

# Bariatric surgery and menopause

Maciej Walędziak<sup>1</sup>, Anna Maria Różańska-Walędziak<sup>2</sup>

<sup>1</sup>Department of General, Oncological, Metabolic and Thoracic Surgery, Military Institute of Medicine, Warsaw, Poland

<sup>2</sup>Department of Human Physiology and Pathophysiology, Faculty of Medicine, Collegium Medicum, Cardinal Stefan Wyszyński University in Warsaw, Warsaw, Poland

## Abstract

**Introduction:** Menopause is a process that affects hormonal levels and metabolic processes in women. The decline in oestrogen levels can predispose to the development of type 2 diabetes mellitus and obesity.

**Material and methods:** The study group included 614 women with a history of bariatric surgery, who were divided into 2 groups according to their menopausal status. The purpose of the study was to assess the influence of menopausal status on the effects of bariatric surgery in terms of weight loss.

**Results:** The percentage of estimated weight loss (%EWL), total weight loss (TWL), percentage of total weight loss (%TWL), and change in body mass index (BMI) after bariatric surgery are lower in postmenopausal than in premenopausal women.

**Conclusions:** Menopause can be considered as a factor influencing the efficacy of bariatric surgery, with lower effects in postmenopausal women.

**Key words:** bariatric surgery, %EWL, menopausal status, LRYGB, LSG.

## Introduction

Obesity is a global healthcare problem, with 13% of world population (650 million) stated as obese in 2016 [1]. Obesity is well-known as a risk factor for numerous concomitant diseases, especially diabetes mellitus type 2, hypertension, chronic heart disease, and obstructive sleep apnoea (OSA) syndrome. Bariatric surgery (BS) is the reference method of treatment, with the most durable weight loss and the highest reduction of concomitant diseases [2, 3]. Women constitute the vast majority of patients undergoing bariatric treatment [4]. There are many studies analysing the importance of old age as a factor influencing the effectiveness of bariatric surgery, but the menopausal status as such is rarely considered. Menopause and the change in hormonal levels in women due to the transition from pre- to post-reproductive life are responsible for numerous changes in metabolic processes; therefore, postmenopausal status is prone to affect the results of bariatric surgery. The decreasing level of circulating oestrogens causes changes in adipose tissue metabolism, decreasing the lipoprotein lipase activity and therefore reducing lipolysis [5]. Ovarian ageing and the decline in endogenous oestrogens lead to metabolic and biochemical changes that can predispose to the development of type 2 diabetes mellitus, weight gain, and obesity, all of which can be treated by BS [6]. The aging process

itself is characterized by gradual loss of lean muscle mass and an increased propensity to store excess energy as fat, which can also be affected by decreased physical activity and changes in dietary intake. Additionally, total energy expenditure decreases with time [7]. The National Institutes of Health guidelines from 1991 limited BS procedures to patients 60 years old or younger; however, the restriction was lifted in 2006. Further studies showed that laparoscopic BS can be considered safe and effective also in patients over 60 years old [8–10].

## Aim of the study

The purpose of the study was to determine the possible influence of menopausal status in women on the efficacy of bariatric surgery in terms of weight loss measures.

## Material and methods

The study group included 614 female patients with a history of bariatric surgery, laparoscopic sleeve gastrectomy (LSG), or laparoscopic Roux-en-Y gastric by-pass (LRYGB). Data were collected using paper and an original internet survey. The recruitment was based on the bariatric centre register and cooperation with Polish Bariatric Patients Society.

Corresponding author:

Maciej Walędziak, Department of General, Oncological, Metabolic and Thoracic Surgery, Military Institute of Medicine, Warsaw, Poland, e-mail: [maciej.waledziak@gmail.com](mailto:maciej.waledziak@gmail.com)

Submitted: 20.05.2022

Accepted: 29.05.2022

Participants were divided into 2 groups according to their menopausal status. Menopause was defined as less than 3 menstrual bleedings in the year before the survey in patients of 45 years old or more. Premenopausal and postmenopausal patients were compared in terms of weight loss measures after bariatric surgery, including the percentage of estimated weight loss (%EWL), total weight loss (TWL), percentage of total weight loss (%TWL), and change in body mass index (BMI).

**Statistical analysis**

Statistical analysis was performed using Statistica 13 (StatSoft. Inc.). *U* Mann-Whitney test and Student’s *t*-tests were used for quantitative data comparison as required. A two-sided Fisher’s exact test was used for categorical and binary data comparison. *P*-value < 0.05 was considered significant.

**Ethical considerations**

The study was anonymous and performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its latter amendments (Fortaleza). Participants were informed about the

aim of the study, and informed consent was obtained by the researchers or electronically prior to the start of the survey. Approval from Military Institute of Medicine Ethics Committee was obtained on 22 August 2018 with code 117/WIM/2018.

**Results**

The median age of the whole group was 39 years (range: 18–70 years), and the median height was 167 cm (range: 148–187 cm). There were significant differences between the groups in terms of education, additional diseases, hypertension, and active smoking pre- and post-operation.

The detailed characteristics of the study group are presented in Table 1.

The median change in BMI in the whole group was 17.2 kg/m<sup>2</sup> (range: 0.8–46.9). TWL, %TWL, and %EWL were as follows (median and range): 48 kg (2–126), 38.3% (1.5–63.0), and 86.9% (3.1–160.0), respectively. In most women (*n* = 564, 91.9%), loss/reduction of more than 50% of excessive weight was observed.

Median changes in BMI in premenopausal and postmenopausal women were as follows: 17.3 kg/m<sup>2</sup> (range 3.8–46.9; i.e. 45.2–27.5) and 15.9 kg/m<sup>2</sup> (0.8–28.9, i.e. 46.3–30.1), respectively. We found statistically signi-

**Table 1.** The detailed characteristics of the study group

Parameters	Menopause		<i>p</i> -value
	Yes	No	
Education (primary/secondary/incomplete higher/higher/medical higher)	1/33/5/26/4	7/162/74/276/25	< 0.05
Professionally active (yes/no)	52/17	436/109	0.38
Operation (SG/RYGB/ASGB)	46/23/0	375/156/14	0.15
Additional diseases (yes/no)	50/19	283/262	< 0.001
Hypertension (yes/no)	36/33	99/446	< 0.001
Insulin resistance and/or diabetes (yes/no)	12/57	132/413	0.19
Active smoking (yes/no)	7/62	117/427	< 0.05
Number of pregnancies (no/1/2/3/4/5/6/7/8)	7/11/24/16/8/3/0/0/0	156/113/169/67/23/5/6/2/2	< 0.001
Number of births (no/1/2/3/4/5)	9/12/33/11/4/0	181/136/184/36/5/1	< 0.001
Number of pregnancies post-operation (no/1/2/3/4)	68/0/0/0/0	439/68/30/6/1	< 0.001
Number of births post-operation (no/1/2/actually pregnant)	69/0/0/0/0	471/60/13/1	< 0.001
Sexual orientation (heterosexual/homosexual/bisexual)	61/1/1	513/8/14	0.87

ASGB – adjustable silicone gastric banding, RYGB – Roux-en-Y gastric by-pass, SG – sleeve gastrectomy

**Table 2.** The differences between pre- and postmenopausal women

Parameters	Menopause		<i>p</i> -value
	No	Yes	
TWL [kg]	50 (10–126)	43 (2–84)	< 0.001
%TWL	38.8 (8.0–62.9)	35.9 (1.5–52.5)	< 0.01
%EWL	87.8 (16.8–160.0)	73.8 (3.1–124.3)	< 0.01
Normal BMI post-operatively (yes/no)	142/403	15/54	0.43
Loss of more than 50% of excessive weight (yes/no)	504/41	60/9	0.14

BMI – body mass index, TWL – total weight loss

ficant differences between pre- and postmenopausal patients in weight loss measures after bariatric surgery. The difference was significant in %EWL, with 87.8 %EWL (range 16.8–160.0) in premenopausal women and 73.8 %EWL (range 3.1–124.3) in postmenopausal women ( $p < 0.01$ ).

The differences between pre- and postmenopausal women are presented in Table 2.

## Discussion

In our study, we found menopause to be a significant determinant of weight loss measures after bariatric surgery, including change in BMI, TWL, %TWL, and %EWL. Weight loss in postmenopausal patients was found to be lower when compared to premenopausal patients in terms of all the aforementioned measures.

There are few studies comparing female bariatric patients before and after menopause. Ochner *et al.* analysed a group of 1356 women after BS, divided into 2 age groups: 20–45 years (presumably premenopausal) and 55–65 years (presumably postmenopausal). Unlike our study group, which included patients after sleeve gastrectomy (SG) or RYGB, their patients had undergone RYGB or gastric banding. They found greater %EWL at both 1 and 2 years after BS in the group of premenopausal women, which remains in correlation with our results [11].

There are many studies comparing the safety of different bariatric procedures in patients aged 60 years old or more. Even though they do not focus only on women, their results can also be considered significant in terms of the subject of our study, given that 4/5 of BS procedures are performed on female patients.

Woźniewska *et al.* analysed the influence of age on the weight loss and metabolic effects after LSG in a group of 555 patients. The participants were divided into 2 groups: less than 45 years old and 45 years old and more. %EWL was found to be higher in the younger group. The younger group also had more rapid normalization of fasting glucose levels after 3 months of observation (109 down to 95 mg/dl vs. 103.5 vs. 99.5 mg/dl,  $p < 0.01$ ) and lower values of low-density lipoprotein serum levels at 3 months (115 vs. 126 mg/dl,  $p < 0.01$ ) and 12 months (114.8 vs. 122 mg/dl,  $p < 0.01$ ) of follow-up, as well as a more significant decrease of triglyceride serum levels [12].

Agarwal *et al.* analysed all cases of primary SG and RYGB at Mayo Clinic from 2015 to 2017. In total, 26,557 procedures (5.6%) were performed in elderly patients (more than 65 years old). Elderly patients had a higher rate of adverse outcomes in all measures, including overall mortality and morbidity. Bariatric surgery was considered safe overall, with emphasis on the preference of SG as the first-choice procedure in elderly patients because RYGB was independently associated with worse outcomes [13].

Giordano *et al.* performed 2 meta-analyses comparing the efficacy and safety of BS procedures between younger and older populations. The first one was about SG and included 11 studies with 2259 patients. Overall complication rates were comparable between patients younger than 60 years old and those aged 60 years old or more. %EWL was higher in younger patients (MD:  $-7.63$ ; 95% CI:  $-13.19$  to  $2.08$ ;  $p < 0.01$ ), and there was a better rate of remission of OSA (RR: 0.81; 95% CI: 0.69–0.95;  $p < 0.01$ ). There were no significant differences found in remission of type 2 diabetes mellitus, hypertension, and hyperlipidaemia between the age groups [14].

The second meta-analysis by Giordano *et al.* assessed the incidence of complications after RYGB in younger and older patients and included 7 studies with 3128 patients. The elderly group had a significantly higher risk of mortality (1%) and overall complications (3%) (RR, 6.12; 95% CI: 1.08–34.83;  $p = 0.04$ ; RR, 1.51; 95% CI: 1.07–2.11;  $p = 0.02$ ). Length of hospital stay, diabetes mellitus, and OSA remission rates were similar between the groups. %EWL was significantly higher in younger patients (MD,  $-3.44$ ; 95% CI:  $-5.20$  to  $1.68$ ;  $p < 0.01$ ), as well as hypertension and hyperlipidaemia remission rates. Overall, there is a higher risk of complications and a lower effectiveness associated with RYGB in elderly patients [15].

Thaher *et al.* analysed data from 3561 patients from the German Bariatric Surgery Registry, who had undergone SG or LRYGB. The outcome criteria were perioperative morbidity, perioperative complications, 30-day mortality, and postoperative length of stay. They found no significant differences in postoperative complications between the 2 types of surgery and concluded that both should be considered safe in elderly patients [16].

A meta-analysis by Shenoy *et al.* included 9 studies comparing the effects of LSG and LRYGB in elderly bariatric patients. There was no difference found between LSG and LRYGB regarding early complications and mortality, and a higher rate of late complications was seen in patients after LRYGB. The weight loss one year after surgery was comparable between the 2 procedures. Laparoscopic Roux-en-Y gastric by-pass had better efficacy in terms of resolution of co-morbidities. However, the authors concluded that LSG should be considered the first choice for elderly patients due to lower morbidity and comparable efficacy [17].

Frieder *et al.* retrospectively reviewed 565 patients aged 65 years or more, who had undergone BS – either SG or RYGB – to compare short-term outcomes. Complication rates were higher in RYGB than SG (27.7% vs. 9.4%,  $p < 0.01$ ), with the risk of anastomosis ulcer 7.2% vs. 0%, stricture – 5.9% vs. 0%, and gastrointestinal obstruction requiring intervention 2.2% vs. 0.4%. There was a similar rate of de novo gastroesophageal reflux, and there were no leaks found in both groups. The general complication rate for LRYGB was almost 3 times

higher than for SG, even though %EWL was higher for LRYGB both at 1- and 2-year time-points [18].

An important problem to be considered is the reduced absorption of vitamins and micronutrients after BS, especially RYGB, which is of greater importance in postmenopausal women because bone mineral density (BMD) becomes lower after menopause. Roux-en-Y gastric by-pass is found to be associated with high bone resorption and hyperparathyroidism prevalence in postmenopausal women; however, it does not seem to affect BMD. Valderas *et al.* observed 65% higher bone resorption measured by C-terminal telopeptide serum levels in women after RYGB, compared to non-operated female controls matched by age, body fat percentage, BMI, and number of years after menopause [19]. There are also studies showing that BMD is comparable after SG and RYGB. Vilarrasa *et al.* presented a comparison of BMD one year after BS in women who had undergone SG and RYGB and showed there were no differences between the groups. Bone mineral density was measured at the femoral neck and the lumbar spine. Furthermore, BMD in women after BS remained, at both measured sites, above the median values of Z score in the general population in the same age groups [20].

Bariatric surgery is also found to reduce risk of breast cancer among severely obese women. In a retrospective cohort study by Feigelson *et al.* 17,998 female patients with a history of BS were matched with 55,889 women with no history of BS. The analysis included 301 premenopausal and 399 postmenopausal breast cancer cases. Bariatric surgery was associated with a reduction in both premenopausal (HR = 0.72, 95% CI: 0.54–0.94) and postmenopausal (HR = 0.55, 95% CI: 0.42–0.72) breast cancer. The effect was more pronounced in oestrogen receptor (ER)-negative cases before menopause and ER-positive cases after menopause [21].

### Limitations of the study

The possible limitation of our study can be the recall bias and the subjectivity of the patients' opinion. Another limitation was that the survey was partly distributed via social media, which excluded the possibility of direct control of the respondents or calculation of the response rate. However, there was no incentive to introduce dishonesty into the responses.

### Conclusions

Menopause can be considered as a factor influencing the efficacy of bariatric surgery, with lower effects in postmenopausal women. It is yet to be determined whether the metabolic and hormonal changes are solely responsible for the result, or the co-existing lifestyle factors like lower professional and physical activity have the same level of importance.

### Disclosure

The authors report no conflict of interest.

### References

1. Neylan CJ, Kannan U, Dempsey DT, Williams NN, Dumon KR. The surgical management of obesity. *Gastroenterol Clin North Am* 2016; 45: 689-703.
2. Lindekilde N, Gladstone B, Lübeck M, et al. The impact of bariatric surgery on quality of life: a systematic review and meta-analysis. *Obes Rev* 2015; 16: 639-651.
3. Gloy VL, Briel M, Bhatt DL, et al. Bariatric surgery versus non-surgical treatment for obesity: a systematic review and meta-analysis of randomised controlled trials. *BMJ* 2013; 347: 1-16.
4. Bal J, Ilonzo N, Adediji T, Leitman IM. Gender as a deterministic factor in procedure selection and outcomes in bariatric surgery. *J Soc Laparosc Surg* 2021; 25: 1-9.
5. Mastorakos G, Valsamakis G, Paltoglou G, Creatsas G. Management of obesity in menopause: diet, exercise, pharmacotherapy and bariatric surgery. *Maturitas* 2010; 65: 219-224.
6. Paschou SA, Marina LV, Spartalis E, et al. Therapeutic strategies for type 2 diabetes mellitus in women after menopause. *Maturitas* 2019; 126: 69-72.
7. Newberry C, Dakin G. Nutrition and weight management in the elderly. *Clin Geriatr Med* 2021; 37: 131-140.
8. Vallois A, Menahem B, Alves A. Is laparoscopic bariatric surgery safe and effective in patients over 60 years of age? An updated systematic review and meta-analysis. *Obes Surg* 2020; 30: 5059-5070.
9. Arolfo S, Salzano A, Dogliotti S, Solerio D, Olandese F, Morino M. Bariatric surgery in over 60 years old patients: is it worth it? *Updates Surg* 2021; 73: 1501-1507.
10. Elnahas AI, Doumouras AG, Anvari M, et al. Access to bariatric surgery among older patients in a publicly funded regionalized care system. *Surg Endosc* 2021; 35: 6990-6997.
11. Ochner CN, Teixeira J, Geary N, Asarian L. Greater short-term weight loss in women 20-45 versus 55-65 years of age following bariatric surgery. *Obes Surg* 2013; 23: 1650-1654.
12. Woźniewska P, Diemiszczuk I, Groth D, et al. The influence of patient's age on metabolic and bariatric results of laparoscopic sleeve gastrectomy in 2-year observation. *BMC Surg* 2020; 20: 1-8.
13. Agarwal S, Mazzei M, Edwards M. A328 Exploring perioperative outcomes in metabolic and bariatric surgery amongst the elderly: an analysis of the 2015–2017 MBSAQIP database. *Surg Obes Relat Dis* 2019; 15: S134-135.
14. Giordano S, Salminen P. Laparoscopic sleeve gastrectomy is safe for patients over 60 years of age: a meta-analysis of comparative studies. *J Laparosc Adv Surg Tech* 2020; 30: 12-19.
15. Giordano S, Victorzon M. Laparoscopic Roux-en-Y gastric bypass in elderly patients (60 years or older): a meta-analysis of comparative studies. *Scand J Surg* 2018; 107: 6-13.
16. Thaher O, Hukauf M, Stroh C. Propensity score matching sleeve gastrectomy vs. gastric bypass with 5 years of follow-up. *Obes Surg* 2021; 31: 5156-5165.
17. Shenoy SS, Gilliam A, Mehanna A, et al. Laparoscopic sleeve gastrectomy versus laparoscopic Roux-en-Y gastric bypass in elderly bariatric patients: safety and efficacy – a systematic review and meta-analysis. *Obes Surg* 2020; 30: 4467-4473.
18. Frieder JS, Montorfano L, Gomez CO, et al. Sleeve gastrectomy versus Roux-en-Y gastric bypass in patients aged  $\geq$  65 years: a comparison of short-term outcomes. *Surg Obes Relat Dis* 2021; 17: 1409-1415.
19. Valderas JP, Velasco S, Solari S, et al. Increase of bone resorption and the parathyroid hormone in postmenopausal women in the long-term after Roux-en-Y gastric bypass. *Obes Surg* 2009; 19: 1132-1138.
20. Vilarrasa N, de Gordejuela AGR, Gómez-Vaquero C, et al. Effect of bariatric surgery on bone mineral density: comparison of gastric bypass and sleeve gastrectomy. *Obes Surg* 2013; 23: 2086-2091.
21. Feigelson HS, Caan B, Weinmann S, et al. Bariatric surgery is associated with reduced risk of breast cancer in both premenopausal and postmenopausal women. *Ann Surg* 2020; 272: 1053-1059.