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Original Article

Internal Medicine Section

Prevalence of Obesity, Dyslipidemia and Diabetes Mellitus in Patients with Gastrojejunostomy

K SUNIL KUMAR[1], ABHISHEK SASIDHARAN[2]

ABSTRACT

Introduction: Billroth Gastrojejunostomy (GJ) is less invasive surgery as compared to Roux-en-Y Gastric Bypass (RYGB), which is performed for obesity and weight loss. There is sparse data on long term metabolic effects of GJ, which was performed frequently in the past.

Aim: To determine the prevalence of obesity, dyslipidemia and Diabetes Mellitus (DM) in patients with GJ.

Materials and Methods: This was a cross-sectional study conducted in the Department of Gastroenterology, Government Medical College, Calicut, Kerala, India, over a period of six years. All patients with history of GJ, done in past 15 years were included in the study. Presence of obesity, DM and dyslipidemia were noted among patients and was compared with their first degree relatives. Patients with family history of diabetes and without first degree relative were excluded from the study. Statistical analysis was performed using Chi-square test for qualitative variables and independent t-test for quantitative variables. Significance level was fixed as p-value of <0.05.

Results: A total of 68 patients were studied. Mean age of patients was 64.01±10.2 years with males predominating the population (92.6%). The most common three reasons for presentation in gastroenterology were dyspeptic symptoms 32 (47%), evaluation of anaemia 12 (17.6%), and history of malena 10 (14.7%). Prevalence of diabetes was significantly less in patients with GJ (2.9% vs 22%). Obesity and dyslipidemia was also common in patients without GJ (7.3%), with p-value <0.05.

Conclusion: Prevalence of obesity, DM and dyslipidemia is significantly lower in patients with GJ. But the metabolic benefits of GJ surgery could possibly have a role in decreasing development of obesity and diabetes in long run.

Keywords: Anaemia, Bariatric surgery, Billroth, Roux-en-Y gastric bypass

INTRODUCTION

The consequences of obesity are well recognised and include comorbidities like hypertension, Type 2 DM (T2DM), and dyslipidemia. Bariatric surgery is one of the most effective treatment options besides lifestyle modifications and medications [1].

Currently, it is widely accepted that weight loss, caloric restriction and the modulations of foregut and hindgut hormones following anatomic alteration together play a role in the pathophysiology of bariatric surgeries. Among these, change of gut hormones, which are beneficial to weight loss and glucose metabolism, are believed to be the important factors [2,3]. Among the bariatric surgeries, RYGB has highest reduction in weight loss. In addition, a prospective observational study has demonstrated that RYGB is effective in improving glucose homeostasis and alleviating DM in Asian, non morbidly obese T2DM patients [4]. It is well established that decreased levels of foregut hormones such as Glucose dependent Insulinotrophic Peptide (GIP), and increased hindgut hormones such as Glucagon Like Peptide-1 (GLP-1) and Peptide YY (PYY) are important for the improvement of early and late glucose metabolism after surgery [5,6].

However, studies are limited because of the invasive nature of the bariatric surgeries. Also, gastrojejunostomy is most commonly performed surgery in the past for duodenal ulcer and gastric antral malignancy due to its less technical aspects and lower complications as compared to RYGB. Billroth II gastrojejunostomy restricts gastric volume and excludes the duodenum and proximal jejunum as RYGB does. Some studies indicated that Billroth II gastrojejunostomy was effective in glucose control in non obese T2DM patients with gastric cancer or gastric ulcer [4,6,7]. However, there is sparse data on long term metabolic effects in these patients who had undergone gastrojejunostomy many years ago. This cross-sectional study was undertaken to determine the prevalence of obesity, dyslipidemia and DM in patients who had undergone gastrojejunostomy, comparing them with age matched first degree relatives.

MATERIALS AND METHODS

This was a cross-sectional study conducted in Department of Gastroenterology, Government Medical College, Kazhikode, Kerala, India, over a period of six years from January 2013 to December 2018. An Institutional Research and Ethical Committee approval (IRC/2011/35) was obtained. An informed consent was obtained from all patients.

Inclusion and Exclusion criteria: All patients attending outpatient department or endoscopy consultation for various reasons who were questioned for a history of undergoing GJ (Billroth II) 15 years ago were included in the study. Also patients who had undergone gastrojejunostomy 15 years ago for peptic ulcer disease were included in the study. Fifteen years were arbitrarily taken for the study to determine long term effects. The GJ performed for malignant conditions were excluded. This was a consecutive sampling based on inclusion criteria. Exclusion criteria were presence of cirrhosis due to other aetiologies than Non alcoholic Fatty Liver Disease (NAFLD) like alcohol, viral hepatitis, autoimmune disease, Wilson's disease, presence of hepatocellular carcinoma, family history (first degree relative) of DM and unwillingness to provide consent were excluded from the study group.

Sample size calculation: Sample size was calculated with the formula $4pq/d^2$, where 'p' is prevalence of obesity and diabetes, 'q' is 100-p and 'd' is precision of the study which was taken as 20% of prevalence.

A detailed history and haematological parameters were studied among the patients. Presence of DM, hypertension, dyslipidemia and obesity were noted. The thorough surgical details were obtained from the past records. Also, presence of these co-morbidities in

the age matched first degree relative who had not undergone any bowel drainage or reduction surgeries in the past were considered as controls of the study. Patients with gastrojejunostomy in whom age matched relative (control) was not available, were not enrolled into the study. Among control group, details of weight, presence of co-morbidities like DM, dyslipidemia and cirrhosis were obtained from relatives and those with cirrhosis were thoroughly evaluated. Cirrhosis was diagnosed by physical examination in the form of jaundice, splenomegaly, low liver size and ascites and later confirmed in such cases with non invasive tests like ultrasound examination. Aetiological workup for cirrhosis was performed in all cirrhotics. Blood parameters were not studied in normal cohorts.

Diagnosis of obesity was done using Body Mass Index (BMI) cut-offs of ≥25 kg/m^2 as per consensus guidelines for Asian Indians [8]. DM was defined according to American diabetes association consensus guidelines [9]. Lipid abnormalities were noted in all the patients and were categorised accordingly [10]. Any single abnormality in fasting lipid profile of serum cholesterol, triglycerides or LDL cholesterol was considered as dyslipidemia in patients. Hypertension was defined according to European guidelines [11]. Haematological parameters and ultrasound examination was performed in all patients. The prevalence of obesity varies between 16.9-36.3% and 5-17% for DM in India [12,13].

STATISTICAL ANALYSIS

The statistical results are presented as mean and Standard Deviation (SD) for continuous variables and as frequencies and percentages for categorical variables. Association between qualitative variables was analysed using Chi-square test. Association between quantitative variables was analysed using independent sample t-test. Significance level was fixed as p-value of <0.05. The Statistical Package for Social Science (SPSS) software version 22.0 for the window was used for statistical analysis.

RESULTS

A total of 78 patients with history of GJ were initially seen during the study period. Of this, two patients had alcoholic cirrhosis in the work up and eight patients had family history of DM. So 68 patients were studied and another 68 patients enrolled as control group. Mean age of patients was 64.01±10.2 years with male to female ratio of 12.6:1. The mean age of control group was 60.4±9.5 years with male to females of 3.05:1. Mean BMI of patients was 19.5±3 kg/m^2 and 20.4±2.8 kg/m^2 in control group. The reasons for presentation in gastroenterology were dyspeptic symptoms, 32 (47%), evaluation of anaemia, 12 (17.6%), history of malena, 10 (14.7%), evaluation of pain abdomen, 8 (11.7%), primary malignancy (stomach body at GJ site)- 6 (8.8%).

Haematological parameters of the case group are shown in [Table/Fig-1]. The mean Hb of the patients was 9.9±2.6 gm/dL. Mean ESR 31.2±19.5 mm/hour. The WBC count was 9186.7±5249 cells/mm^3. Total cholesterol was 256.8±86.2 mg/dL and triglycerides 310±66.4 mg/dL and LDL cholesterol was 168.6±56.1 mg/dL.

Parameters	Mean±SD
Hb (gm/dL)	9.9±2.6
WBC count (cells/mm^3)	9186.7±5249
ESR (mm/hour)	31.2±19.5
RBS (mg/dL)	98.7±26.2
Cholesterol (mg/dL)	256.8±86.2
Triglyceride (mg/dL)	310±66.4
LDL cholesterol (mg/dL)	168.6±56.1

[Table/Fig-1]: Table showing haematological parameters in the study population (case group).
Hb: Haemoglobin; WBC: White blood count; ESR: Erythrocyte sedimentation rate; RBS: Random blood sugar; LDL: Low density lipoprotein

On comparison of patients with GJ and controls, Body Mass Index (BMI) was comparable in these two groups (19.5 vs 20.4 kg/m^2, p=0.085). [Table/Fig-2] shows the prevalence of DM, dyslipidemia, obesity, cirrhosis and hypertension in the patients and their first degree relatives. The prevalence of DM (2.9% vs 22%) was significantly less in GJ patients as compared to controls. There were no presence of dyslipidemia and obesity in patients with gastrojejunostomy, however presence of dyslipidemia and obesity was 7.3% in controls. This was statistically significant. The prevalence of cirrhosis (2.9% vs 10.2%) and hypertension (8.8% vs 19.1%) did not show statistical difference as compared to controls.

Parameters	Case group (n=68)	Control group (n=68)	p-value
Age (in years)	64.01±10.2	60.47±9.5	0.40
Gender (M/F)	63/5	52/16	0.009
BMI (kg/m^2)	19.5±3.0	20.4±2.8	0.085
Presence of DM	2 (2.9%)	15 (22%)	0.001
Presence of dyslipidemia	0	5 (7.3%)	0.023
Presence of obesity	0	5 (7.3%)	0.023
Presence of cirrhosis	2 (2.9%)	7 (10.2%)	0.085
Presence of hypertension	6 (8.8%)	13 (19.1%)	0.083

[Table/Fig-2]: Clinical characteristics and comparison of prevalence of various parameters among cases and control group.
*Independent t-test for continuous quantitative variable like age and BMI. Rest of qualitative variables were tested using Chi-square test. p-value <0.05 was considered as statistically significant

DISCUSSION

This study was performed to determine the occurrence of obesity, diabetes and dyslipidemia in patients who had undergone gastrojejunostomy. The previous observations of reduced insulin requirement and improved insulin sensitivity following gastric resection and bypass were extrapolated on a long term basis in this observational study to determine the change in development of DM or obesity in the study population. In this study, occurrence of diabetes, dyslipidemia and obesity were lower as compared to control cohorts. In one of randomised control trial where RYGB was compared with Billroth I, incidence of DM improvement and hormonal changes were better in RYGB group, signifying the metabolic changes of gastric bypass [14].

The mean age of surgery in our patients was 33 years (mean follow-up of 31 years). In one of prospective study from India, the mean age of patients with obesity undergoing RYGB was 49 years [15]. After 1 year of surgery, 84.6% of patients had achieved resolution without medication. Interestingly, patients with shorter duration of diabetes had best remission. The preoperative cholesterol of 206 mg/dL in this study had controlled to 140 mg/dL and up to 54% did not required statins at end of five year follow-up. Out of 61% hypertensives, only 34% required continuation of anti-hypertensive drugs at end of 5 years [15]. Shah SS et al., performed RYGB with a BMI of 22-35 kg/m^2 and reported 100% remission of DM at a follow-up of 9 months. Also, cardiovascular risk, waist circumference, dyslipidemia, and hypertension improved significantly [16]. This data can be extrapolated to adolescents too as shown in one of retrospective study from India. The median BMI of 47 kg/m^2 in ten patients with mean age of 16 years had complete resolution of diabetes at end of one year [17].

It is known that Asians develop metabolic syndrome even at lower BMI as compared to west [18]. Hence, it is important to understand the metabolic benefits of such surgeries at lower BMI. Although many confounding factors are present in the pathogenesis of diabetes and obesity, a lower occurrence was identified in this study. This occurrence maybe similar to the metabolic effects seen in patients undergoing RYGB, although not described widely for Billroth II surgeries in literature. In another retrospective study where weight loss and glucose control in DM patients were analysed following gastroduodenostomy vs gastrojejunostomy, in

the long term, gastrojejunostomy facilitated greater weight loss, as it, unlike gastroduodenostomy, involved performing proximal intestinal bypass. Also, the percentage of patients with an improved diabetes course was highest in the gastrojejunostomy group [19]. The metabolic benefits of gastrojejunostomy surgery could possibly have a role in decreasing development of obesity and diabetes in long run.

Limitation(s)

Firstly, it was cross-sectional study and data on dynamic changes in patients were not available. However, the prevalence of DM and obesity were considerably lower as compared to cohorts where the only prime factor was bypass of food and consequently alteration in gut hormones due to GJ. Secondly, the prevalent numbers of DM, dyslipidemia and cirrhosis in the study was less. However, with advent of proton pump inhibitors, prevalence of gastrojejunostomy surgery has drastically reduced. Thirdly, hormonal changes in these patients and its variations as compared to normal subjects were not conducted. Since, the occurrence of DM involves multiple factors from genetics to daily lifestyle, other confounding factors in the prevalence of these co-morbidities is other limitation of the study.

CONCLUSION(S)

Prevalence of obesity, DM and dyslipidemia is lower in patients with GJ. The complex alterations in gut hormones secondary to bypass of food due to GJ may have a role in the lesser occurrence of obesity and DM.

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PARTICULARS OF CONTRIBUTORS:

1. Additional Professor, Department of Gastroenterology, Government Medical College, Calicut, Kerala, India.
2. Senior Resident, Department of Gastroenterology, Government Medical College, Calicut, Kerala, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. K Sunil Kumar,
Additional Professor, Department of Gastroenterology, Superspecialty Block,
Government Medical College, Calicut-673008, Kerala, India.
E-mail: sunilcalicut@gmail.com

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