabetes, reduce the usage of medications and to prevent complications. However, the main concern is risk of surgery. Adequate training and a multidisciplinary approach will help to improve the quality of surgical treatment. Increasing the awareness of the public, primary care physicians and other diabetic specialists regarding metabolic surgery will give realistic expectations of the benefits and risks of surgery. It is exciting to know that in the future, surgery could be part of the armamentarium for diabetes therapy that can be readily acceptable by patients, driving the advancement of treatment for diabetes.

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Appendix 1

Information Sheet for Patient's Attitudes and Perception towards Diabetic Surgery

Q1) What is Diabetes?

Diabetes is long-term condition with high blood sugar levels because the body cannot use the sugar properly. It happens when the pancreas is not producing enough hormones (insulin) that utilizes the blood sugar, or the insulin produced does not work properly.

Q2) What can diabetes do to your body?

- a. Short term – Sugar levels that rise very high can cause dangerous chemical changes in the bloodstream, or even coma.
- b. Long-term – affect multiple organs causing blindness, heart attacks, strokes, kidney failure requiring dialysis, numbness in hands and feet, non-healing leg ulcers and even amputations.

Q3) How do we treat diabetes?

- a. Lifestyle changes such as controlling diet and regular exercise,
- b. Oral medications
- c. Insulin injections.

The aim is to bring the sugar level down to an optimal level to prevent complications.

Q4) What is new?

In recent years, evidence has suggested that surgeries (2 are listed and explained below) have worked well in obese patients with diabetes with overall 70% diabetes remissionⁱ.

Q5) Are these operations dangerous?

The overall risk of such operations varies from 3-16%, with significant complications like bleeding, leaks and long-term nutritional issues.

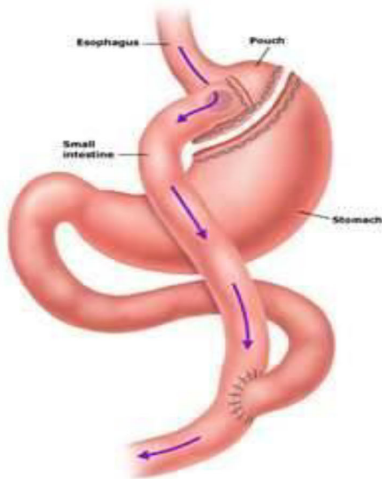
Q6) Why is surgery better than medical therapy?

- Better and sustained weight loss
- Reduction of sugar levels to within normal limits, increasing likelihood of being able to stop or reduce diabetes medications
- Better blood pressure control and reduced lipid levels.

Q7) What surgeries are available?

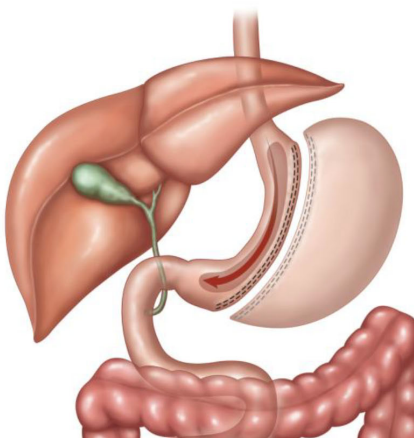
A) Gastric bypass

1. Creating a small pouch from the upper stomach, bypassing the remaining stomach, to restrict the volume of food that can be eaten.
2. Joining the stomach pouch to the lower part of the small intestine to reduce food absorption.



B) Sleeve gastrectomy:

The stomach is restricted to 25% of its size by cutting and simultaneously stapling using a surgical device to form a tube-like structure, with no bypassing of intestines. The part of the stomach producing “hunger” hormones is cut off, so the patient will feel full easily.



Advantages: Both procedures are one-off; producing rapid weight loss, reduce hunger pangs, with up to 80% of people gaining improvement or resolution of hypertension and diabetes.ⁱⁱ

Disadvantages:

	Gastric Bypass	Sleeve Gastrectomy
Procedure	Technically challenging	Technically simple
Operative time	2-4h	1-1.5h
Complications	Early: Bleeding from wounds, leaks along staple line Late: Internal hernias, stomach ulcers, narrowing of stomach outlet	Early: bleeding from wounds, leaks along staple line Late: risk of reflux disease
Others	Need for life-long vitamins	

*Estimated cost for the surgery (excluding hospital stay and ward charges) for a typical B2 class patient: S\$1250, claimable from Medisave (subject to means testing).

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Appendix 2

Questionnaire of Patient's Perceptions and Attitudes towards Diabetic Surgery

- 1) Age: _____
- 2) Gender:
 Female ☐
 Male ☐
- 3) Highest education qualifications:
 Primary School ☐
 GCSE 'O' Levels ☐
 GCSE 'A' Levels ☐
 Diploma ☐
 University ☐
 Postgraduate or higher ☐
- 4) Height= _____ Weight= _____ BMI: _____
- 5) Years diagnosed with diabetes: _____
- 6) Current medical therapy of diabetes:
 Lifestyle changes (diet control and exercise) Yes/No
 Oral medications Yes/No
 Insulin Yes/No
- 7) A) Your impression of your diabetic control over the last one year
 (or from diagnosis till now):
 Good ☐
 Acceptable ☐
 Poor ☐
 B) Latest HbA1c: _____
- 8) What medical problems do you have from diabetes?
 a) Eye disease (requiring laser treatment) ☐
 b) Kidney problems ☐
 c) Numbness in hands and feet ☐
 d) Vessel disease in legs ☐
 e) Heart disease ☐
 f) Stroke ☐
- 9) Have you previously heard of surgery to cure/reduce diabetes?
 Yes ☐
 No ☐
- 10) Now that you know of the surgeries available, would you be keen to undergo surgery
 to cure diabetes/improve control and stop/reduce medications
 Yes, please go onto Q11)
 No, please go onto Q12)

11) If you answered yes, how important are these factors in helping you decide to undergo surgery ?

	Slightly important	Moderately important	Important	Very important	Extremely important
a) You are unable to control your diabetes well with medications.	1	2	3	4	5
b) You have many complications now (eye, vessel, kidney disease, stroke, heart attack)	1	2	3	4	5
c) You hope to prevent complications from diabetes.	1	2	3	4	5
d) You hope for a cure for diabetes.	1	2	3	4	5
e) You are keen to stop/ reduce medications.	1	2	3	4	5
f) High costs of medications	1	2	3	4	5
g) Recommendations from doctor taking care of your diabetes	1	2	3	4	5
h) Others: (Please specify)					

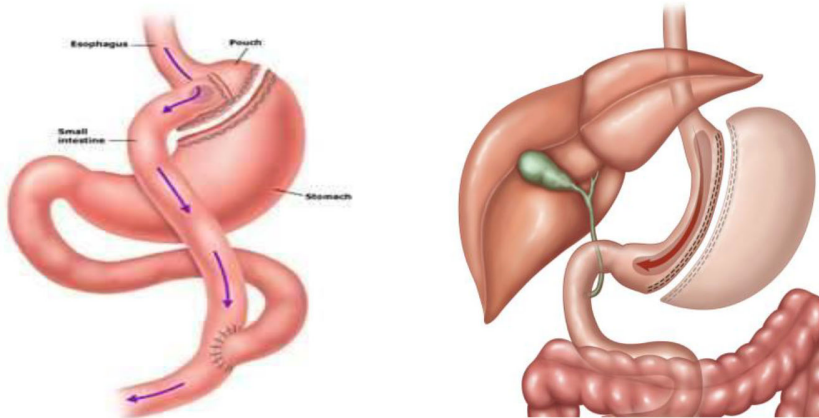
12) If you answered no, how important are these factors in helping you decide not to go for surgery ?

	Slightly important	Moderately important	Important	Very important	Extremely important
a) You are satisfied with current medical treatment of diabetes.	1	2	3	4	5
b) You are afraid of complications/side effects from surgery.	1	2	3	4	5
c) Cost of surgery	1	2	3	4	5
d) You are unconvinced about the effectiveness of surgery to treat diabetes.	1	2	3	4	5
e) Others: (Please specify)					

13) If you could choose the surgery, which one would you prefer?

Gastric bypass ☐

Sleeve gastrectomy ☐



14) If your doctor has recommended you for an elective surgery, how important are these factors in helping you decide whether or not to proceed?

	Slightly important	Moderately important	Important	Very important	Extremely important
a) Whether the surgery has a high risk of complications	1	2	3	4	5
b) The estimated length of recovery	1	2	3	4	5
c) Cost of surgery and hospitalization	1	2	3	4	5
d) Others: (Please specify)					

15) If your doctor has recommended you for this diabetic surgery, what is the minimum duration you would like for the reported benefits?

_____ (months/years)