

Application of The X-Ray to Assess The Structural and Functional Restrictions of The Gastrointestinal Tract in The Postoperative Period of Bariatric Interventions

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Abstract: Obesity is one of the most significant challenges that needs to be addressed in contemporary healthcare. As per the World Health Organization, now more than 700 million people are obese all over the world and it keeps getting worse. In Uzbekistan, (where the) 24-30% of population have obesity and 3-4% have morbid adiposity.

Keywords: Multispiral computed tomography, bariatric surgery, postoperative complications, structural and functional changes, gastrointestinal tract, obesity, sleeve gastrectomy, gastric shunting.

Introduction

Bariatric surgery is considered to be the most efficacious treatment for morbid obesity, resulting in sustainable weight loss and resolution of co-morbidities [1, 2]. In Uzbekistan, number of bariatric surgeries have risen more than tenfold since the early 2010s to reach 5,000 per year in 2026 [3]. Laparoscopic longitudinal gastrectomy and gastric bypass are the most frequently performed bariatric procedures accounting for more than 80% of cases [4]. They have a profound impact on the anatomy and physiology of the gut and are associated with an increased need of follow-up.

Postoperative complications occur in 10-25% of cases, such as suture dehiscence, stenosis, haemorrhage, reflux esophagitis and syndrome of excessive bacterial growth [5-6]. Early detection of complications is essential for early treatment and to avoid severe sequelae. Radiological techniques, such as general radiography, contrast radioscopy and barium passage are classically central in the diagnosis of GI diseases. Despite the development of modern imaging methods such as multispiral computed tomography and magnetic resonance imaging, radiological studies remain relevant due to their high informativeness, accessibility, and relatively low cost [7,8].

The issues of using radiological methods to assess long-term structural and functional changes after bariatric surgeries have not been sufficiently covered in the literature. Most research focuses on the diagnosis of acute complications, while the patterns of adaptive restructuring of the gastrointestinal tract remain poorly understood [9,10].

Purpose of the study: to assess the diagnostic capabilities of radiological methods in identifying and monitoring structural and functional restructuring of the gastrointestinal tract in the postoperative period of bariatric interventions.

The study included 86 patients who underwent bariatric surgeries from January 2022 to December 2026, of which sleeve gastrectomy was performed in 47 patients (54.7%), gastric bypass - in 39 patients (45.3%). Demographic characteristics: age 18-65 years (average 42.3 ± 11.2 years), women 65 (75.6%), men 21 (24.4%), initial BMI 35-58 kg/m² (average 43.8 ± 6.4 kg/m²). Dynamic observation was conducted: after 1 month in 86 patients, 6 months in 80, 12 months in 69, 24 months in 54, 36 months in 31 patients.

Radiological diagnostics of structural and functional changes after bariatric surgeries is a complex of radiation research methods aimed at identifying and monitoring anatomical and physiological restructuring of the gastrointestinal tract in patients with morbid obesity in the postoperative period. The diagnostic program involves multiple radiological imaging modalities using contrast medium to show the disfigured anatomy of the gastrointestinal system. The research were performed in patients who had underwent most popular bariatric operations and its laparoscopic version (longitudinal gastric resection / sleeve gastrectomy) and gastric bypass, carried out at successive periods of the postoperative period.

Materials and Methods

The routine examination method includes step by step radiography, that is, imaging or visual radiography of abdominal organs in vertical and horizontal positions to diagnose free gas, intestinal obstruction and the position of foreign bodies. Contrast radiography is performed differentially: in the first 3 days -water-soluble contrast medium (urographin, gastrographin), after a month and later barium sulfate 100-150 ml. The examination is conducted in the following way: assessment of the primary state (on an empty stomach), initial contrast dose 20-30 ml, polyposition testing, additional doses of contrasts 20-30 ml, functional tests. If intra-intestinal transit disorder is suspected, barium enters small intestine (Barosipase total amount of 200-300 ml) and X-rays are taken 1 hour, 2 hours, 4 hours and 6 hours later until it appears in the leakage pouch. The evaluated parameters included anastomosis permeability, the shape and size of the gastric tube or small ventricle, evacuatory function with determination of half-evacuation time, presence of reflux, and peristaltic activity.

Results and Discussion

Morphometric measurements for the SG group: maximum diameter of the gastric tube, diameter in the area of the gastric angle and antral section, total length of the gastric tube; for the GB group: diameter of the lesser ventricle, gastrojejunal and jejunojejunal anastomoses, length of the alimentary loop.

Statistical processing was carried out in the SPSS 26.0 program using descriptive statistics, Pearson's correlation analysis, Student's t-test, χ^2 criterion at a significance level of $p < 0.05$.

Radiological changes after bariatric surgeries are a complex of structural and functional restructuring of the gastrointestinal tract, detected during radiation diagnostics at various stages of the postoperative period in patients after surgical treatment of morbid obesity. Radiological changes are based on the adaptive reaction of the digestive system to a radical change in the anatomy of the gastrointestinal tract. The process is based on the surgical reconstruction of the gastrointestinal tract in the form of longitudinal gastric resection (sleeve gastrectomy) or the creation of a gastrojejunal anastomosis (gastric bypass), which leads to the formation of new anatomical and physiological relationships between various parts of the digestive system.

Typical radiological manifestations of normal adaptation are observed in the early postoperative period (1-3 months) after sleeve gastrectomy, the gastric tube has a characteristic "banana" shape with a

uniform diameter along its entire length of 2.5-3.5 cm, the contrast freely passes into the duodenum, the half-evacuation time is 15-25 minutes. (Figure 1).

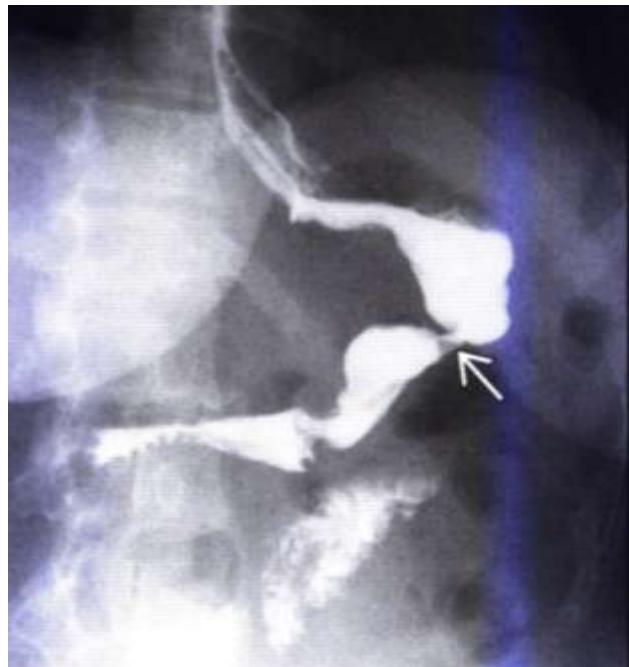


Figure 1. Sleeve resection of the stomach, in which 75% of the stomach is removed by cutting it along the length of the axis. The remaining part of the stomach in the form of a "banana" has a volume of about 100 ml. On a standing radiograph of a patient who recently underwent a sleeve gastric resection, a reduced stomach in the form of a "banana" is visualized, with a narrowing at the end of the suture line in a limited area. Such strictures are usually "soft" and transient, even if balloon dilatation was required in this case.

After gastric bypass, the small ventricle acquires a rounded shape with a diameter of 2-3 cm, a volume of 20-30 ml, a gastrojejunral anastomosis with a diameter of 8-12 mm provides free contrast passage, the alimentary loop fills in 2-5 minutes. After 6-12 months, a slight expansion of the gastric tube to 3.5-4.5 cm in the fundus region is observed as a normal adaptation, and the half-evacuation time increases to 25-35 minutes. During the stabilization period (6-12 months), normalization of anastomosis patency and optimal evacuation function are observed. Adaptive changes develop in 198 patients (80.2%), including compensatory dilatation and functional restructuring.

Objectively, compensatory dilatation is observed after SG, manifested in the dilation of the gastric tube after 12-18 months with an increase in diameter by 15-25%, after GB - the expansion of the alimentary loop of the small intestine to 3-4 cm compared to the norm of 2-2.5 cm. In most patients, functional changes develop: slowing of evacuation with an increase in the half-evacuation time by 20-40%, a decrease in the amplitude of peristaltic waves by 30-50%, compensatory enhancement of small intestine motility. Pathological changes include stomach tube dilation in 23 patients (17.2% of the SG group) with a diameter of >6 cm after 18-24 months, correlating with weight recurrence ($r=0.73$, $p<0.001$) and the need for revision surgery in 34.8% of cases. Anastomotic stenosis develops in 15 patients (13.3% of the GB group) with a gastrojejunral anastomosis diameter of <6 mm and a contrast delay in the small ventricle of >45 minutes. Early complications are represented by joint failure (8 cases, 3.2%) with contrast leakage beyond the gastrointestinal tract lumen, radioscopy sensitivity is 94.2%, specificity 98.7%. Late complications included reflux esophagitis in 34 patients (25.4% of the SG group) with contrast ejection into the esophagus, correlating with a Giss angle of $>120^\circ$ ($r=0.68$, $p<0.001$), and excessive bacterial growth syndrome in 28 patients (24.8% of the GB group) with contrast segmentation in the small intestine and delayed passage to the cecum for >6 hours. The temporal dynamics are characterized by four periods: primary adaptation (1-3 months) with tissue swelling and delayed

evacuation, stabilization of function (6-12 months), compensatory changes (12-24 months), and a period of possible complications (>24 months) with a risk of pronounced dilatation, reflux, and stenosis. Comparative analysis showed the sensitivity of radioscopy in diagnosing stenosis at 89.7% (compared to 95.2% in endoscopy and 78.3% in CT), reflux at 92.3% (compared to 88.1% and 65.4%, respectively), with excellent evaluation of function and low cost of research.

Conclusion

Thus, radiological methods demonstrate high diagnostic effectiveness in identifying complications of bariatric surgeries: anastomotic failure (sensitivity 94.2%), stenosis (89.7%), reflux (92.3%). Specific patterns of structural and functional restructuring have been identified: compensatory intestinal dilatation after GB, adaptive dilation of the gastric tube after SG after 12-18 months. Radiological predictors of surgical failure have been established: stomach tube dilation >6 cm correlates with weight recurrence ($r=0.73$) and the need for revision. Radioscopy retains unique advantages in functional diagnostics, providing real-time assessment of evacuatory function and peristalsis. The economic efficiency and accessibility of radiological methods make them optimal for routine monitoring of patients after bariatric surgeries.

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