

Rationale of Operation Choice in Patients with Morbid Obesity and *Diabetes Mellitus* Type 2

E. V. Kruchinin, K. M. Autlev, E. L. Yanin, B. B. Hashimov, A. V. Efanov

Federal State Budgetary Educational Institution of Higher Education

"Tyumen State Medical University" of the Ministry of Healthcare of the Russian Federation

625023, Russia, Tyumen, street Odessa, 54.

Abstract

Objective.

To define criteria for selection of bariatric surgery method in patients with morbid obesity and *diabetes mellitus* type 2.

Materials and methods.

Three groups were formed during research: the first one included 60 patients who had biliary-pancreatic bypass surgery, the second – 50 patients with laparoscopic gastric banding, the third – 50 patients who had longitudinal gastric resection. All patients had both morbid obesity and type 2 diabetes, except for 30 patients in the second group, who had 1-2 stage of obesity with *diabetes mellitus* type 2. To determine the operation technique, a score system was used.

Results and discussion.

The suggested method of score system is an attempt to develop an algorithm for choosing optimal bariatric surgery technique. If patient scores 1 or 2, it is safe to expect good results in both *diabetes mellitus* type 2 compensation and weight decrease during the first year after gastric banding. If a patient with score of 3 (a patient with morbid obesity) undergoes gastric banding, the success rate of *diabetes* compensation drops to 40%, and only 7% of patients who scored 6 and more had *diabetes mellitus* compensated. 80% of patients who underwent longitudinal gastric resection and scored 3 or 4 had *diabetes* compensated and achieved subnormal body mass. A minimal score of 5 was required for choosing biliary-pancreatic bypass surgery as a surgical method, and 98% of patients had hyperglycemia normalized during the first month post-op and *diabetes* compensated during the first year.

Conclusion.

The score system Introduced allows to easily estimate the metabolic status of patients, select optimal surgical technique, and predict operation results.

Keywords: morbid obesity, *diabetes mellitus* type 2, selection of surgical technique

INTRODUCTION

Obesity is one of the most common problems currently being faced by medics throughout the world. The first studies of surgical solutions for morbid obesity took place in 1950 [2-4]. Today, there are over 40 bariatric operations [5-8]. The variety of those methods suggests that the ideal operation is still to be found. Some techniques are used more frequently in bariatric surgery, including laparoscopy-associated gastric banding, laparoscopic gastric bypass surgery, biliary-pancreatic bypass surgery [1, 9]. However, no clear criteria for determining optimal option exists, thus making this topic relevant for research. Our objective was to define the criteria which would allow to easily choose a bariatric surgery method for patients with morbid obesity and *diabetes mellitus* type 2.

MATERIALS AND METHODS

Over 160 operative treatments of obesity carried out in association with surgery department of Tyumen State Medical Academy and Tyumen clinical hospital #1 since 2003. Three groups were formed during research: the first one included 60 patients who had biliary-pancreatic bypass surgery, the second – 50 patients with laparoscopic gastric banding, the third – 50 patients who had longitudinal gastric resection. All patients had both morbid obesity and type 2 diabetes, except for 30 patients in the second group, who had 1-2 stage of obesity alongside *diabetes mellitus* type 2. To determine the operation technique, a score system was used; however, there were exceptions due to

patients' preferences and specifics of particular patients' treatment. The WHO scale of obesity was used as a basis for the score system (each class from I to II resulting in 1 to 3 points accordingly). If BMI was higher than 40.0 (class III obesity), 1 point was added for each extra 5 points in BMI. Thus, BMI of 56.0 nets 6 points, while class III obesity (BMI 40) transfers to 3 points. If any obesity-associated lesions were present (arterial hypertension, *diabetes mellitus* type 2, knee joints arthrosis, dyslipidemia etc.), 1 extra point was added for each of them. If a patient had *diabetes mellitus* type 2 and scored 1-2 points, laparoscopy-associated gastric banding was suggested; 3-4 points - longitudinal gastric resection; 5 and more points - biliary-pancreatic bypass surgery. It should also be mentioned that gastric banding could be used as one of the elements of complex preparation for biliary-pancreatic bypass surgery in patients with morbid obesity. Statistic evaluation of research results was carried out using *Statistica AX v 5.5*. To evaluate statistic relevance, Student's t-test and Mann-Whitney U-test were used, $M \pm m$ being applied (average \pm standard average error) for both criteria. Post-hoc analysis was carried out using the methods of multiple comparison with corrections by Sheaffe, Danette and Tuki. Comparison of parameters prior and after surgery was made using Wilcoxon signed-rank test for doubles. To study relations between variables, Pearson correlation and Spearman rank correlation were used. Results were considered true for all tests if difference value level was $p \neq 0.05$.

RESULTS AND DISCUSSION

The suggested score system is an attempt to develop a mechanism for choosing optimal surgical treatment of bariatric patients, resulting in better results for both patients and doctors. If patient scores 1 or 2, it is safe to expect good results in both diabetes mellitus type 2 compensation and weight decrease during first year after gastric banding. If patient with score of 3 (patient with morbid obesity) undergoes gastric banding, the success rate of diabetes compensation drops to 40%, and only 7% of patients who scored 6 and more had diabetes mellitus compensated. Higher difference in treatment results was discovered when analyzing BMI reduction rate after laparoscopic gastric banding, which is believed to depend on patients' motivation to achieve results. Body mass reduced from 122±23.4 to 107±19.3 kg during the first 3 months, thus netting a difference of 15±14.7 kg, which was considered unreliable. However, after a year average body mass was 90±23.9 kg ($p < 0.01$).

Clinical case. A 41-years-old female patient complained of overweight. Anamnesis: patient has been suffering from overweight since 2005, when after the childbirth observed a gradual increase of body mass. Despite of using diets and Reduxin intake, the patient did not observe an effect of weight loss. She has been suffering diabetes mellitus type 2 for 2 years. Compensation was achieved through dietary advices. Physical examination: class I obesity with BMI 33.7 (weight 101 kg, height 173 cm). Score: the degree of obesity was estimated at 1 point, which corresponds to the 1st degree of obesity, and 1 point was associated with obesity diabetes mellitus type 2. The total score was 2 points, for which reason the laparoscopic gastric banding operation was recommended. After this operation during the first year, 4 adjustments of the bandage system were performed. As a result body weight decreased from 101 kg to 76 kg.

80% of patients who underwent longitudinal gastric resection and scored 3 or 4 points had diabetes compensated and achieved subnormal body mass. If patient scored 1-2 points underwent longitudinal gastric resection was not carried out. When supervising body mass reduction rate in patients after longitudinal gastric resection, the fastest drop in body mass was recorded during the first 3 months (from 134±13.8 to 110±10.4 kg; $p < 0.01$; average reduction - 24±2.8 kg). At the end of the first year, average body mass in those patients was 83±8.6 kg ($p < 0.01$).

Clinical case. A 27-years-old female patient treats complaining of overweight. Anamnesis: patient has been suffering from overweight after the childbirth since 2008. For the last 4 years, she has been suffering diabetes mellitus type 2. Compensation of glycemia was achieved through dietary advices. Physical examination: class III obesity with a BMI 40.7. At the time of admission, the height was 168 cm, weight 115 kg. Score: 3 points were estimated that corresponds to class III of obesity, 1 point was added for the associated diabetes mellitus type 2. The total score was 4 points, sleeve gastric resection was recommended for the patient. A year after the surgery, a good result of treatment was observed: the patient's body

weight decreased from 115 kg to 88 kg. Diabetes mellitus type 2 was compensated.

A minimal score of 5 was required for choosing biliary-pancreatic bypass surgery as a surgical method, and 98% of patients had hyperglycemia normalized during the first month post-op and diabetes compensated during the first year. The fastest loss of body mass was registered during the first 3 months after surgery ($p < 0.01$). The initial body mass was 154.75± 23.49 kg, and it reduced by 27.78±7.36 kg during the first 3 months, which is 17.95%, and by 48.89±11.73 kg after 6 months (31.6%). One year after biliary-pancreatic bypass surgery overall body mass decreased by 64.37±12.87 kg ($p < 0.01$), thus resulting in BMI of 37.73±4.45.

Clinical case. A 57-years-old female patient treats complaining of overweight. Anamnesis: patient has been suffering from overweight since 1999 after the lifestyle changing (change of job). During the last year, body mass increased by 11 kg. For the last 5 years patient has had diabetes mellitus type 2. Compensation was achieved through dietary advices and antihyperglycemic drugs intake. At the time of admission: weight 115 kg, height 160 cm, which corresponds to class III obesity with a BMI 44.2. Ultrasound abdominal examination detected fatty hepatosis. No other pathology was found. The degree of obesity was estimated at 3 points (class III obesity), extra points added for obesity-associated diabetes mellitus type 2 and liver pathology. The total amount was 5 points. The operation of biliopancreatic shunting was recommended for this patient and done. In the next year after surgery a good result of treatment was noted: the patient's body weight decreased from 115 kg to 79 kg. Ultrasound control detected a normalization of the structure of the parenchyma of the liver. Normoglycemia does not require the hypoglycemic drugs intake.

Clinical case. A 42-years-old male patient treats complaining of overweight. Anamnesis: patient has been suffering from morbid obesity from childhood. In 2000, a sleeve gastric resection was made. After surgical treatment he noted a decrease in body weight of 25 kg (from 155 kg to 130 kg), but five years later he noted a gradual increase in weight. For three years he has been suffering from diabetes mellitus type 2. Compensation was achieved through dietary advices. At the time of admission height was 170 cm, weight 180 kg, BMI 62.3, arterial hypertension 2 (risk 4), fatty hepatosis. Score: class III of obesity, which corresponds to 3 points, 1 point for every 5 body weight units with a BMI > 40, and a score for the associated diabetes mellitus type 2. The total score was 9 points. The operation of biliopancreatic shunting was recommended for this patient. During the first year of the postoperative period there was a decrease in body weight from 180 kg to 126 kg. Compensation of arterial hypertension: decrease in the average level of systolic blood pressure to 126, diastolic to 84 mm Hg.

The analysis of clinical manifestations of diabetes mellitus type 2 in patients who underwent bariatric surgery revealed that after biliary-pancreatic bypass surgery hyperglycemia normalized after 3 months, and 1 year post-op just 2 (2%) patients did not have full compensation of

diabetes without hypoglycemic therapy; after 3 years just 1 (1%) patient did not show any compensation of diabetes. After laparoscopic gastric banding, 30 patients with morbid obesity and diabetes mellitus 13 (43%) did not show compensation post-op and 6 (20%) after 1 year post-op. Laparoscopic gastric banding led to compensation of diabetes without additional hypoglycemic treatment in 24 (80%) patients. In group of 30 patients who had longitudinal gastric resection, 11 (36%) patients had hyperglycemia remaining post-op and 8 (27%) after 3 years post-op. After 12 months of observation, average blood pressure (BP) was 136.45 ± 9.45 mmHg systolic, 84.34 ± 5.84 mmHg diastolic in operated patients, which is significantly lower than pre-op BP ($p < 0.001$). 99 (99%) patients who had biliary-pancreatic bypass surgery achieved compensation of arterial hypertension after 1 and 3 years post-op. 69% of patients who had laparoscopic gastric banding achieved compensation of arterial hypertension in 1 year and 91% in 3 years post-op. 87% of patients who had longitudinal gastric resection achieved compensation of arterial hypertension in 1 year and 90% in 3 years post-op. Therefore, bariatric operations – laparoscopic gastric banding, longitudinal gastric resection, biliary-pancreatic bypass surgery – proved effective in treatment of morbid obesity, and caused the compensation of both diabetes mellitus type 2 and arterial hypertension as a part of metabolic syndrome: this link was reported recently (10).

CONCLUSION

The score system introduced allows to easily estimate the metabolic status of patients, select optimal surgical technique, and predict operation and post-op results. Biliary-pancreatic bypass surgery should be chosen for patients with morbid obesity and diabetes mellitus type 2, because it leads to compensation of diabetes within 1

month post-op. Longitudinal gastric resection showed lesser efficiency in such patients, but could be used in case a patient never had laparotomy before, as well as in patients who had mild form of diabetes pre-op. Laparoscopic gastric banding proved to be the least effective method of all three, thus it should not be used to treat patients with morbid obesity and diabetes mellitus type 2 as an isolate method, but could be considered a prep stage for biliary-pancreatic bypass surgery.

REFERENCES

1. Autlev, K.M., Medvedeva, I.V. and Kruchinin, E.V. Biliopancreatic bypass surgery in the treatment of morbid obesity. Tyumen': Pechatnik; 2013 (in Russian).
2. Butrova, S.A. and Dzogoeva, F.Kh. Visceral obesity – a key element of the metabolic syndrome. *Ozhirenie i metabolism.* 2004; 1: 10–6 (in Russian).
3. Fonseka, V. Metabolic syndrome (trans. fr. Engl.). M: Praktika; 2011 (in Russian).
4. World Health Organization. Fact sheet: obesity and overweight. <http://www.who.int/dietphysicalactivity/en/> (accessed 3 January. 2005).
5. Sedletskiy, Y.I. Surgical treatment of metabolic syndrome. St. Petersburg: ELBY-SPb; 2014 (in Russian).
6. Sedov, V.M., Fishman, M.B. and Lantsberg, L. Laparoscopic adjustable gastric banding in the treatment of obese patients. *Vestnik Khirurgii.* 2008; 167 (1): 29–32 (in Russian).
7. Fishman, M.B., Sedov, V.M., Avinoach, E. and Lantsberg L. Laparoscopic adjustable gastric banding in the treatment of patients with obesity at a young age. *Endoskopicheskaya khirurgiya.* 2007; 6: 18–21 (in Russian).
8. Chazova, I.E. and Mychka, V.B. Metabolic syndrome: treatment approaches. *Consilium Provisorum.* 2003; 8: 2–3 (in Russian).
9. Yanin, E.L. et al. Metabolic effects of surgical treatment of morbid obesity. *Ural'skiy Meditsinskiy zhurnal.* 2008; 9 (49): 123–6 (in Russian).
10. Shulkina S.G., Smirnova E.N., Trushin M.V. Interrelation of Adipokines with Functional State of Kidneys in Patients with Metabolic Syndrome. *Biol Med (Aligarh)* 2016; 8(7): Art. 360. doi:10.4172/0974-8369.1000360.