The Utilization of Bariatric Surgery in Patients with and without Diabetes: Results from the Second Kuwait National Bariatric Surgery Database Report

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Abstract

Background

During the year 2021, we were able to create the second Kuwait National Bariatric Surgery Database Report, which we used to extract data on the status and outcomes of patients presenting with type 2 diabetes mellitus (T2DM) undergoing bariatric-metabolic surgery in Kuwait.

Methods

Data was collected from seven public hospitals in Kuwait, and submitted to be merged in the National Registry. Cross-sectional analysis was then conducted.

Results

All seven hospitals contributed to the submission of data. The rate of T2DM was 12.5% (607 patients), of which 69% were female. The mean age of patients with T2DM was higher than that of patients without (42 years vs 31.9 years). The overall BMI was slightly higher for patients with T2DM (mean 43.4kg/m2 vs 43.1kg/m2). The majority of patients with T2DM were in the BMI range 40.0-49.9kg/m2. Laparoscopic sleeve gastrectomy accounted for 79.0% of all procedures performed in non-diabetic patients and 79.7% of those performed in diabetic patients. When looking at surgical procedure distribution when classified according to starting BMI group in diabetic patients, it was interesting to see that, in Group 1 (BMI <35), sleeve gastrectomy only accounted for 47.2%, while in the larger BMI groups (>35), sleeve gastrectomy accounted for 82.6-83.2% of all procedures performed. When comparing post-op compilations between diabetic vs non-diabetic patients, the percentage of overall complications encountered did not show a significant difference (1.81% vs 2.10% ; p=0.602). When looking at cardiovascular complications, patients with diabetes tended to present with higher post-op cardiac complications compared to non-diabetics (p=0.000).

Conclusion

Laparoscopic sleeve gastrectomy was the most performed procedure in both diabetics and non diabetics alike. Patients with diabetes tended to present for surgery at an older age than those without. It was interesting, albeit possibly expected, to note that patients with diabetes presented with a higher percentage of a multitude of complications post-operatively, pointing towards the importance of post-operative care in diabetic patients that present for bariatric surgery.

Background

The twin epidemic of obesity and diabetes has become a major global crisis (1). With cardiovascular disease still remaining the leading cause of death around the world (2), and diabetes being a major contributor to cardiovascular disease, the influence of obesity to diabetes has gained significant weight. Diabetes mellitus (DM) is a chronic condition caused by the absence of insulin secretion, either due to the

inability of the pancreas cells to produce insulin, or due to defects in insulin uptake in peripheral tissue. The disease consequently has the ability to alter carbohydrate, protein and fat metabolism (3), contributing to the vicious cycle that links diabetes to obesity.

It has been proven that women with a body mass index (BMI) exceeding 30 kg/m^2 have a 28x greater risk of developing diabetes, with the risk reaching 93 times greater in those with a BMI of 35 kg/m^2, compared to those with a normal weight (4). Bariatric and metabolic surgery has consistently proven it's benefits for patients presenting with type 2 diabetes mellitus (T2DM) and severe obesity, compared to medical therapy alone, via randomized controlled trials (5–8), international guidelines (9–11), as well as systemic reviews and meta-analysis (12, 13). Metabolic surgery is defined as 'the operative manipulation of a normal organ or organ system to achieve a biological result for a potential health gain', and therefore encompasses interventions that cause a positive impact on the management of T2DM (14).

Currently, few comparative data exist that exhibit worldwide patient results that are receiving bariatric-metabolic surgery (15, 16). Therefore, the ability to map these current international practices could provide a baseline for the development of strategies to increase the availability and uptake of bariatric surgery. The International Federation of Surgery for Obesity (IFSO) has embarked on undertaking several surveys and reports, mostly relying on estimates, over the last 20 years (17–21). These reports were able to describe only operation type and procedure numbers, without detailed correlation on demography or obesity-related disease. A description of which patients with T2DM are receiving bariatric-metabolic surgery and whether having T2DM influences the procedure undertaken is currently lacking, especially in the Arab world.

During the year 2021, we were able to create the second Kuwait National Bariatric Surgery Database Report to report on bariatric surgeries performed in Government hospitals in Kuwait, baseline obesity-related diseases, operation types, operative outcomes and status after bariatric surgery. From this report, we aim to describe the differences in demographic data and type of bariatric and metabolic surgery performed in patients with and without T2DM.

Methods

National database data collection

A cross-sectional study was performed of the baseline data for patients with or without T2DM having primary bariatric surgery from the Kuwait National Registry 2021 data cut. For the report, permission was obtained from the ministry of health to collect data from the seven public hospitals in Kuwait on bariatric results and outcomes. Invitations were sent to bariatric surgeons working in these hospitals, of which 66 contributed to the data collection. This data was then submitted to a merged National Registry. A Direct Data Entry system, and an Upload-My-Data web portal were used to upload, merge, and analyze the data. Data was collected on 4,862 cases, of which 3,963 were primary procedures (**Table 1**). Data collection was demonstrably of a very high quality; over 87% of entries for patients having their primary operation

had either no missing data or one missing data-item amongst a list of 10 obesity-related diseases assessed pre-operatively. All patients provided written consent prior to undergoing their procedure.

Definition of Diabetes

We aimed to set a standard baseline for defining obesity related diseases as to be able to compare between individual patients. Positive responses (data denoting patients who have the condition) for Type 2 diabetes were:

1. Impaired glycaemia or impaired glucose tolerance.
2. Insulin treatment.
3. OAD & insulin treatment.
4. Oral hypoglycaemics.

Procedures

The procedures in the data set were as described previously and comprised gastric balloon/gastric band/gastric bypass/sleeve gastrectomy/duodenal switch/biliopancreatic diversion/other, and type of gastric bypass: Roux-en-Y (RYGB) or one anastomosis gastric bypass (OAGB).

Outcomes

Other variables collected were age or date of birth, sex, height, weight, T2DM defined as mentioned earlier. Only valid records, defined as those including height, weight and calculated BMI, were included for analysis. Data were grouped according to T2DM on medication, age, sex and BMI. The BMI groups were stratified according to obesity severity < 35.0 (class I), 35.0–39.9 (class II), 40.0–49.9 (class III), and > 49.9 kg/m2. Types of operation were assessed to investigate practice undertaken for T2DM according to BMI groupings.

Data analysis

Descriptive statistics were used for the analysis of the data. Furthermore, as data from different hospitals may only provide variable representation of the population, no comparative analysis was performed between hospitals.

On the whole, unless otherwise stated, the tables and charts in this report record the number of procedures. The numbers in each table are bolded so that entries with complete data for all of the components under consideration are shown in regular black text. If one or more of the database questions under analysis is blank, the data are reported as unspecified in bold text. The totals for both rows and columns are highlighted as italic text. Some tables record percentage values; in such cases this is made clear by the use of an appropriate title within the table and a % symbol after the numeric value.

Rows and columns within tables have been ordered so that they are either in ascending order or with negative response options first (No; None) followed by positive response options (Yes; One, Two, etc.).

Graphs

All entries with missing data are excluded from the analysis used to generate the graph. In the charts prepared for this report, most of the bars plotted around rates (percentage values) represent 95% confidence intervals. The width of the confidence interval provides some idea of how certain we can be about the calculated rate of an event or occurrence. If the intervals around two rates do not overlap, then we can say, with the specified level of confidence, that these rates are different; however, if the bars do overlap, we cannot make such an assertion.

Bars around averaged values (such as patients' age, post-operative length-of-stay, etc.) are classical standard error bars or 95% confidence intervals; they give some idea of the spread of the data around the calculated average. In some analyses that employ these error bars there may be insufficient data to legitimately calculate the standard error around the average for each sub-group under analysis; rather than entirely exclude these low-volume sub- groups from the chart their arithmetic average would be plotted without error bars. Such averages without error bars are valid in the sense that they truly represent the data submitted; however, they should not to be taken as definitive and therefore it is recommended that such values are viewed with extra caution.

Results

Figure 1 demonstrates the completeness of the obesity-related disease data for entries where only one data-item is missing, and for all entries in the central Kuwait National Bariatric Surgery Registry. Where a single data-item is missing, it was largely liver disease, sleep apnea, dyslipidemia and back / leg pain questions that have not been completed. Across the board, the biggest issues seem to be with the same four questions in the database.

Demographic Characteristics of Those with and without T2DM

The number on medication for T2DM was 607, with females accounting for 69.1% of the population of patients defined as having type 2 diabetes mellitus. Males with diabetes accounted for 4% of the overall population, while females accounted for 8.9% ($p = 0.000$) (Table 2). The mean age of patients with T2DM was higher than that of patients without (overall mean age 42 (11.2) years vs 31.9 (10.5) years). The mean ages of men and women with T2DM were 41.8 (10.8) years and 42.1 (11.4) years.

The overall BMI was slightly higher for patients with T2DM (mean 43.4 (8.3) kg/m^2 vs 43.1 (8.3) kg/m^2). The majority of patients with T2DM were in the BMI range 40.0-49.9 kg/m^2 (**Table 3**). The proportion of patients with T2DM in each obesity class can be seen in Fig. 2. The proportion of female patients with diabetes exceeded that of males in every BMI group.

Procedure Performed Based on T2DM Status

Alone, laparoscopic sleeve gastrectomy (SG) accounted for 79.0% of all procedures performed in non-diabetic patients and 79.7% of those performed in diabetic patients. Mini-gastric bypass (OAGB) accounted for 10.4% of procedures performed in diabetics, followed by Roux-en-Y Gastric Bypass (RYGB), which accounted for 6.4% (**Table 4**, Fig. 3). When looking at surgical procedure distribution when classified according to starting BMI group in diabetic patients, it was interesting to see that, in Group 1 (BMI < 35), sleeve gastrectomy only accounted for 47.2%, while in the larger BMI groups (> 35), sleeve gastrectomy accounted for 82.6–83.2% of all procedures performed, pointing to a favor for SG's in the larger BMI population of diabetics (**Table 5**).

Post-Op Complications

When comparing post-op compilations between diabetic vs non-diabetic patients, the percentage of overall complications encountered in patients with T2DM vs non-diabetic did not show a significant difference (1.81% vs 2.10% ; p = 0.602), while the percentage of other complications can be seen presented in **Table 6.** It is interesting to note that bleeding (0.49 vs 0.46%), port site infection (0.33 vs 0.29%), pneumonia/atelectasis/RTI (0.82 vs 0.24%), and unanticipated transfer to the ICU (1.81 vs 0.41%) were the only complications that were shown to be higher in patients with T2DM as compared to non-diabetics. When looking at cardiovascular complications, patients with diabetes tended to present with higher post-op cardiac complications (dysrhythmia, pulmonary embolism, and other) compared to non-diabetics (p = 0.000) (**Table 7**).

Discussion

In the face of this accelerated standard of living and modernization through communication, an emergent market may directly even further impact these present dire conditions (22). In the last decade, home delivery of foods has been revolutionized in Kuwait 8. Through the development of smartphone applications, ordering a high caloric meal with none to minimal movement has become possible through the click of a button (23). This, in turn, is a recipe for disaster in terms of the growing rates of obesity, and subsequently, diabetes. In terms of the increasing population amongst the youth and adolescents that presently constitute 80% of the non-diabetic obese population, the risk factors based on genetics put these demographics at risk for developing diabetes (24). While obesity itself is considered a debilitating condition, major studies have clearly correlated obesity with the development of chronic metabolic disorders such as diabetes, hypertension, and hyperlipidemia and reduced quality of life, shorter life expectancy, and an overall increase in the cost of care (22).

Chronic metabolic disorders are complex diseases that need ongoing care and management (25). Of the many lifestyle factors such as lack of exercise, a poor diet, and smoking, being overweight has been identified as the most critical predictor of obesity-related diseases (1).

In the Arabian Gulf region, due to the high prevalence of obesity and the lack of national screening programs and routine medical checkups, there is a higher potential for the delay in diagnosis and commencement of treatment that increases the risks of complications, metabolic comorbidities, and

mortalities (26). Some of the complications of uncontrolled diabetes include diabetic retinopathy, diabetic neuropathy, diabetic nephropathy, macrovascular events like cardiovascular diseases and diabetic foot ulcers, and amputations (27). According to the International Diabetes Federation's publication titled Diabetes Atlas, Kuwait is ranked amongst the top 10 countries with a national prevalence of 22% in adults aged 20–79 years (28). While diabetes can be controlled and managed with oral hypoglycemic agents, insulin, and lifestyle modification such as diet and exercise, recent updates from the Standards of Medical Care published by the American Diabetes Association also recommend metabolic surgery to manage diabetes in appropriate obese patients (27, 29).

Metabolic surgeries have opened a new door for the management of obese patients with diabetes and became accepted as a safe and effective method for treating and controlling diabetes in the obese population (30–34). The American Diabetes Association, 2018 Standards of Care for the Management of Obesity and diabetes indicates that metabolic surgery is an effective treatment to improve weight loss measures and is beneficial in treating diabetes (27, 29). In fact, no other treatment has produced such durable and ample control of diabetes (9, 31, 32). Accordingly, in a study conducted by the International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO) of 42 countries that indicated metabolic trends worldwide, Kuwait ranks number one for the frequency of metabolic procedures performed as a percentage of the national population (20, 33).

In terms of surgery, there are many types of metabolic surgeries performed to manage obesity, e.g., Roux-en-Y Gastric Bypass, Adjustable Gastric Band, and Laparoscopic Sleeve Gastrectomy (35). Bariatric surgery is instrumental in treating metabolic syndrome with significant remission or improvement in most cases (31, 32, 34, 35). Metabolic outcomes have improved over time with these surgical procedures. While all these procedures have been studied in relation to metabolic syndrome and obesity, LSG has been gaining popularity and is the highest performed surgery in the Arabian Gulf region and especially Kuwait for the management of obesity (32, 34, 36–40).

In terms of funding in Kuwait, bariatric / metabolic surgery is covered by the government sector (Ministry of Health) with the exception of medical equipment specific to the procedure like ports, stapler, energy device etc. Ministry of Health covers pre-operative, intra-operative, and post-operative care, including clinical investigations, doctor visits, operating room fees, multidisciplinary bariatric team professional visits, and hospital stays. Additionally, the Ministry of Health covers the management of complications, revisional procedures, and international visitors workshops for challenging cases. Ministry of Health also covers international care for eligible patients abroad. Bariatric procedures performed in private-sector hospitals are not covered by insurance. However, the government covers complications that originate from private sector bariatric procedures.

With the increasing frequency of bariatric procedures performed in Kuwait and Kuwait ranked as one of the highest countries for the frequency of bariatric surgeries performed, collecting this growing body of data into national registries is crucial. One of the most essential facets of collecting this data is the need

for standardization in reporting the different comorbidities. In this report, there is a need to include more complete details on patients consistently and accurately (41).

It remains a goal for the future to incorporate data from all key stakeholders in bariatric surgery, especially surgeons, and physicians to embrace this data collection and reporting process at individual clinics and hospitals. It will require widespread involvement and ongoing commitment from all those involved in the care of the bariatric patient to ensure high-quality data can be collected, properly analyzed and shared, so that we will be better able to understand shifts in disease patterns, practice, and outcomes on a national scale. Therefore, the data is presented using a small and far from comprehensive dataset, as simple tables and graphs usually 2 variables, one for each axis, plus a dedicated commentary for each.

Conclusion

Laparoscopic sleeve gastrectomy was shown to be the most performed procedure in both diabetics and non diabetics alike, having similar numbers in the 2 populations. Patients with diabetes tended to present for surgery at an older age, with higher BMI's than those without. The number of female patients exceeded male patients for all BMI groups. It was interesting, albeit possibly expected, to note that patients with diabetes presented with a higher percentage of a multitude of complications post-operatively, included cardiac, pointing towards the importance of post-operative care in diabetic patients that present for bariatric surgery.

Abbreviations

BMI
Body mass index
BPD/DS
biliopancreatic bypass +/− duodenal switch
EWL
percent Excess Weight Loss
LAGB
laparoscopic adjustable gastric banding
RYGB
Roux-en-Y gastric bypass
IFSO
International Federation for the Surgery of Obesity and Metabolic Surgery of Obesity and Metabolic Disorders
H2RA
H2 receptor antagonists
PPI
Proton pump inhibitors

DVT
Deep vein thrombosis
PE
Pulmonary embolus
OAGB
one anastomosis gastric bypass
OSMRS
Obesity Surgery Mortality Risk Score
GERD
Gastro-esophageal reflux disorder
OAGB/MGB
Single anastomosis gastric bypass

Declarations

Ethics approval and consent to participate

All patients provided written consent prior to undergoing the procedures. Informed consent was obtained from parents of patients aged 16 years or younger. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Ethics Committee approval was obtained from the Kuwait Ministry of Health prior to commencement of the study.

Consent to publish

Not Applicable.

Competing interests

The authors declare that they have no conflict of interest.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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Authors Contributions

SA conceptualized the idea and brought together all the authors, as well as collected the date from the hospitals; EA analyzed the data and wrote the manuscript. All authors have read and approved the manuscript.

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Tables

Table 1

Hospital		Count
	Al Adan Hospital	455
	Al Amiri Hospital	1,386
	Al Jahra Hospital	726
	Al Sabah Hospital	723
	Farwaniya Hospital	555
	Jaber Hospital	169
	Mubarak Al-Kabeer Hospital	848
	All	**4,862**

Table 2: Proportion of patients with DM according to Gender

			T2DM		Total
			0	1	
Gender		Count	5	0	5
		% of Total	0.1%	0.0%	0.1%
	Female	Count	3095	419	3514
		% of Total	65.7%	8.9%	74.6%
	Male	Count	1004	187	1191
		% of Total	21.3%	4.0%	25.3%
	Unknown	Count	0	1	1
		% of Total	0.0%	0.0%	0.0%
Total		Count	4104	607	4711
		% of Total	87.1%	12.9%	100.0%

P=0.000

Table 3

			DM		Total
			0	1	
BMI group (Kg/m^2)	<35	Count	349	53	402
		% of Total	7.7%	1.2%	8.8%
	35-39.9	Count	1062	173	1235
		% of Total	23.3%	3.8%	27.1%
	40-49.9	Count	2008	270	2278
		% of Total	44.0%	5.9%	49.9%
	>49.9	Count	541	105	646
		% of Total	11.9%	2.3%	14.2%
Total		Count	3960	601	4561
		% of Total	86.8%	13.2%	100.0%

P=0.022

Table 4

			DM		Total
			0	1	
Operation	Bilio-pancreatic diversion	Count	0	1	1
		% of Total	0.0%	0.0%	0.0%
	Duodenal switch	Count	13	1	14
		% of Total	0.3%	0.0%	0.3%
	Gastric balloon	Count	279	8	287
		% of Total	5.9%	0.2%	6.1%
	Gastric band	Count	125	8	133
		% of Total	2.7%	0.2%	2.8%
	Mini-gastric bypass	Count	245	63	308
		% of Total	5.2%	1.3%	6.5%
	Other	Count	18	3	21
		% of Total	0.4%	0.1%	0.4%
	Roux en Y gastric bypass	Count	177	39	216
		% of Total	3.8%	0.8%	4.6%
	Sleeve gastrectomy	Count	3247	484	3731
		% of Total	68.9%	10.3%	79.2%
Total		Count	4104	607	4711
		% of Total	87.1%	12.9%	100.0%

P=0.000

Table 5

	BMI Group 1 (<35)	BMI Group 2 (35-39.9)	BMI Group 3 (40-49.9)	BMI Group 4 (>50)
BPD	0.0%	0.6%	0.0%	0.0%
Duodenal Switch	0.0%	0.0%	0.0%	0.9%
Gastric balloon	3.8%	1.2%	0.4%	2.7%
Gastric band	11.3%	0.6%	0.4%	0.0%
Mini-Gastric bypass	13.2%	8.1%	11.9%	9.0%
RYGB	22.6%	6.4%	4.1%	4.5%
Sleeve Gastrectomy	47.2%	83.2%	82.6%	82.9%
Other	1.9%	0.0%	0.2%	0.0%

Table 6

Complication	Number (n)		Percentage (%)	
	Non-diabetic	**T2DM**	**Non-diabetic**	**T2DM**
Acute cholecystitis/CBD stones	3	0	0.07%	0%
Bleeding	19	3	0.46%	0.49%
Leak	7	0	0.17%	0%
Port site infection	12	2	0.29%	0.33%
Pneumonia/atelectasis/RTI	10	5	0.24%	0.82%
Vomiting/poor intake	108	12	2.63%	1.98%
Wound Infection	18	0	0.44%	0%
Unanticipated transfer to ICU	17	11	0.41%	1.81%

Table 7

Complication	Number (n)		Percentage (%)	
	Non-diabetic	**T2DM**	**Non-diabetic**	**T2DM**
DVT	1	0	0.02%	0%
Dysrhythmia	44	18	1.07%	2.97%
PE	6	3	0.15%	0.49%
Other	68	17	1.66%	2.80%

Figures

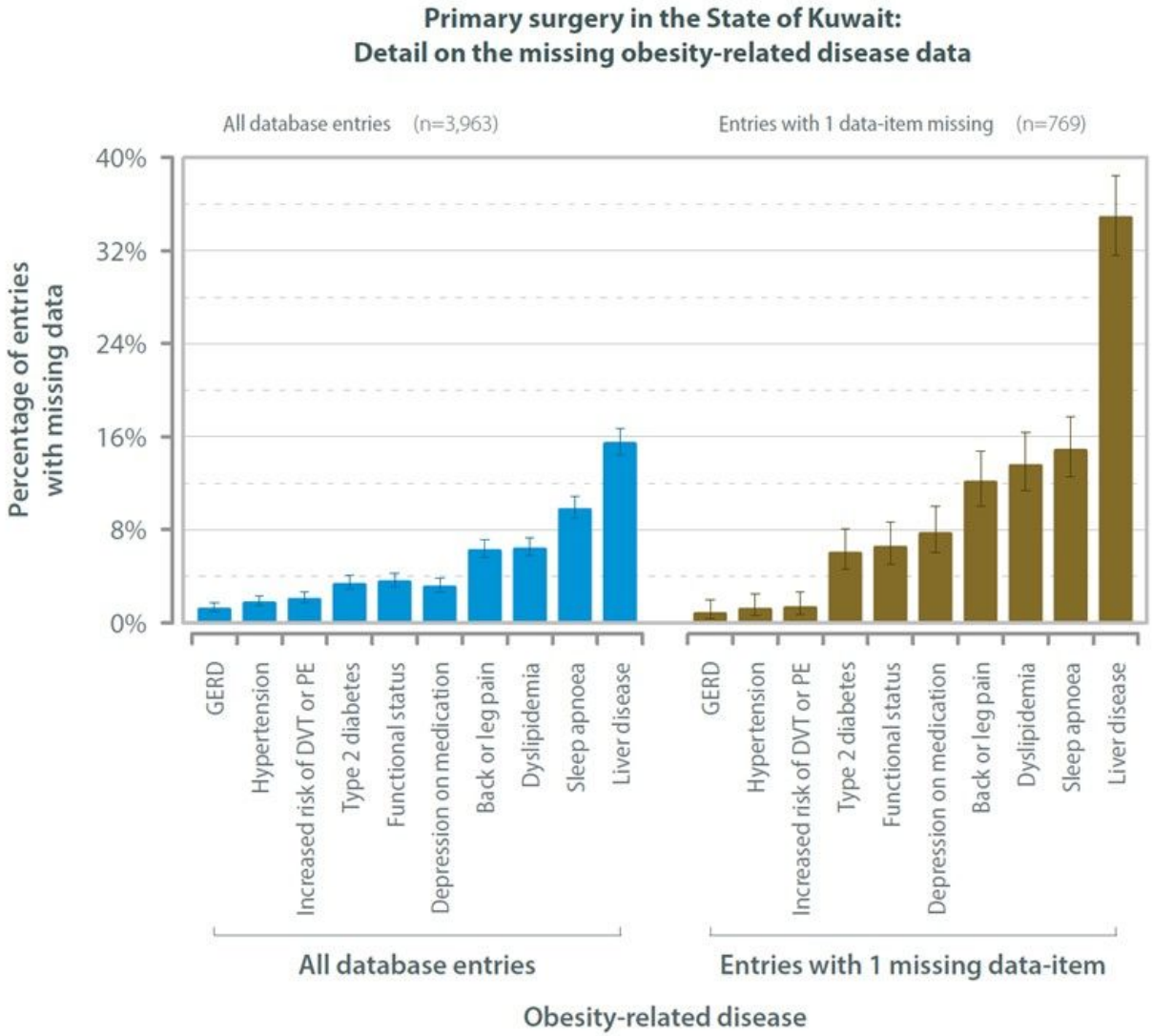

Figure 1

Completeness of the obesity-related disease data for entries where only one data-item is missing, and for all entries in the central Kuwait National Bariatric Surgery Registry

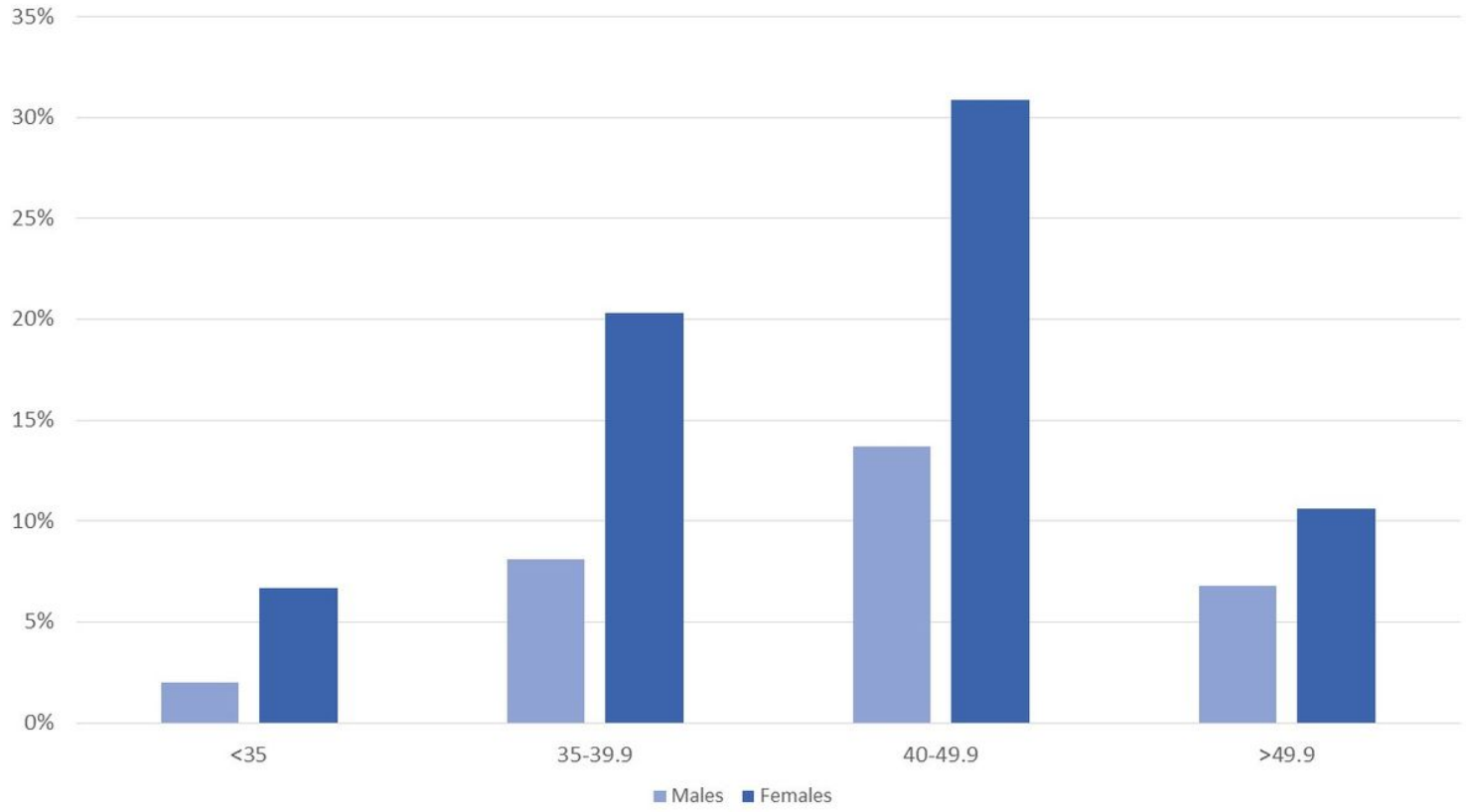

Figure 2

Diabetes Rates for Males and Females in General Population

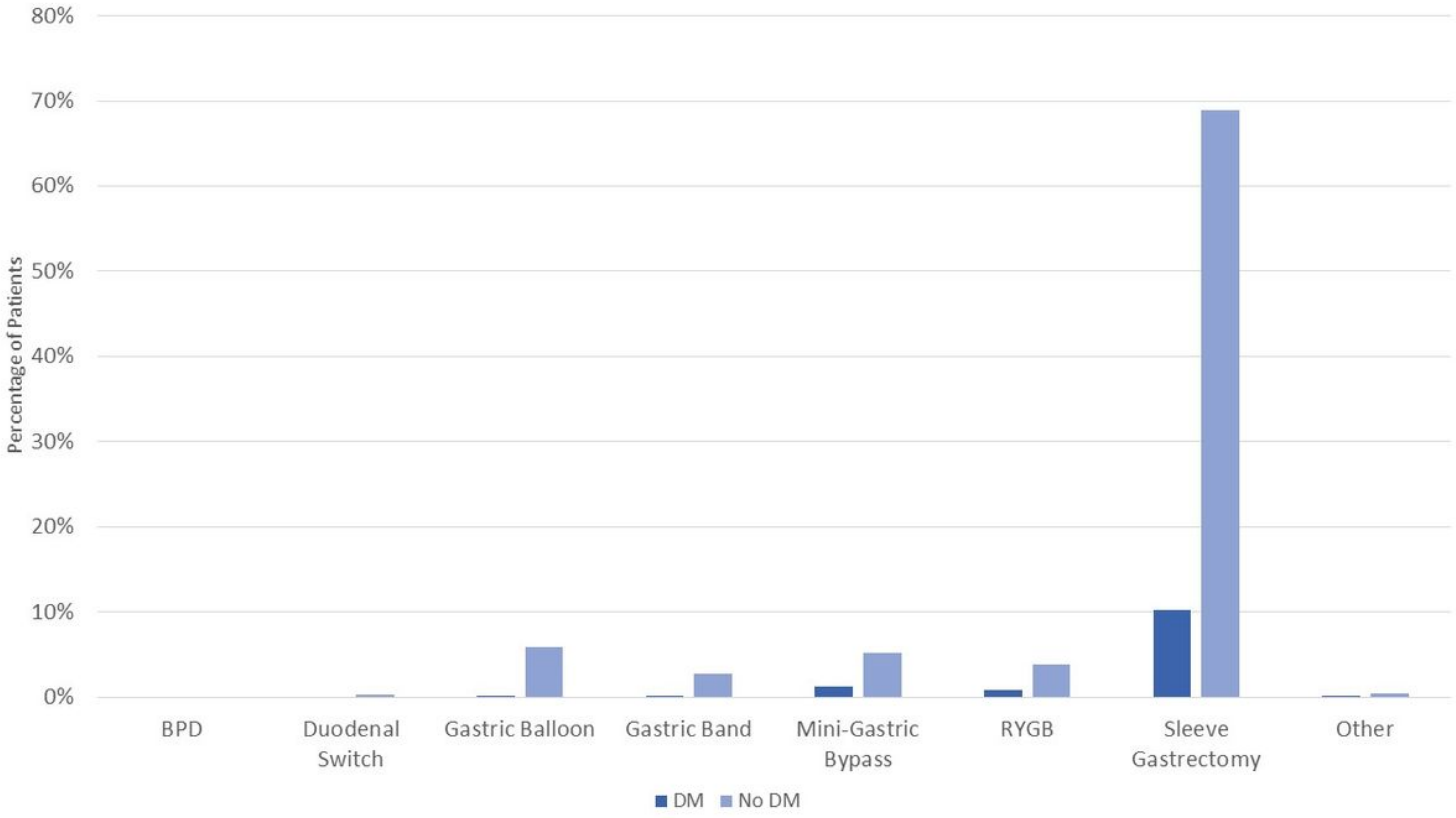

Figure 3

Procedures Performed Based on T2DM Status