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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии
საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

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GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman (Кириллица)**, для текста на грузинском языке следует использовать **AcadNusx**. Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи.** Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - <http://www.spinesurgery.ru/files/publish.pdf> и http://www.nlm.nih.gov/bsd/uniform_requirements.html. В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректур авторам не высылаются, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or computer-printed on a single side of standard typing paper, with the left margin of 3 centimeters width, and 1.5 spacing between the lines, typeface - **Times New Roman (Cyrillic)**, print size - 12 (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf

In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

**Articles that Fail to Meet the Aforementioned
Requirements are not Assigned to be Reviewed.**

ავტორთა საყურადღებო!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე, დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx**. შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემავსებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრაფიის ფოტოსურათები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შედეგების ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფხიხლებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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THE IMPACT OF BARIATRIC SURGERY ON TYPE 2 DIABETES MELLITUS REMISSION IN THE GEORGIAN POPULATION

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Abstract.

Background: Obesity and diabetes are two closely related diseases that increase morbidity and mortality.

Our study aims to investigate the effect of bariatric surgery on diabetes remission.

Methods: We studied 91 patients with type 2 diabetes mellitus (T2DM) and morbid obesity who underwent bariatric surgery—sleeve gastrectomy—at the "David Abuladze Georgian-Italian Clinic" from 2015-2022. The patients' ages ranged from 23 to 67 years (46.67 ± 8.60), including 50 women and 41 men.

Results: After the surgery, all patients reported weight loss (kg): before the surgery 146.80 ± 25.81 , after the surgery 97.87 ± 17.56 . $t = 23.30$, $p < 0.0001$ the relative chance of remission after bariatric surgery increases Weight (kg) - OR=1.03(95% CI:1.02-1.05) and reduce Glycemia - Fasting >125 mg/dL - OR=0.06(95% CI:0.01-0.60); Sulfonylurea - OR=0.07(95% CI:0.02-0.27); Insulin - OR=0.06(95% CI:0.01-0.56)

Conclusions:

- Bariatric surgery in patients with type 2 diabetes promotes long-term remission of diabetes.

- Positive predictor of complete remission is the patient's initial weight before bariatric surgery. Treatment and high glycemia (fasting >125 mg/dL) before surgery reduce the relative probability of complete remission.

- Weight loss as a predictor of complete remission shows high sensitivity and specificity (cutoff value = 37.5kg).

Key words. Bariatric surgery, diabetes mellitus, obesity, post-operative remission.

Introduction.

About 830 million people worldwide have diabetes. More than half of people with diabetes are untreated. The proportion of people with diabetes, particularly untreated diabetes, living in low- and middle-income countries is increasing [1]. People with impaired fasting glucose (5.6–6.9 mmol/L), impaired glucose tolerance (2-hour glucose tolerance 7.8–11.0 mmol/L), and glycosylated hemoglobin levels of 5.7–6.4% have an increased risk of developing diabetes. About 25% of people with any of these conditions will develop diabetes within three to five years, although the natural history of IFG (Fasting Glucose) and IGT (Glucose Tolerance) is different [2].

Obesity and diabetes are two closely related diseases that increase morbidity and mortality. The influence of genetic and environmental factors characterizes their pathogenesis. Obesity increases the influence of environmental factors on diabetes in individuals with a genetic predisposition. Given their pathogenetic links, modern approaches to the treatment

of obesity and diabetes have some similarities: from lifestyle changes to pharmacotherapy and various bariatric surgeries [3].

Obesity is a risk factor for type 2 diabetes, with the likelihood of developing the disease increasing proportionally to body mass index. Accordingly, the increasing prevalence of obesity worldwide has led to a concomitant increase in the prevalence of type 2 diabetes mellitus. The cellular and physiological mechanisms responsible for the association between obesity and type 2 diabetes are complex and involve changes in beta cell function, adipose tissue biology and multi-organ insulin resistance, which are often ameliorated and can be normalized by adequate weight loss [4].

In 2010, at the Diabetes Surgery Summit-I (DSS-I), international experts discussed and developed recommendations for the use of gastrointestinal (GI) surgery to treat type 2 diabetes mellitus (T2DM). This conference marked the first formal recognition of metabolic surgery as a treatment option for diabetes, beyond its traditional role in the treatment of obesity.

Bariatric surgery facilitates weight loss through multiple mechanisms, including malabsorption, food restriction, and neurohormonal responses that regulate hunger and energy balance [5].

According to the 2010 DSS consensus, metabolic surgery is defined as gastrointestinal surgeries performed to treat diabetes and related metabolic conditions regardless of disease severity [6].

A retrospective multicenter cohort analysis of 240 patients who underwent sleeve gastrectomy evaluated the diabetes remission rate at 1 year and 5 years after surgery. Forty-six percent of the patients achieved diabetes remission 5 years after the operation [7].

The study was conducted for the first time in Georgia. The impact of bariatric surgery on the remission of type 2 diabetes has not been studied before.

Our study aims to investigate the effect of bariatric surgery on diabetes remission.

Materials and Methods.

We studied 91 patients with type 2 diabetes mellitus (T2DM) and morbid obesity who underwent bariatric surgery—sleeve gastrectomy—at the "David Abuladze Georgian Italian Clinic" from 2015-2022. The patients' ages ranged from 23 to 67 years (46.67 ± 8.60), including 50 women and 41 men.

Study Inclusion Criteria: Morbidly obese patients with type 2 diabetes mellitus aged 18-65.

5 years after bariatric surgery

Exclusion criteria: Patients receiving glucocorticoid treatment.

Qualification criteria for bariatric surgery:

The procedure was performed with a body mass index (BMI) of 40 kg/m² or more or a BMI of 35 kg/m² or more and concomitant obesity-related diseases [8].

Before the operation, the weight ranged from 81 to 197 kg, the average weight was 146.80±25.81 kg (Figure 1).

We divided the patients into two groups: the first group included patients who failed to achieve complete remission within 4 years after surgery, the second group included patients with complete remission.

According to the 2009 American Diabetes Association consensus, "Complete" remission was defined as fasting blood glucose <100 mg/dL and HbA1c <5.7% without pharmacotherapy for 1 year.

The demographic characteristics of the patients, genetic predisposition to obesity and diabetes, lifestyle, comorbidities, type and frequency of diet, preoperative weight loss, parameters of diabetes, duration of type 2 diabetes, antihypertensive drugs (before surgery), liver function tests and lipid profile, number of "Healthy days" before and after surgery were studied.

Statistical analysis:

Qualitative indicators were determined by frequency and % value, and quantitative indicators were compared by mean value and standard deviation. Qualitative indicators were compared between groups using Fisher's exact test (F test), and before and after surgery using Wilcoxon's signed rank test. Quantitative characteristics were compared using Student's t-test. To compare groups, Student's t-test for an independent sample was used, and equality of variances was compared using Levene's test. Data before and after surgery were compared using Student's paired t-test.

The relative probability of remission was determined using multivariate regression analysis.

The diagnostic value of markers was determined using ROC analysis.

• The diagnostic value of markers was determined using ROC analysis.

• An indicator of the diagnostic accuracy of a test: Area of diagnostic accuracy.

• 0.9 – 1.0 excellent, 0.8-0.9 very good, 0.7-0.8 good, 0.6-0.7 satisfactory, 0.5-0.6 poor, < 0.5 test is unreliable.

The results were considered significant at $p < 0.05$.

Statistical analysis was performed using the SPSS 23 software package.

Results.

General characteristics of patients are given in Table 1.

84.6% of patients were city residents, most patients had a genetic predisposition to both diabetes mellitus (63 patients) and obesity (51 patients), most led a sedentary lifestyle (74.73%). The highest frequency of comorbid diseases was observed in fatty liver and dyslipidemia. All patients took antidiabetic drugs.

After the surgery, all patients reported weight loss: before the surgery 146.80 + 25.81, after the surgery 97.87 + 17.56. $t = 23.30$, $p < 0.0001$

Decrease in glucose levels and glycated hemoglobin was observed after the surgery (Table 2).

After surgery, the frequency of medication intake was significantly reduced. Insulin consumption is no longer observed among them.

The incidence of patients with glycosylated hemoglobin <5.7% increases significantly. and significantly reduces the incidence of patients with >6.4%.

Accordingly, the incidence of patients with fasting glucose levels of 100-125 mg / dL and < 100 mg/dL increased significantly, while the number of patients with >125 mg/dL decreased significantly.

At the next stage of the study, we divided the patients into two groups: group 1 included patients without complete remission, group 2 included patients with complete remission (glycosylated hemoglobin <5.7) (Table 3).

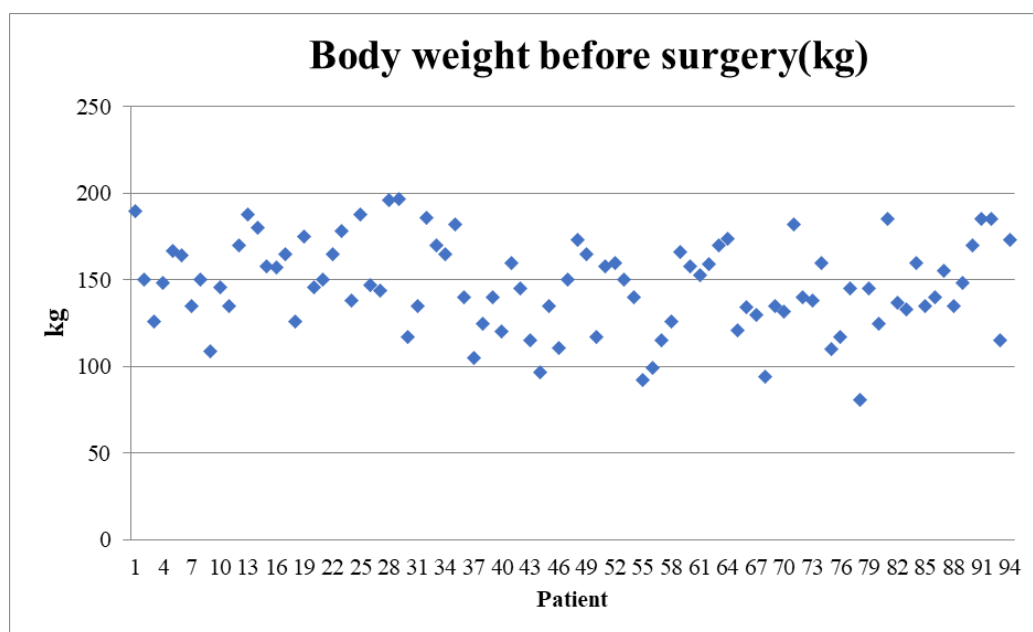


Figure 1. Before the operation, the weight ranged from 81 to 197 kg, the average weight was 146.80±25.81 kg.

Table 1. General characteristics of patients.

Factor groups	Patient characteristics	n	%
Gender	Female	50	54.95
	Male	41	45.05
Place of residence	City	77	84.62
	Village	14	15.38
Lifestyle	Sedentary	68	74.73
	Lightly active (1-3 times per week)	22	24.18
	Moderately active (4-5 times per week)	0	0.00
Genetic predisposition to obesity	From the mother's side	25	27.47
	From the father's side	15	16.48
	From both sides	23	25.27
Genetic predisposition to diabetes	From the mother's side	27	29.67
	From the father's side	13	14.29
	From both sides	11	12.09
Comorbidities	Sleep Apnea (before surgery)	35	38.46
	Fatty liver disease	88	96.70
	PCOS before surgery	2	2.20
	Dyslipidemia	66	72.53
	Thyreopathy	13	14.29
	Venous insufficiency (chronic)	2	2.20
	Arthropathy	2	2.20
	Cardiopathy	4	4.40
How many times a day did she/he eat (before surgery)?	once	4	4.40
	2 times	24	26.37
	3 times	46	50.55
	4 times	17	18.68
	Night eating	54	59.34
Type of food	Fatty	25	27.47
	Protein	25	27.47
	Complex Carbohydrates	78	85.71
	Energy Drinks	7	7.69
	Synthetic Drinks	46	50.55
Bad habits	Smokers	31	34.07
	Alcohol Consumers	10	10.99
Preoperative weight loss	<5%	61	67.03
	5%-10%	10	10.99
	Did not lose weight	20	21.98
Duration of T2DM	1 year	43	47.25
	1-5 years	26	28.57
	> 5 years	22	24.18
Antidiabetic treatment (before surgery)	Biguanides	87	95.60
	Sulfonylurea	20	21.98
	insulin	6	6.59
	DPP-4	15	16.48

Table 2. Changes in T2DM parameters after bariatric surgery.

Factors		Before the surgery		After the surgery		p
		n	%	n	%	
A/D medications	Biguanides	87	95.6	3	3.30	<0.0001
	Sulfonylurea	20	21.98	1	1.10	<0.0001
	insulin	6	6.59	0	0.00	0.0143
Glycated hemoglobin	<5.7%	9	9.89	70	76.92	<0.0001
	5.7-6.4%	14	15.38	14	15.38	1.0000
	>6.4%	68	74.73	6	6.59	<0.0001
Glycemia	100-125 mg / dL	17	18.68	30	32.97	0.0280
	<100 mg / dL	1	1.1	52	57.14	<0.0001
	>125 mg / dL	73	80.22	7	7.69	<0.0001

Table 3. Assessment of the characteristics of diabetes remission based on the patient's initial characteristics.

Factors		>5.7 (without complete remission) (n=21)		≤5.7 (with complete remission) (n=70)		F	p
		n	%	n	%		
Gender	Female	15	71.43	35	50.00	3.03	0.0852
	Male	6	28.57	35	50.00	3.03	0.0852
Place of residence	City	17	80.95	60	85.71	0.28	0.6006
	Village	4	19.05	10	14.29	0.28	0.6006
Lifestyle	Sedentary	14	66.67	54	77.14	0.93	0.3381
	Lightly active (1-3 times per week)	7	33.33	15	21.43	1.24	0.2688
	Moderately active (4-5 times per week)	0	0.00	0	0.00		
Genetic predisposition to obesity	From the to mother's side	4	19.05	21	30.00	0.96	0.3295
	From the father's side	4	19.05	11	15.71	0.13	0.7217
	From both sides	5	23.81	18	25.71	0.03	0.8621
Genetic predisposition to diabetes	From the mother's side	6	28.57	21	30.00	0.02	0.9013
	From the father's side	2	9.52	11	15.71	0.50	0.4826
	From both sides	2	9.52	9	12.86	0.17	0.6851
Comorbidities	Sleep Apnea (before surgery)	8	38.10	27	38.57	0.00	0.9691
	PCOS	1	4.76	1	1.43	0.82	0.3664
	Dyslipidemia	18	85.71	48	68.57	2.39	0.1254
	Thyreopathy	4	19.05	9	12.86	0.50	0.4826
	Venous insufficiency (chronic)	1	4.76	1	1.43	0.82	0.3664
	Arthropathy	0	0.00	2	2.86	0.60	0.4391
	Cardiopathy	1	4.76	3	4.29	0.01	0.9266
	Hypertension (before surgery)	19	90.48	56	80.00	1.21	0.2737
	Fatty liver (before surgery)	19	90.48	69	98.57	3.37	0.0697
Eating habits	mixed	21	100.00	70	100.00	-	-
	Vegetarian	0	0.00	0	0.00	-	-
How many times a day did she/he eat (before surgery)?	once	1	4.76	3	4.29	0.01	0.9266
	2 times	5	23.81	19	27.14	0.09	0.7643
	3 times	13	61.90	33	47.14	1.40	0.2401
	4 times	2	9.52	15	21.43	1.50	0.2241
	Night eating	11	52.38	43	61.43	0.54	0.4647
Type of food	Simple Carbohydrates	13	61.90	45	64.29	0.04	0.8444
	Fatty	7	33.33	18	25.71	0.46	0.4981
	Protein	7	33.33	18	25.71	0.46	0.4981
	Complex carbohydrates	20	95.24	58	82.86	2.02	0.1585
	Energy Drinks	0	0.00	7	10.00	2.28	0.1344
Bad habits	Smokers	6	28.57	25	35.7	1	0.36
	Alcohol Consumer	2	9.	52	8	11.	43
Preoperative weight loss	<5%	11	52.38	50	71.43	2.67	0.1057
	5%-10%	2	9.52	8	11.43	0.06	0.8092
	Did not lose weight.	8	38.10	12	17.14	4.24	0.0425
	100-125 mg / dL	1	4.76	19	27.14	4.87	0.0299
Glycemia (before surgery)	<100 mg / dL	0	0	1	0.14	0.30	0.5867
	>125 mg / dL	20	95.24	50	71.43	5.35	0.0230

As seen in the table, the group with complete remission had a significantly higher frequency of patients with a diabetes duration of less than one year. In contrast, the group without complete remission had a significantly higher frequency of patients who had not lost weight, had a diabetes duration of more than five years, and were taking sulfonylureas or insulin before surgery.

No more than 20 “Healthy Days” were observed before the surgery in the without complete remission group.

Evaluation of age and anthropometric characteristics non-remission and in remission groups are in Table 4.

There was no significant difference in weight and height after surgery.

Comparison of preoperative data in the remission group showed that the average weight was significantly higher, and the average age was significantly lower.

We estimated the relative probability of complete remission after surgery using regression analysis (Table 5).

Thus, the relative probability of complete remission based on preoperative factors increases with the patient's baseline weight and decreases with preoperative sulfonylurea and insulin use and Glycemia - Fasting glucose >125 mg /dL.

We examined the primary outcome of bariatric surgery, weight loss, 1 year after the surgery.

Comparison of weight loss between the remission and non-remission groups showed that the remission group had

significant weight loss compared to the other group (Table 6).

The result allowed us to consider weight loss as an independent predictor of remission. Using ROC analysis, we determined the sensitivity and specificity of weight loss as a predictor of remission after bariatric surgery (Figure 2 and Table 7).

As we can see, the area under the curve is 0.80, which means that the diagnostic value of weight loss as a predictor of complete remission is very good.

The test specificity is 0.857, the specificity is 0.714, the cutoff point is 37.5 kg.

This allows us to consider weight loss of more than 37.5 kg 1 year after the bariatric surgery as an independent predictor of remission.

Discussion.

Remission of diabetes without specific intervention is rare. A study conducted in the USA on 122,781 patients revealed that the 7-year remission rate was 1.60%, but it was higher (4.6%) in patients who had been diagnosed with diabetes for less than 2 years [9].

According to data from a study conducted in the UK, which involved 2,297,700 people with type 2 diabetes, only 1.7% met the criteria for remission. Those who had been diagnosed with diabetes for less than 1 year had a higher remission rate (2.87%) compared to those diagnosed for 3-5 years.

With a $\geq 10\%$ reduction in body mass index, the remission rate was 3.57 times higher compared to a $< 5\%$ reduction [10].

Table 4. Evaluation of age and anthropometric characteristics non-remission and in remission groups.

Factors	HbA1c >5.7 n = 21		HbA1c ≤5.7 n=70		t	p
	Mean	StD	Mean	StD		
Age before surgery	50.14	8.53	45.69	8.42	2.12	0.0366
Age Questionnaire: While filling it out	53.71	9.16	50.19	8.69	1.61	0.1105
Weight (before surgery) kg	132.62	31.75	151.06	22.29	-2.48	0.0197
BMI (kg / m2)	47.56	9.95	50.26	6.84	-1.42	0.1592
Weight (after surgery)	99.14	21.15	97.49	16.48	0.38	0.7066
BMI (after surgery)	35.45	7.21	33.19	5.15	1.60	0.1127

Table 5. Relative probability of complete remission after bariatric surgery.

Factors before surgery	B	S.E.	Wald	p	OR	95% C.I. OR	
						Lower	Upper
Weight(kg)	0.03	0.01	14.84	0.0001	1.03	1.02	1.05
Glycemia - Fasting >125 mg /dL (1)	-2.75	1.14	5.80	0.0160	0.06	0.01	0.60
Sulfonylurea (1)	-2.72	0.73	13.98	0.0002	0.07	0.02	0.27
Insulin (1)	-2.80	1.13	6.14	0.0132	0.06	0.01	0.56

Table 6. Comparison of weight loss between the remission and non-remission groups.

	No remission		Remission		t	p
	Mean	Standard Deviation	Mean	Standard Deviation		
Weight loss After surgery (kg)	32.52	21.06	53.57	17.19	-4.66	<0.0001

Table 7. Area under the curve.

Test result variables:			Asymptotic 95% Confidence Interval	
Area	Std. Error	p	Lower Bound	Upper Bound
0.801	0.065	<0.0001	0.681	0.931

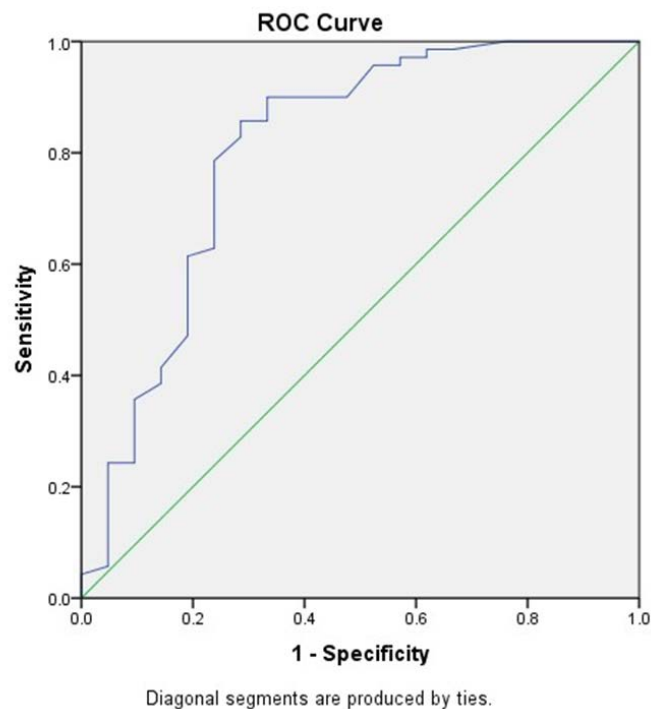


Figure 2. Using ROC analysis, we determined the sensitivity and specificity of weight loss as a predictor of remission after bariatric surgery.

The main risk factor for developing diabetes is obesity [11].

Available evidence suggests that bariatric surgery provides better resolution of T2DM in obese patients compared with best medical management alone [12,13]. According to our studies, after surgery, the frequency of antidiabetic medication use decreases, with insulin use no longer being required.

After bariatric surgery, the frequency of patients with a glycated hemoglobin level $<5.7\%$ significantly increases, while the frequency of those with a level $>6.4\%$ significantly decreases.

Accordingly, the incidence of patients with fasting glucose levels of 100-125 mg / dL and < 100 mg/dL increased significantly, while the number of patients with >125 mg/dL decreased significantly.

Bariatric/metabolic surgery significantly improves glycemic control in patients with T2DM and can lead to complete remission of T2DM in some patients [14].

According to our study, complete remission after bariatric surgery was observed in 76.9% of patients.

A multicenter study showed that the duration of T2DM ($p<0.0001$), the number of drugs for type 2 diabetes ($p=0.003$) and weight loss ($p=0.048$) were the only independent factors for long-term remission of T2DM [15]. Our data confirmed the negative impact of insulin and sulfonylurea administration before bariatric surgery on remission.

According to other studies, preoperative insulin therapy, duration of type 2 diabetes, age, and high glycated hemoglobin A1c (HbA1c) levels were associated with lower rates of type 2 diabetes remission. In contrast, residence in a medium-size town and percentage of total weight loss were associated with higher remission rates [16]. Immediate post-operative effects, independent of weight loss, along with the weight loss itself,

can lead to remission of type 2 diabetes in up to 80% of patients [17]. According to our data, weight loss as a predictor of complete remission shows high sensitivity and specificity when the weight loss is more than 37.5 kg.

Conclusion.

- Bariatric surgery in patients with type 2 diabetes promotes long-term remission of diabetes.
- Positive predictor of complete remission is the patient's initial weight before bariatric surgery. Treatment and high glycemia (fasting >125 mg/dL) before surgery reduce the relative probability of complete remission.
- Weight loss as a predictor of complete remission shows high sensitivity and specificity (cutoff value = 37.5kg).

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