**The effect of longitudinal gastric resection in morbid obesity surgery on the course of insulin-dependent diabetes and gastroesophageal reflux disease**


## Abstract

Longitudinal resection of the stomach is a relatively new type of gastroplasty within the framework of bariatric surgery, which is gaining popularity worldwide today not only as a method of getting rid of excess subcutaneous fat, but also from a range of serious chronic diseases together. The potential of longitudinal gastric resection turned out to be promising, and if the first performed longitudinal gastric resection in 1988 was only a restrictive stage of biliopancreotic bypass surgery, then since the 2000s, laparoscopic longitudinal resection has been started as a deliberately first stage in patients with morbid obesity with high operational risk. To date, longitudinal gastric resection has become increasingly used in particularly difficult cases in the form of independent surgical intervention, for example, in the elderly, teenagers, people with cirrhosis of the liver and other severe pathologies. At the initial stages of the formation of this type of treatment, different surgeons did not have a common opinion on many issues related to the technique of this operation. And therefore, to date, the data on the longitudinal resection of the stomach of many years ago are contradictory. They do not create a holistic view of the effectiveness of surgical intervention, especially in the long term. According to IFSO (The International Federation for the Surgery of Obesity and Metabolic Disorders) data, in 2012, longitudinal gastric resection accounted for 27.8% of all bariatric operations, which even then overtook the gastric banding operation in terms of the number of operations. Over the past 20 years, a little more than 250 thousand such operations have been performed worldwide, and the frequency of performing longitudinal gastric resection increases every year.

The purpose of this article is to reveal the statistics of the effectiveness of longitudinal gastric resection.

**Keywords**: *longitudinal gastric resection, obesity, gastroesophageal reflux disease, type II diabetes mellitus*

## Introduction

To date, a lot of data has been collected on the results of the effects of longitudinal gastric resection on the body not only in the postoperative period, but also in the long term on the entire body as a whole, despite the fact that many sources are contradictory due to the lack of a unified technique [1]. However, regardless of the path of this surgical intervention, a common link plays an important role in these results – the characteristics of the patient contingent. Despite the fact that the initial data on this cohort of patients may vary greatly for each surgical group, it should be remembered that the results may be different due to the high body mass index and concomitant pathologies [1-3].

The data on the long-term results of longitudinal gastric resection are even less systematized, considering that the first operations were performed only 20 years ago, and their serial execution began 10-15 years ago in conditions of different opinions of surgeons regarding the understanding of indications for longitudinal gastric resection and technique. The results of some individual mid-term studies and meta-analysis are presented in Table 1.

Table 1. Excess weight loss (%EWL) after longitudinal gastric resection

| Research | Number of patients | Observation period, months | %EWL |
|---|---|---|---|
| **Hamoui** | 118 | 24 | 47,3 |
| **Himpens** | 40 | 36 | 66 |
| **Lee et al.** | 216 | 24 | 59 |
| **Nocca** | 163 | 24 | 61,5 |
| **Ou Yang** | 138 | 24 | 46 |
| **Uglioni** | 41 | 36 | 60 |
| **Meta-analysis of Stacy** | 2570 | 3-60 | 33-85 (av. 55,4) |

*Santoro* cites data from 8 years of experience of longitudinal gastric resection as an independent operation with %EVL of 84.55 and 50% after 12

months, 5 and 6 years, respectively. *Arias* reports 68% EWL after 24 months and claims that these results are no worse than with other bariatric surgeries. *Himpens* presented 6-year results of longitudinal gastric resection. %EWL after 3 years was 77.5%, and after 6 years - 53.3%. Despite some weight recovery, as well as the presence of gastroesophageal reflux in a certain percentage, patients were satisfied with the results of therapy [4-7].

## 1. Results of longitudinal gastric resection in patients with morbid obesity

From 2003 to 2012, in the company "Center for Endosurgery and Lithotripsy" (Moscow, Russia), gastric longitudinal resection was performed in 161 patients aged 16 to 65 years (average age 38.5 years) [8, 9]. The average body weight of patients was 116.5±21.1 kg, the average body mass index was 41.3±7.8 kg/m$^2$. Longitudinal resection of the stomach via laparotomy was performed in 25 patients (15.5%). As a rule, these were persons in whom longitudinal gastric resection was performed with abdominoplasty or herniation at the same time [10].

From observations, a significant factor is the low mortality of patients: there were no cases of postoperative hospital mortality, with the exception of one patient who died 6 months after longitudinal gastric resection from an acute heart attack. A decrease in body weight was observed in 100% of patients. To evaluate the results in terms of weight loss, the percentage of excess body weight loss (%EWL) was estimated, determined by the formula:

$$\%EWL = (W_{in} – W_a) / (W_{in} – W_{id}) * 100\%,$$

where $W_a$ is the actual body weight, $W_{in}$ - initial body weight, $W_{id}$ - ideal body weight, determined by the Metropolitan Life Insurance Company (1983).

The effectiveness of longitudinal gastric resection in terms of reducing excess body weight is presented below according to the works of Y.I.Yushkov [11], which consisted in monitoring patients for 4 years after longitudinal gastric resection (Figure 1):

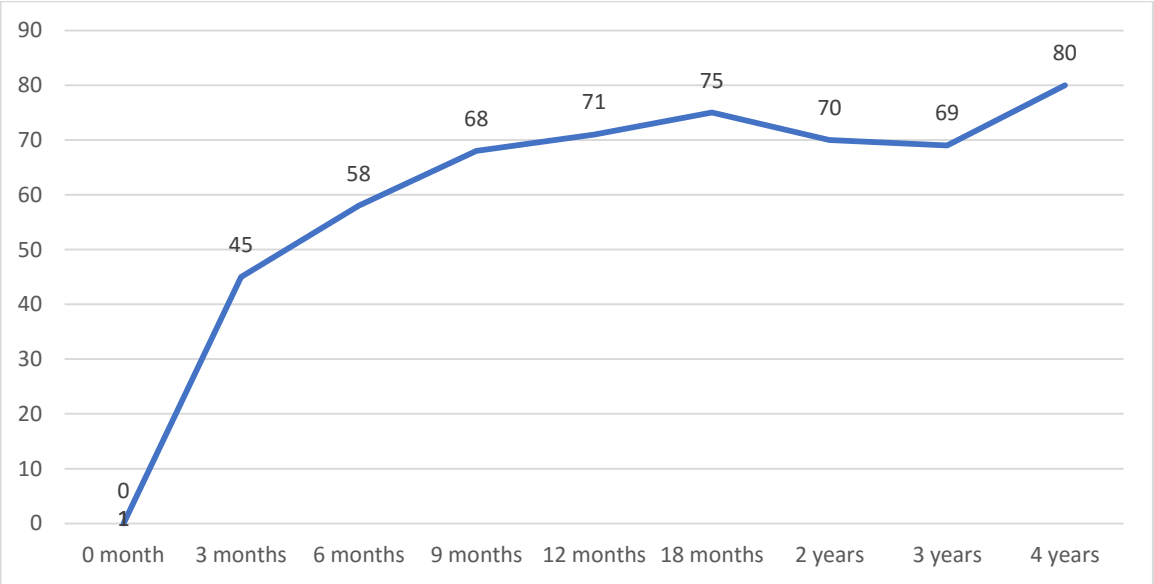


Figure 1. Percentage of excess body weight loss (%EWL) after longitudinal gastric resection during follow-up up to 4 years (according to Y.I.Yushkov)

From the analysis of scientific data, it follows that stabilization of body weight occurs approximately 12 months after surgery in almost all patients. The maximum loss of excess body weight in 47 patients who had body weight stabilization was 76.4%, in the final follow-up period in this group, %EWL was 69.9. The rate of excess body weight loss also varies from 50 to 70% of the initial weight for 12 months, however, cases of extremely rapid weight loss after longitudinal gastric resection have become increasingly recorded (2020-2021). A case of longitudinal gastric resection was registered in March 2021, when the patient lost 120% of the planned body weight loss within 6 months after surgery (but it is necessary to take into account the fact of repeated longitudinal gastric resection on the second day after the first operation due to suture failure and prolonged postoperative recovery) [12-15].

In the long term, after longitudinal resection of the stomach, almost 7% of patients have the appearance of gastroesophageal reflux disease, which required prolonged treatment with proton pump inhibitors, 4.5% have cholelithiasis [16].

## 2. Laparoscopic longitudinal gastric resection with double transit in the treatment of obesity in combination with insulin-dependent diabetes and gastroesophageal reflux disease

According to WHO (The World Health Organization), more than 300 million people in the world suffer from diabetes and every year there are more and more patients. 90% of people have excess body weight, which is the main cause of diabetes. The advantage of longitudinal gastric resection is its effectiveness in mild forms of type 2 diabetes mellitus and moderate manifestations of dyslipidemia [17].

According to V.V.Anishchenko, laparoscopic longitudinal resection of the stomach with double transit is an effective operation for the treatment of patients with obesity, type II diabetes mellitus and gastroesophageal reflux. The pronounced antimetabolic result of the operation in combination with the antireflux effect gives encouraging results, however, a small sample of patients and the absence of long-term observations certainly determines the need for further study of this phenomenon [18].

V.V.Fedenko published the results of his work in which he analyzed the effectiveness of laparoscopic sleeve resection of the stomach and laparoscopic gastric bypass surgery in patients with type 2 diabetes mellitus and impaired glucose tolerance [19-21]. After that, he and his team concluded that performing bariatric surgical interventions in patients with obesity and associated carbohydrate metabolism disorders, as in the scope of bariatric operations, is highly effective and safe. Indications for the use of a particular technique can be determined individually, taking into account the severity of the associated pathology and the expected results of surgical treatment. This conclusion was confirmed based on a comparative analysis of the results of laparoscopic sleeve resection of the stomach in the proposed antireflux modification (183 operations) and laparoscopic gastric bypass (37 operations), where the frequency of postoperative complications was 4.37 and 10.81% ($p>0.05$). 12 months after the operation, the loss of excess body weight was equal to 69.9±31.5 and 73.7±42.9% ($p>0.05$). The proportion of

patients with complete remission of carbohydrate metabolism disorders was 83.1 and 75.7% ($p>0.05$), respectively. 18 months after surgery, differences in the loss of excess body weight became statistically significant in favor of gastric bypass surgery (76.2% vs. 86.3%, $p<0.05$).

**Conclusion**

Bariatric surgery, in particular gastric longitudinal resection, is an effective method of treating patients with morbid obesity. Despite the high risk of this operation, its technique is being improved every year, and helps patients not only in the fight against excess body weight, but also with diseases such as type 2 diabetes mellitus, gastroesophageal reflux disease, dyslipedemia, which confirms a large array of data accumulated over more than 20 years of existence of this type of operation.

**COMPETING INTERESTS DISCLAIMER:**

**Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.**

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