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Comparison of the Incidence of Dumping Syndrome in Post-Bariatric Surgery Patients with Roux-en-Y Gastric Bypass (RYGB) Techniques and Single Anastomosis Duodeno-Ileal Bypass with Sleeve Gastrectomy (SADI-S)

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A B S T R A C T

Introduction: Dumping syndrome (DS) is a common post-bariatric surgery complication. This study aims to compare the incidence of DS between Roux-en-Y gastric bypass (RYGB) and single anastomosis duodeno-ileal bypass with sleeve gastrectomy (SADI-S) at Sumber Waras Hospital, Jakarta, Indonesia. **Methods:** This single-center retrospective observational study included 187 patients who underwent RYGB or SADI-S between January 2018 and December 2023. Demographic, clinical, and DS-related data were collected from patients' medical records. Statistical analysis was carried out using SPSS version 25. **Results:** The overall incidence of DS was 21.4%, with 23.2% in the RYGB group (n=95) and 19.6% in the SADI-S group (n=92). There was no significant difference in the incidence of DS between the two groups (p = 0.56). Young age (OR 2.18; 95% CI 1.05-4.53; p = 0.04) and history of type 2 diabetes mellitus (OR 3.05; 95% CI 1.21-7.70; p = 0.02) is an independent risk factor for DS. **Conclusion:** There was no significant difference in the incidence of DS between RYGB and SADI-S. Young age and a history of type 2 diabetes mellitus are independent risk factors for DS.

1. Introduction

Obesity has reached global pandemic proportions, with prevalence continuing to increase worldwide. In Indonesia, 2018 Basic Health Research (Riskesdas) data shows that 21.8% of the adult population is obese. This figure is expected to continue to increase along with changes in modern lifestyles and eating patterns. Obesity is not just an aesthetic problem, it is also a major risk factor for many chronic diseases, including type 2 diabetes, heart disease, hypertension, stroke, and some types of cancer. Treatment of obesity requires a comprehensive approach involving lifestyle changes, pharmacological therapy, and surgical intervention. In recent decades, bariatric surgery has emerged as an effective treatment option for severe and morbid obesity. This procedure aims to reduce body weight significantly and sustainably, as well as improve obesity-related health conditions.[1-3]

There are various types of bariatric surgery, each with different mechanisms of action. Some commonly performed procedures include: Roux-en-Y gastric bypass (RYGB): This procedure involves creating a small gastric pouch and connecting it directly to the lower small intestine. This limits food intake and reduces nutrient absorption as well as single anastomosis duodeno-ileal bypass with sleeve gastrectomy (SADI-S): This procedure involves removing a large part of the stomach, thereby reducing stomach capacity and production of the hormone ghrelin (hunger hormone). Bariatric surgery has been

shown to be effective in significantly reducing weight, improving blood sugar control in type 2 diabetes patients, reducing the risk of heart disease, and improving overall quality of life. However, like any surgical procedure, bariatric surgery also carries a risk of complications. One of the complications that may occur after bariatric surgery is dumping syndrome. This condition occurs when food, especially those high in sugar, moves too quickly from the stomach to the small intestine. Symptoms of dumping syndrome can vary, ranging from mild to severe, and can occur immediately after eating (early dumping) or several hours after eating (late dumping). Symptoms of early dumping can include nausea, vomiting, diarrhea, stomach cramps, bloating, sweating, dizziness, and palpitations. Meanwhile, symptoms of late dumping can include fatigue, dizziness, sweating, shaking, and difficulty concentrating. These symptoms often interfere with daily activities and reduce the patient's quality of life.[4,5]

The pathophysiology of dumping syndrome involves several complex mechanisms. After bariatric surgery, the capacity of the stomach is significantly reduced, so food can pass into the small intestine quickly. Foods that are high in sugar will cause an increase in osmolarity in the small intestine, drawing fluid from the body into the intestinal lumen. This causes intestinal distension which stimulates the release of hormones such as serotonin, bradykinin, and neurotensin, which trigger the symptoms of dumping syndrome. In addition, bariatric surgery can also interfere with the regulation of incretin hormones, such as glucagon-like peptide-1 (GLP-1) and glucose-dependent insulinotropic polypeptide (GIP). These hormones play an important role in controlling blood sugar levels and slowing gastric emptying. Disruption of incretin hormone regulation can contribute to dumping syndrome. Several risk factors that can increase the risk of dumping syndrome after bariatric surgery include RYGB having a higher risk of dumping syndrome compared to SADI-S, Foods and drinks high in sugar can trigger symptoms of dumping syndrome, Eating too quickly can worsen the symptoms of dumping syndrome and Some people may have a genetic predisposition to dumping syndrome.[6-8]

The prevalence of dumping syndrome varies depending on the type of bariatric surgery, the definition of dumping syndrome used, and data collection methods. However, in general, it is estimated that approximately 10-70% of patients experience dumping syndrome after bariatric surgery. Dumping syndrome can have a significant impact on a patient's quality of life. Disturbing symptoms can limit daily activities, affect work productivity, and cause anxiety and depression. In addition, dumping syndrome can also interfere with nutrient absorption, cause vitamin and mineral deficiencies, and increase the risk of reactive hypoglycemia.[9,10] This study aims to compare the incidence of DS in patients who underwent Roux-en-Y gastric bypass (RYGB) and single anastomosis duodeno-ileal bypass with sleeve gastrectomy (SADI-S) at Sumber Waras Hospital, Jakarta.

2. Methods

This research is a retrospective observational study with a single cohort approach. This study focuses on analyzing data on patients who have undergone bariatric surgery at Sumber Waras Hospital, Jakarta in the period January 2018 to December 2023. A retrospective approach was chosen because this study aims to analyze previously collected data, namely medical record data of patients who have undergone surgery. bariatric. The study population in this research were all patients who underwent Roux-en-Y gastric bypass (RYGB) bariatric surgery or single anastomosis duodeno-ileal bypass with sleeve gastrectomy (SADI-S) at Sumber Waras Hospital, Jakarta between January 2018 and December 2023. Inclusion criteria are patients aged 18-65 years. This age limit was set to ensure that patients have sufficient physical and psychological maturity to undergo bariatric surgery and reduce the risk of post-operative complications which are higher in elderly patients; Patients with a body mass index (BMI) ≥ 40 kg/m^2 or BMI ≥ 35 kg/m^2 with obesity-related comorbidities. These criteria are in accordance with the clinical

guidelines for bariatric surgery, which recommend surgery for individuals with severe obesity or obesity with comorbidities; Patients undergoing RYGB or SADI-S as a primary procedure, this criterion ensures that the patient has no history of previous bariatric surgery, which could affect the surgical outcome and risk of complications; Patients with complete medical record data. This criterion is important to ensure the availability of adequate data for analysis and reduce information bias. Meanwhile, the exclusion criteria are patients with a history of previous bariatric surgery. This criterion excludes patients who have undergone previous bariatric surgery because the surgical results and risk of complications may be different in patients who undergo reoperation; Patients with severe gastrointestinal disease (e.g., Crohn's disease, ulcerative colitis), This criterion excludes patients with severe gastrointestinal disease because these conditions may increase the risk of postoperative complications and compromise surgical outcomes; Patients with severe psychiatric disorders. This criterion excludes patients with severe psychiatric disorders because these conditions can affect the patient's ability to understand and follow post-operative instructions, as well as increase the risk of psychological complications; Patients who are unwilling to participate in research. These criteria ensure that participation in research is voluntary and respects the patient's right to refuse to participate.

Data collection was carried out retrospectively by searching the medical records of patients who met the inclusion and exclusion criteria. Data collected includes: Demographic data: Age, gender, smoking history, and history of diabetes mellitus. This demographic data was collected to analyze patient characteristics and identify risk factors associated with dumping syndrome (DS); Clinical data: BMI before surgery, comorbidities. These clinical data were collected to evaluate the patient's health status before surgery and identify risk factors associated with the occurrence of DS; DS related data: Time of DS occurrence, DS symptoms, DS treatment. This data was collected to analyze the incidence of DS, identify risk factors associated with the occurrence of DS, and evaluate the effectiveness of DS treatment. Data collection was carried out by a research team trained and experienced in searching medical records. The research team used a structured data collection form to ensure data consistency and accuracy. In this study, DS was defined operationally as the presence of one or more typical DS symptoms that occurred within 30 minutes after eating and lasted for at least 15 minutes. Typical symptoms of DS include nausea, vomiting, diarrhea, sweating, dizziness, palpitations, and fatigue. This operational definition was used to ensure consistency in DS diagnosis and reduce subjectivity bias.

Data analysis was carried out using SPSS version 25 statistical software. Statistical analysis used included: Descriptive analysis was used to describe the demographic and clinical characteristics of patients, as well as the incidence and symptoms of DS. This analysis includes calculating frequencies, percentages, averages, and standard deviations; The chi-square test was used to compare the proportion of DS events between the groups of patients undergoing RYGB and SADI-S. This test was used to test the null hypothesis that there was no significant difference in the proportion of DS events between the two surgery groups; Logistic regression was used to identify independent risk factors associated with the occurrence of DS. This analysis makes it possible to control confounding variables and identify risk factors that have a significant influence on the occurrence of DS. The level of significance was set at $p < 0.05$. This level of significance indicates that the results obtained have less than a 5% probability of occurring by chance. This research has received approval from the ethical committee for health assessment of the faculty of medicine, Tarumanagara University No.266/KEPK/FK UNTAR/XII/2023. This ethical approval ensures that the research was conducted in accordance with applicable research ethical principles, including the protection of the rights and welfare of research participants. All patient data is kept confidential and is only used for research purposes.

The patient's identity will not be disclosed in the publication of the research results. Patient data is stored securely and can only be accessed by the authorized research team.

3. Results

Table 1 presents the demographic and clinical characteristics of patients undergoing bariatric surgery Roux-en-Y gastric bypass (RYGB) and single anastomosis duodeno-ileal bypass with sleeve gastrectomy (SADI-S). There was no significant difference in age between the RYGB (43.2 ± 10.5 years) and SADI-S (41.8 ± 9.8 years) groups (p = 0.38). This shows that the two groups have a similar age distribution. There was no significant difference in gender distribution between the two groups (p = 0.71). The proportion of men and women was relatively balanced in both groups. There was no significant difference in preoperative BMI between the RYGB (48.5 ± 6.2 kg/m^2) and SADI-S (47.9 ± 5.9 kg/m^2) groups (p = 0.52). This suggests that both groups had similar levels of obesity before surgery. There were no significant differences in the prevalence of diabetes mellitus, hypertension, and dyslipidemia between the two groups (p > 0.05). This suggests that both groups have similar comorbidity profiles. Overall, Table 1 shows that the RYGB and SADI-S groups had similar demographic and clinical characteristics. There were no significant differences in age, gender, preoperative BMI, and prevalence of comorbidities between the two groups.

Table 1. Characteristics of respondents.

Characteristics	RYGB (n=95)	SADI-S (n=92)	p-value
Age (years)	43,2 ± 10,5	41,8 ± 9,8	0,38
Gender (M/F)	28/67	31/61	0,71
BMI (kg/m^2)	48,5 ± 6,2	47,9 ± 5,9	0,52
Diabetes mellitus (%)	42,1	38	0,59
Hypertension (%)	68,4	65,2	0,62
Dyslipidemia (%)	57,9	52,2	0,43

Table 2 presents the characteristics of dumping syndrome (DS) in patients undergoing bariatric surgery Roux-en-Y gastric bypass (RYGB) and single anastomosis duodeno-ileal bypass with sleeve gastrectomy (SADI-S). The average time to DS in the RYGB group was 4.5 weeks after surgery, while in the SADI-S group, it was 5.1 weeks. Although there is a slight difference, it is not statistically significant. This indicates that the timing of DS occurrence is relatively similar between the two types of surgery. Nausea was the most common symptom in both groups, with 18 RYGB patients and 15 SADI-S patients experiencing it. Vomiting and diarrhea also occurred frequently in both groups, indicating significant gastrointestinal disturbances. Sweating, dizziness, heart palpitations, and fatigue are less common than nausea, vomiting, and diarrhea. However, it remains a significant problem for some patients. Overall, table 2 shows that there is no significant difference in the time to occurrence and main symptoms of DS between RYGB and SADI-S patients. Both types of surgery have relatively the same risk of causing DS, with similar symptoms.

Table 2. Time of occurrence and symptoms of dumping syndrome.

Characteristics	RYGB (n=22)	SADI-S (n=18)
Time of occurrence (weeks)	4,5 ± 3,2	5,1 ± 2,8
Main symptoms		
Nauseous	18	15
Vomiting	12	10
Diarrhea	16	14
Sweating	10	8
Dizzy	7	5
Heart palpitations	5	4
Fatigue	14	12

Table 3 presents the results of logistic regression analysis to identify risk factors associated with the occurrence of dumping syndrome (DS) after bariatric surgery. Age (per 10 years younger) showed an OR value of 2.18 (95% CI 1.05-4.53, p = 0.04) indicating that every 10-year decrease in age was associated with a 2.18-fold increase in the risk of DS. These results were statistically significant, indicating that younger age is an independent risk factor for DS. Type 2 diabetes mellitus showed an OR value of 3.05 (95% CI 1.21-7.70, p = 0.02) indicating that patients with type 2 diabetes mellitus had a 3.05-fold higher risk of experiencing DS compared to patients without diabetes. These results were also statistically significant, indicating that type 2 diabetes mellitus is an independent risk factor for DS. Type of surgery (SADI-S vs. RYGB) showed an OR value of 0.82 (95% CI 0.38-1.79, p = 0.62) indicating that there was no significant difference in the risk of DS between patients undergoing SADI-S and RYGB. These results were not statistically significant, indicating that the type of surgery was not an independent risk factor for DS. BMI before surgery showed an OR value of 1.03 (95% CI 0.95-1.12, p = 0.48) indicating that there was no significant relationship between BMI before surgery and the risk of DS. These results were not statistically significant, indicating that preoperative BMI was not an independent risk factor for DS. Younger age and type 2 diabetes mellitus are independent risk factors for dumping syndrome after bariatric surgery. Type of surgery (SADI-S vs. RYGB) and preoperative BMI were not significantly associated with DS risk.

Table 3. Multivariate analysis of dumping syndrome risk factors.

Variable	OR	95% CI	p-value
Age (per 10 years younger)	2,18	1,05-4,53	0,04
Type 2 diabetes mellitus	3,05	1,21-7,70	0,02
Type of surgery (SADI-S vs. RYGB)	0,82	0,38-1,79	0,62
BMI before surgery	1,03	0,95-1,12	0,48

4. Discussion

Dumping syndrome (DS) is a complication after bariatric surgery characterized by the appearance of gastrointestinal and vasomotor symptoms after eating. These symptoms result from rapid and uncontrolled emptying of the stomach into the small intestine, triggering complex hormonal and neurological responses. Bariatric surgery, especially RYGB, and SADI-S, alters the anatomy and physiology of the digestive tract. These changes can cause rapid and uncontrolled gastric emptying, especially after consuming foods high in simple carbohydrates. Food that is not properly digested in the stomach enters the small intestine in hyperosmolar form. This causes a shift of fluid from the blood plasma into the lumen of the small intestine, which can cause a decrease in blood volume and vasomotor symptoms such as dizziness, sweating, and palpitations. The entry of hyperosmolar food into the small intestine also triggers the release of hormones such as insulin, glucagon, and peptide YY (PYY). Elevated insulin levels can cause reactive hypoglycemia, which is characterized by a rapid drop in blood sugar levels and symptoms such as fatigue, tremors, and confusion. In addition to hormone release, hyperosmolar foods also trigger neurohormonal reflexes involving the autonomic nervous system. This reflex can cause increased motility of the small intestine, which can lead to diarrhea. Younger patients tend to have more rapid gastric emptying and a stronger hormonal response to hyperosmolar foods. Patients with type 2 diabetes mellitus often have impaired gastrointestinal motility and autonomic neuropathy, which may increase the risk of DS. Although this study did not find a significant difference in the incidence of DS between RYGB and SADI-S, several other studies reported a higher incidence of DS in RYGB. This may be due to differences in the degree of changes in the anatomy and physiology of the digestive tract between the two types of surgery. Patients who do not adhere to a post-bariatric surgery diet, especially by consuming foods high in sugar and refined

carbohydrates, have a higher risk of DS.[11-13]

The results of this study provide valuable insight into the incidence of dumping syndrome (DS) in patients undergoing bariatric surgery Roux-en-Y gastric bypass (RYGB) and single anastomosis duodeno-ileal bypass with sleeve gastrectomy (SADI-S). Overall, no significant difference was found in the incidence of DS between these two types of surgery, with an overall incidence rate of 21.4%. These findings support a number of previous studies that also showed similarities in DS risk between RYGB and SADI-S. This study is in line with another study involving 11 studies which found no significant difference in the incidence of DS between RYGB and SADI-S. Additionally, studies in Asian patient populations also report similar results. This consistency strengthens the evidence that both types of surgery have comparable DS risk profiles.[13-15]

Nevertheless, the results of this study conflict with several other studies that reported a higher incidence of DS in RYGB compared with SADI-S. Another study reported a DS incidence of 35% in RYGB and 18% in SADI-S. These differences may be explained by several methodological factors and population characteristics. First, the definition of DS may vary between studies. Some studies use broader definitions, including milder symptoms, while others use stricter definitions. These differences in definitions may influence study results and lead to differences in reported DS incidence rates. Second, data collection methods can also influence research results. Retrospective studies, such as this study, rely on medical record data that may be incomplete or inconsistent. Prospective studies, on the other hand, can collect data in a more structured and controlled manner but may be more expensive and time-consuming. Third, patient population characteristics may also influence study results. Factors such as age, gender, body mass index (BMI), and comorbidities may influence the risk of DS. If the patient populations in the study differ significantly in terms of these factors, then the study results may also differ.[14-16]

This study also identified young age and a history of type 2 diabetes mellitus as independent risk factors for DS in post-bariatric surgery patients. Young age was associated with a 2.18-fold increased risk of DS, while a history of type 2 diabetes mellitus was associated with a 3.05-fold increased risk of DS. These findings are consistent with previous studies that also reported an association between younger age and type 2 diabetes mellitus with an increased risk of DS. The mechanisms underlying this relationship are not fully understood, but several hypotheses have been proposed. In young patients, physiological adaptation after bariatric surgery may not be optimal. The anatomical and hormonal changes that occur after surgery may affect gastrointestinal motility and blood glucose regulation, which in turn may increase the risk of DS. In patients with type 2 diabetes mellitus, preexisting gastrointestinal motility disorders and autonomic neuropathy may worsen DS symptoms after bariatric surgery. In addition, unhealthy eating habits before surgery, such as consuming foods high in sugar and refined carbohydrates, can worsen DS symptoms.[17,18]

This study has several strengths, including the relatively large sample size (n=187), prospective study design, and the use of a clear definition of DS. This makes it possible to obtain more accurate and reliable results compared to retrospective studies with smaller sample sizes. However, this study also has several limitations. First, this research was conducted in one health center (Sumber Waras Hospital Jakarta), so the research results may not be generalizable to a wider population. Second, this study relies on medical record data, which may be incomplete or inconsistent. Third, this study did not collect data on patients' dietary compliance and lifestyle changes after surgery, which are important factors in the management of DS. The results of this study have important clinical implications. First, these findings indicate that patients undergoing RYGB or SADI-S have a similar risk of DS, so they need to be given the same education and monitoring regarding the risk and treatment of DS. Second, young patients and patients with a

history of type 2 diabetes mellitus need to be identified as high-risk groups for DS and given special attention in postoperative management. Future studies are needed to confirm these findings and further explore the risk factors for DS in post-bariatric surgery patients. Multicenter studies with larger sample sizes can provide more representative and generalizable results. In addition, prospective studies that collect data on patients' dietary compliance and lifestyle changes may provide more comprehensive insight into the factors influencing the occurrence and management of DS. This study provides evidence that there is no significant difference in the incidence of dumping syndrome between RYGB and SADI-S. Young age and history of type 2 diabetes mellitus were identified as independent risk factors for DS. These findings have important clinical implications in the management of post-bariatric surgery patients.[19,20]

5. Conclusion

This study concluded that there was no significant difference in the incidence of dumping syndrome between Roux-en-Y gastric bypass and single anastomosis duodeno-ileal bypass with sleeve gastrectomy in patients at Sumber Waras Hospital, Jakarta. Young age and a history of type 2 diabetes mellitus are independent risk factors for DS in post-bariatric surgery patients.

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