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CLINICAL AND PATHOMORPHOLOGICAL BASES FOR OPTIMIZING GASTRIC RESECTION IN BARIATRIC SURGERY

Akbarov Farrux Saydalievich
Andijan State Medical Institute
https://orcid.org/0009-0008-1146-4165

Abstract: The study evaluates clinical and pathomorphological parameters influencing optimization of gastric resection during sleeve gastrectomy. Analysis of gastric wall structure, endocrine cell distribution, and regional morphological variations demonstrates that individualized resection improves surgical precision, reduces complications, and enhances metabolic outcomes.

Keywords: sleeve gastrectomy, bariatric surgery, gastric resection, pathomorphology, ghrelin cells, obesity.

Introduction

Obesity has emerged as one of the most significant global public health challenges of the 21st century, with its prevalence steadily increasing across all age groups and socioeconomic strata. According to international metabolic and bariatric surgery reports, the prevalence of severe obesity continues to rise despite numerous preventive initiatives and lifestyle interventions, making surgical treatment a necessary option for many patients [1]. Bariatric surgery has therefore become the most effective long-term treatment modality for morbid obesity, offering substantial and sustained weight loss as well as improvement or remission of obesity-related comorbidities such as type 2 diabetes mellitus, hypertension, and dyslipidemia [1,2].

Among various bariatric procedures, laparoscopic sleeve gastrectomy (LSG) has gained widespread acceptance due to its relative technical simplicity, preservation of gastrointestinal continuity, low complication rates, and favorable metabolic outcomes [2,3]. Originally introduced as a component of biliopancreatic diversion with duodenal switch, LSG has evolved into a standalone procedure and is now one of the most frequently performed bariatric operations worldwide [3,4]. Despite its popularity, several key technical aspects of LSG remain the subject of ongoing debate—particularly the optimal extent and anatomical level of gastric resection, choice of stapler height, and the ideal width of the resulting gastric sleeve [2,4,7].

Recent studies emphasize that regional variations in gastric wall morphology significantly influence surgical decision-making during sleeve gastrectomy. The stomach demonstrates substantial differences in wall thickness, vascular architecture, and connective tissue content between the antrum, corpus, and fundus. For example, the antral region consistently presents the greatest wall thickness, whereas the fundus is the thinnest and most prone to mechanical complications such as staple-line failure [6,8]. These morphological characteristics directly affect the selection of stapler cartridges and the pressure distribution along the staple line, which in turn influence operative safety and postoperative complication rates, notably hemorrhage and leaks [7,12].

Another critical factor is the distribution of ghrelin-producing endocrine cells, which are predominantly located in the gastric fundus. Resection of this region leads to a sharp decline in

circulating ghrelin levels, contributing to appetite suppression and metabolic benefits observed after LSG [9,14,15]. Thus, anatomical and endocrine considerations must be balanced to ensure the optimal metabolic effect without compromising surgical safety.

Furthermore, individual differences in submucosal fibrosis, vascular patterns, and tissue elasticity may increase resistance during stapling and predispose patients to complications if not taken into account [8,12]. Understanding these pathomorphological variations is essential for tailoring the resection line and selecting adequate instrument parameters. Using morphological criteria to guide resection has been shown to reduce staple-line compromise and leaks, which remain among the most feared complications following LSG [7,10].

Given these factors, there is a growing emphasis on integrating clinical parameters with detailed pathomorphological assessment of gastric tissue to optimize surgical technique. Such an approach may enhance operative precision, reduce intra- and postoperative risks, and improve overall patient outcomes. Therefore, the present study aims to investigate the clinical and pathomorphological bases for optimizing gastric resection during sleeve gastrectomy and to identify morphological parameters that should be considered when determining the ideal resection strategy.

Materials and Methods

A prospective study was conducted on adult patients with morbid obesity undergoing sleeve gastrectomy. Preoperative assessment included anthropometric measurements, metabolic status, and comorbidity evaluation. A standardized surgical technique was applied. Gastric tissue samples from the fundus, corpus, and antrum were examined using routine histological and immunohistochemical methods. Morphometric parameters and endocrine cell density were quantitatively analyzed. Statistical evaluation was performed to identify correlations between morphological features and clinical indicators.

Results

Marked regional differences in gastric morphology were identified. The antral wall was significantly thicker than the fundus, while the fundus exhibited the highest density of ghrelin-producing cells. Variability in submucosal fibrosis and vascular patterns was observed across patients. Morphological features demonstrated a measurable association with operative difficulty and postoperative complications. Optimization of resection based on these parameters resulted in improved staple-line integrity and favorable early metabolic responses.

Discussion

The findings highlight the relevance of stomach morphology in determining the optimal resection line during sleeve gastrectomy. The thin fundic wall and concentration of ghrelin-secreting cells support precise proximal resection to achieve metabolic benefits. Thicker antral tissue necessitates appropriate stapler selection to avoid mechanical failure. Fibrotic changes may increase resistance during stapling and require intraoperative adjustment. Incorporating pathomorphological characteristics into surgical planning enhances the safety and efficacy of bariatric interventions.

Conclusion

The findings of this study demonstrate that the optimization of gastric resection during sleeve gastrectomy requires a comprehensive integration of clinical indicators and detailed pathomorphological characteristics of the stomach. Significant regional differences in gastric wall thickness, vascular organization, connective tissue composition, and endocrine cell distribution reaffirm that the stomach is not a uniform organ; rather, it requires a differentiated surgical approach for safe and effective resection.

The identification of the fundus as the thinnest gastric region with the highest density of ghrelin-producing cells confirms its central role in achieving the metabolic efficacy of sleeve gastrectomy. Precise resection of this segment contributes to appetite suppression and enhanced metabolic benefits. Meanwhile, the markedly thicker antral wall emphasizes the need for appropriate stapler height selection to avoid mechanical complications associated with incomplete compression. Variations in submucosal fibrosis and tissue rigidity further underline the necessity of real-time intraoperative judgment and individualized adjustments to the resection technique.

The study also highlights that morphological features of the stomach correlate with operative difficulty, likelihood of staple-line compromise, and early postoperative complications. Incorporating these parameters into surgical planning can reduce the incidence of leaks, minimize intraoperative bleeding, and improve early postoperative recovery. Moreover, a morphology-guided approach contributes to more predictable outcomes in weight reduction and metabolic improvement.

Overall, the results support the concept that individualized, morphology-informed sleeve gastrectomy is superior to a one-size-fits-all technique. Surgeons should consider patient-specific factors—including gastric wall structure, endocrine cell localization, fibrosis, and vascular variations—when determining the resection line and selecting surgical instruments. Future research should focus on developing standardized morphological assessment protocols, integrating advanced imaging and intraoperative technologies, and validating morphology-based surgical algorithms in larger, multi-center patient populations.

In conclusion, the integration of clinical and pathomorphological data provides a solid scientific foundation for optimizing gastric resection strategies in bariatric surgery. This individualized approach enhances the safety, metabolic effectiveness, and long-term outcomes of sleeve gastrectomy and represents a progressive step toward precision bariatric surgery.

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