Received: 09.05.2019 Accepted: 04.07.2019 Published: 30.06.2020

Bariatric surgery

Chirurgia bariatryczna

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Abstract Obesity, which is becoming a lifestyle disease, is a significant social problem due to its growing frequency and its complications, primarily cardiovascular diseases. The recommended conservative treatment of obesity, consisting in the use of a weight reduction diet and physical activity, is often not effective or the effect of these actions does not last long. Bariatric surgery is an emerging field of surgery that can be used to treat obesity in a selected group of patients. Different operative methods of bariatric procedures are available. They allow one to achieve a significant weight loss. However, their application requires proper preparation of the patient before surgery and changes in eating habits and often chronic use of dietary supplements after surgery. This method of treatment should be considered in patients in whom conservative treatment has not produced the desired effect. Bariatric treatments are aimed not only at achieving weight loss, but also at improving the course of diseases often coexisting with obesity, such as type 2 diabetes or hypertension.

Keywords: obesity, type 2 diabetes, bariatric operations, diet

Streszczenie Otyłość, stająca się chorobą cywilizacyjną, stanowi istotny problem społeczny, co wynika z rosnącej częstości jej występowania oraz z powikłań, do których prowadzi, przede wszystkim chorób układu sercowo-naczyniowego. Zalecane postępowanie zachowawcze w ramach leczenia otyłości, polegające na stosowaniu diety redukcyjnej oraz podejmowaniu aktywności fizycznej, często nie przynosi skutku lub efekt tych działań nie utrzymuje się długo. Chirurgia bariatryczna jest rozwijającą się dziedziną chirurgii, która w wybranej grupie pacjentów może zostać wykorzystana w leczeniu otyłości. Dostępne są różne metody operacyjne zabiegów bariatrycznych, pozwalające na uzyskanie znacznego spadku masy ciała. Ich przeprowadzenie wymaga jednak odpowiedniego przygotowania pacjenta przed operacją oraz zmiany nawyków żywieniowych i często przewlekłego stosowania suplementów diety po zabiegu. Tę metodę leczenia należy rozważać u pacjentów, u których postępowanie zachowawcze nie przyniosło spodziewanego efektu. Zabiegi bariatryczne mają na celu doprowadzenie nie tylko do ubytku masy ciała, ale także do poprawy przebiegu często współistniejących z otyłością chorób, takich jak cukrzyca typu 2 czy nadciśnienie tętnicze.

Słowa kluczowe: otyłość, cukrzyca typu 2, operacje bariatryczne, dieta

INTRODUCTION

The increasing frequency of obesity is a growing problem in Poland and in the world. Data show that the prevalence of obesity has significantly increased over the last 20 years and approximately 10-25% of men and 10-30% of women in Europe are affected⁽¹⁾.

Obesity is diagnosed when one's body mass index (BMI) is 30 kg/m² or more, while overweight is defined as a BMI of 25–29.9 kg/m²⁽²⁾. A BMI of 40 kg/m² or more is called morbid obesity⁽³⁾.

Treatment of obesity is very important since obesity can lead to many complications. It can result in the development of cardiovascular diseases, respiratory disorders such as obstructive sleep apnoea, type 2 diabetes or nonalcoholic fatty liver disease⁽⁴⁾. Over 80% of obese patients with a BMI of \geq 40 kg/m2 meet the criteria of metabolic syndrome⁽⁵⁾. The life expectancy of individuals with morbid obesity is believed to be 5-20 years shorter compared to those with a normal body weight⁽⁶⁾. Obesity also affects fertility in women and can lead to menstrual disorders such as oligomenorrhoea or amenorrhoea. Such women may be affected by polycystic ovary syndrome and pregnancy in them is associated with the risk of obstetric complications such as pre-eclampsia⁽⁷⁾, foetal macrosomia, diabetes⁽⁸⁾, miscarriage and development of thromboembolism⁽⁹⁾.

It should be noted that the growing prevalence of obesity and the related complications also have economic consequences and require increased healthcare expenditure⁽¹⁰⁾. Bariatric procedures are the most effective method for the treatment of obesity⁽¹¹⁾. Lifestyle and diet changes often do not cause a significant weight loss and individuals usually return to their initial weight after 5 years⁽¹²⁾.

In some patients – those with a BMI of $\geq 30 \text{ kg/m}^2$ or $\geq 27 \text{ kg/m}^2$ – pharmacotherapy can be considered⁽¹²⁾.

Weight loss as a result of bariatric surgery is due to not only the reduction of stomach volume or absorption surface area, but also changes in hormonal secretion⁽⁶⁾.

INDICATIONS

Bariatric surgery should be considered in those patients in whom other methods of obesity treatment have not been effective or the effects were short-lived⁽¹³⁾. Generally, only patients aged 18–65 should be assessed for bariatric surgery. However, surgical treatment can also be considered for patients over 65 years of age if the benefits resulting from bariatric surgery potentially exceed the risk associated with it⁽¹⁴⁾.

Bariatric surgery eligibility criteria include a BMI of 40 kg/m² or more or a BMI of at least 35 kg/m² with an additional disorder such as type 2 diabetes, arterial hypertension, obstructive sleep apnoea, obesity hypoventilation syndrome, hyperlipidaemia, non-alcoholic fatty liver disease, non-alcoholic steatohepatitis, chronic venous insufficiency, asthma, severe urinary incontinence, reflux oesophagitis, pseudotumour cerebri and joint diseases. The idea behind such a procedure is weight reduction to the point of improving the course of the disorders mentioned above⁽¹⁵⁾.

Bariatric surgery can also be considered in patients with a BMI of $30-35 \text{ kg/m}^2$ and concomitant type 2 diabetes⁽¹⁶⁾.

CONTRAINDICATIONS

Contraindications to bariatric procedures include: a diagnosis of a debilitating or incurable disease, unstable psychiatric disorder, addiction to psychoactive substances, alcohol or prescription medication, lack of patient cooperation^(17,18), inability to function independently and having no possibility of receiving assistance from other people. Before deciding on surgical intervention one should make an attempt at conservative management of obesity and consider a bariatric procedure if conservative treatment is ineffective⁽¹⁹⁾.

TYPES OF BARIATRIC SURGERY

There are three types of bariatric procedures: restrictive, malabsorptive and combinations of the two. Restrictive bariatric surgery involves reducing stomach volume, while malabsorptive procedures consist in decreasing the nutrient-absorbing area of the digestive tract⁽²⁰⁾.

Restrictive methods

- 1. Sleeve gastrectomy (SG) this procedure consists in reducing stomach capacity by approximately $80\%^{(21)}$. In this method, only a narrow stomach tube is left along the lesser curvature. SG can be performed as a preparatory procedure before another bariatric surgery⁽²²⁾. After the procedure, stomach voiding time is shorter⁽²¹⁾. After this type of operation, supplementation of only B vitamins is necessary, particularly B₁ and B₁₂⁽²³⁾.
- 2. Gastric banding (GB) this method involves fitting a silicone balloon around the stomach below the oesophago-gastric junction. It is possible to adjust band tension by modifying the amount of fluid (saline) in a subcutaneous port connected to the band⁽²⁴⁾. The procedure does not cause malabsorption and patients are instructed to eat slower and in smaller portions⁽²³⁾.
- 3. Vertical banded gastroplasty (VBG) this procedure consists in applying a vertical suture in the stomach, dividing it into a smaller and larger part. This results in restricting food passage from the smaller to the larger part. In this case, the band is not adjustable^(6,25).

Malabsorbtive methods

1. Jejunoileal bypass (JIB) – this procedure involves transecting the jejunum at approximately 30 cm from its

beginning and connecting it to the ileum at its last 10 cm, which reduces the absorption surface area to a significant extent. Currently, this procedure is no longer performed. Although it was effective in producing a significant weight loss, it did cause numerous complications⁽²⁵⁾.

- 2. Biliopancreatic diversion (BPD) this approach consists in removing part of the stomach with the pylorus and connecting it to the distal part of the small intestine. The remaining portion of the small intestine is sutured blind on the one end and its other end is connected with the nutrient-absorbing intestinal loop running from the stomach, thus creating a common food-enzyme route. After this procedure, the nutrient-absorbing section of the gastrointestinal tract is significantly shortened^(4,25). The preserved portion of the small intestine is usually 50 cm long. The advantages of the procedure are significant weight loss and lack of vomiting, while its disadvantages include the need to take dietary supplements to the end of one's life and a higher risk of complications and postoperative death than for other procedures(25).
- 3. Duodenal-jejunal bypass (DJB) this method consists in connecting the pylorus to the distal part of the jejunum. The ingested food bypasses the duodenum and the proximal part of the jejunum, which are sutured blind. This method brings better results in terms of diabetes control than in terms of weight loss^(11,25).

Combined methods

- 1. Roux-en-Y gastric bypass (RYGB) this procedure involves transecting the stomach and dividing it into two parts. The upper, smaller part of the stomach is connected to the distal part of the jejunum. The larger part of the stomach with pylorus changes over to the duodenum, which is connected with the proximal part of the jejunum^(6,21,25). As a result, food does not pass through the distal part of the stomach, duodenum and proximal part of the jejunum⁽²⁶⁾ and digestion takes place past the junction of the two routes⁽²⁵⁾. RYGB is associated with a small risk of malabsorption^(21,25). In this method, it is possible to adjust the capacity of the upper part of the stomach and the length of the jejunum excluded from digestion(25).
- 2. Biliopancreatic diversion with duodenal switch (BPD-DS) – this approach involves the removal of part of the stomach from the side of the greater curvature. Unlike BPD, the remaining part of the stomach has a preserved pylorus and is smaller. In BPD-DS, the common food-enzyme route is usually longer than in BPD^(15,25).

In Poland, the most popular method is sleeve gastrectomy and the second most commonly conducted procedure is RYGB. Over 99% of bariatric procedures are performed laparoscopically⁽²⁷⁾.

CONSEQUENCES

After the procedure, periodic assessment of its effects needs to be performed, which should take into account not only weight loss, but also the impact of surgery on comorbidities⁽¹³⁾. Research shows mortality reduction and improved diabetes and hypertension control in patients after bariatric surgery⁽²⁸⁾. There are also studies available which indicate improved quality of life and reduced stress levels in patients after bariatric procedures⁽²⁹⁾.

Periodic postoperative follow-up involves clinical examination and certain laboratory tests. They also aim at detecting possible nutrient and trace element deficiencies⁽¹⁰⁾.

Weight loss evaluation is based on the percentage of excess weight loss (EWL, %). An EWL of >50% is considered satisfactory. The maintenance of reduced body weight over time is also an important aspect⁽¹⁹⁾. The highest weight loss is achieved after the biliopancreatic diversion procedure; lower degrees of weight loss take place after, in descending order, Roux-en-Y gastric bypass, vertical banded gastroplasty and gastric banding⁽²²⁾. In their study, Ahmed et al. demonstrated that bariatric procedures lead to altered taste sensation, which can have an additional effect on weight loss after the operation and on the maintenance of reduced body weight⁽³⁰⁾. It is also worth emphasising the role of a dietitian. This is because it is important that the patient's diet be matched to the time elapsed from the procedure and the type of surgical intervention⁽³¹⁾.

A very important aspect is improved blood glucose control in type 2 diabetes patients after bariatric procedures. The largest effect is observed after RYGB and BPD/DS procedures. After surgery, it is often possible to reduce insulin doses or discontinue certain oral anti-diabetic drugs(32). Improved glucose control can occur already after a few days from the procedure, i.e. before weight loss, and is associated with altered secretion of gastrointestinal hormones⁽²⁵⁾.

Since the frequency of bariatric surgery has been growing, an increasing number of procedures have been conducted in young patients as well. Approximately half of the procedures are performed in women of childbearing age. For this reason, it is important to know how to care for women who are planning pregnancy and how to manage pregnancy in women after bariatric procedures⁽³³⁾. After surgery, the menstrual cycle becomes regular in women who previously had irregular periods. Weight loss following the procedure can result in improved fertility. However, it is believed that the waiting period between surgery and conception, which is also the time necessary for body weight to stabilise, should last approximately 12-24 months. In pregnant women, appropriate vitamin and nutrient supplementation is indicated⁽³⁴⁾. In this group of patients, oral glucose tolerance test should not be performed due to the risk of hypoglycaemia⁽⁸⁾. Pregnant women are particularly at risk | 161 of malnutrition and trace element deficiency⁽⁹⁾. At the same time, one should bear in mind that in women who are not planning to become pregnant oral hormonal contraception can be ineffective and other methods of contraception should be considered⁽⁸⁾.

Bariatric procedures also affect the male reproductive system. After such operations, blood testosterone increase⁽³⁵⁾, gonadotropin increase and oestradiol decrease are observed⁽³⁶⁾. In addition, sexual function can improve post-surgery⁽³⁵⁾. However, the influence of bariatric surgery on semen quality and male fertility remains unclear⁽³⁶⁾.

COMPLICATIONS

Complications of bariatric surgery can be early (in the perioperative period) or late (developing with time).

The risk factors for early postoperative complications include male sex, BMI \geq 50 kg/m², age \geq 45 years, arterial hypertension, pulmonary hypertension, history of pulmonary embolism, presence of a filter in the vena cava and hypoventilation with carbon dioxide retention of \geq 45 mm Hg⁽³⁷⁾.

The complications developing after bariatric procedures may be hair loss, malnutrition, nausea and vomiting, ileus, hernias and haemorrhages. Particular attention should be paid to the risk of malnutrition, which appears in nearly 38% of patients undergoing bariatric surgery⁽⁵⁾. Postoperative vomiting can appear in 50% of patients and represent and additional cause of nutritional deficiencies⁽³⁸⁾.

Protein and calorie malnutrition (PCM) can develop postsurgery. The risk of PCM is higher if the common intestinal canal is left shorter: approximately 50 cm⁽³⁹⁾.

Iron, vitamin B₁₂, vitamin D and calcium deficiencies are most commonly observed following bariatric surgery⁽⁴⁰⁾. Iron deficiency can be due to stomach volume reduction and the associated decrease in hydrochloric acid secretion. This leads to an increased Fe³⁺ to Fe²⁺ ratio, which results in poorer iron absorption⁽⁴¹⁾. Vitamin B₁₂ deficiency observed after surgery is also primarily due to gastric volume reduction that results in decreased intrinsic factor synthesis and ultimately impaired vitamin B₁₂ absorption⁽³¹⁾. There is a risk of Wernicke's encephalopathy following bariatric surgery due to thiamine deficiency. One should remain vigilant to the possible manifestations of this condition. Wernicke's encephalopathy presents with ataxia, nystagmus and impaired consciousness⁽⁴²⁾. For this reason, thiamine (vitamin B_1) should be supplemented before the procedure in patients deficient in the compound and in all patients in the postoperative period⁽⁴³⁾. It is believed that fat-soluble vitamin deficiencies can occur in as many as 60% of patients undergoing malabsorptive procedures, although they are usually mild⁽⁴⁴⁾. Vitamin D and calcium malabsorption can result in bone mass loss. After the procedure, bone turnover rate increases⁽⁴⁵⁾.

Patients who have undergone RYGB are at risk of cholelithiasis. By way of prevention, ursodeoxycholic acid can be administered for 6 months post-surgery⁽³⁹⁾.

Postprandial syndrome can also develop after bariatric procedures. There are two types of postprandial syndrome. The symptoms of early postprandial syndrome occur approximately 10 to 30 minutes from eating a meal. It may be associated with blood pressure decrease and heart rate increase⁽⁴⁶⁾, vomiting, diarrhoea and bloating^(18,23). It is the result of quick stomach emptying and the transfer of hyperosmolar stomach content to the intestine, which causes water to be secreted into the lumen of the intestine⁽⁴⁶⁾. Late postprandial syndrome, which occurs approximately 1-3 hours after a meal, is associated with reactive hypoglycaemia and is due to changes in the secretion of gastrointestinal hormones and insulin after eating. In order to prevent postprandial syndrome, one needs to consume meals more often, but of smaller volume. It is recommended that patients avoid the consumption of simple sugars and increase their intake of fibre, complex carbohydrates and proteins. In addition, during the 30 minutes after eating solid food one should not drink any fluids. In order to prevent late postprandial syndrome, one is advised to drink half a glass of orange juice or ingest an equivalent amount of carbohydrates one hour after a meal⁽⁴⁷⁾.

One should not forget about the problem of excess skin left after significant weight loss following bariatric surgery. This condition not only has important psychological implications, but can also lead to ulceration and infection of skin folds and the umbilicus⁽⁴⁸⁾.

POSTOPERATIVE MANAGEMENT

Obese patients assessed for bariatric surgery often have nutritional deficiencies already before the procedure. Even though their diet is rich in calories, it is not wellbalanced and does not provide the optimal supply of nutrients⁽⁴⁹⁾.

The proportions between nutrients in patients after bariatric surgery should be the following: carbohydrates should account for 45% of calorie intake, proteins approximately 25% and fats approximately 30%⁽⁵⁰⁾.

As mentioned previously, patients after bariatric surgery are at risk of iron, vitamin and trace element deficiencies. Depending on the type of procedure, patients can become deficient in different substances. Folic acid deficiency is rare, since this compound is absorbed in the whole gastrointestinal tract. Bariatric surgery-related deficiencies of trace elements such as zinc, selenium, copper, magnesium and potassium may occur; therefore, they should be supplemented. They are usually included in multivitamin formulations⁽⁴⁷⁾.

If a patient develops any neurological symptoms post-surgery such as disorientation, memory problems or progressing asthenia, vitamin or trace element deficiencies may be suspected and the patient should report to a doctor. The patient should be warned about the alarming symptoms than can occur after the operation⁽⁵¹⁾.

It is important that patients supplement their diet with calcium (1,200–1,500 mg daily), vitamin D₃ (1,000–2,000 U daily), vitamin B₁₂ (500 μ g per day orally or 1,000 μ g once a month intramuscularly), folic acid (400 μ g daily) and iron (65–80 mg daily)⁽¹³⁾.

CONCLUSION

Bariatric surgery has become a very important branch of surgery. It represents alternative treatment in selected cases of obesity in which conservative treatment proved ineffective. When assessing patients for bariatric procedures, one should bear in mind that good cooperation with the patient is an important factor for therapeutic success. The patient should be aware of the fact that periodic follow-up is necessary after the surgery and that their way of eating will have to change and that they may have to take dietary supplements on a permanent basis. It is also important to make physicians aware of how they should manage bariatric surgery patients, particularly considering the fact that the number of such individuals is very likely to rise.

Conflict of interest

The authors do not report any financial or personal affiliations to persons or organisations that could adversely affect the content of or claim to have rights to this publication.

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