Український журнал клінічної хірургії
The Ukrainian Journal of Clinical Surgery

Ukrainian Journal of Clinical Surgery. 2025 July/August; 92(4):40-44
DOI: 10.26779/2786-832X.2025.4.40

Treatment outcomes and quality of life of patients after esophagectomy with simultaneous reconstruction using different gastric grafts

E. A. Shudrak[1], A. V. Horodetskyi[1], Y. A. Dibrova[2], A. A. Shudrak[1], Y. M. Kondratskyi[1], N. O. Koval[1], O. Y. Dobrzhanskyi[1], A. V. Kolesnyk[1], M. O. Pepenin[1], E. O. Kozak[1], V. O. Turchak[1]

[1]National Cancer Institute, Kyiv,
[2]Bohomolets National Medical University, Kyiv

Результати лікування та якість життя пацієнтів після езофагектомії з одномоментною реконструкцією за допомогою різних шлункових трансплантатів

Є. А. Шудрак[1], А. В. Городецький[1], Ю. А. Діброва[2], А. А. Шудрак[1], Ю. М. Кондрацький[1], Н. О. Коваль[1], О. Ю. Добржанський[1], А. В. Колесник[1], М. О. Пепенін[1], Є. О. Козак[1], В. О. Турчак[1]

[1]Національний інститут раку, м. Київ,
[2]Національний медичний університет імені О. О. Богомольця, м. Київ

Abstract

Objective. To compare short–term postoperative outcomes and quality of life in patients after esophagectomy with simultaneous reconstruction using different gastric grafts.

Materials and methods. A prospective single–center cohort study included 195 patients with resectable esophageal or esophagogastric junction cancer who underwent Lewis esophagectomy with restoration of digestive tract continuity using different gastric grafts. The primary endpoints were the incidence of anastomotic failure, intrathoracic complications, mortality, length of hospital stay, and quality of life according to the European Organization for Research and Treatment of Cancer QLQ–OES18 scale.

Results. The best results were obtained with a typical gastric graft: fewer complications (31.6%), shorter hospital stay (15.3 ± 4.5 days), and better quality of life, especially in terms of dietary restrictions (p=0.01). Although statistical significance was not achieved for all indicators, a stable trend in favor of this reconstruction option was observed.

Conclusions. The option of simultaneous reconstruction after esophagectomy using a typical gastric graft is optimal: the clinical course of the disease and functional results are better than with other options.

Keywords: esophagectomy; gastric transplant; quality of life; anastomosis; QLQ–OES18 scale.

Esophageal cancer ranks ninth among the most common malignant neoplasms and sixth among the leading causes of cancer death worldwide [1]. It is one of the most aggressive forms of cancer, causing a significant global epidemiological burden. Despite the development of multimodal treatment strategies, including chemoradiotherapy and surgery, the overall 5–year survival rate remains low (between 15% and 20%) and varies significantly depending on the location of the tumor [2].

The standard treatment for resectable esophageal cancer is neoadjuvant chemoradiotherapy followed by esophagectomy, which remains the only radical treatment for localized and regionally advanced disease [3–6]. At the same time, the frequency of complications after esophagectomy ranges from 20 to 80%, including both systemic complications (e.g., pneumonia) and those specific to surgical intervention, such as anastomotic failure and graft necrosis. The most common pulmonary complications (16–67%), while anastomotic failure, although less frequent (0–40%), is considered the most serious complication [7–11].

The preferred method of reconstruction after esophagectomy is the formation of an anastomosis between the remnant of the esophagus and the stomach, which has a reliable blood supply [3, 10, 12, 13]. Although gastric transplantation is recognized as the "gold standard" for single–stage reconstruction, the optimal technique for its formation remains a subject of debate [14]. In clinical practice, various types of gastric grafts are used: whole stomach, subtotal stomach, typical gastric tube, as well as special configurations, such as a cone–shaped gastric graft [12, 15–18].

Some studies have looked at the pros of these techniques, but there's not much of a comprehensive comparison of the different types of intestinal transplants.

The aim of the study was to compare short–term postoperative outcomes and quality of life in patients after esophagectomy with simultaneous reconstruction using different gastric grafts.

Materials and methods

This is a prospective cohort study conducted at a single center, the National Cancer Institute (Kyiv), from January 1, 2018, to March 31, 2024. During the study period, 321 patients were evaluated for inclusion criteria. Written informed consent to participate in the study was obtained from 235 patients, but 23 patients were excluded from the study due to disease progression, and contact was lost with 17 patients. Thus, 195 patients with resectable carcinoma of the thoracic esophagus or esophagogastric junction who underwent Lewis esophagectomy with reconstruction of the digestive tract using a gastric graft were included in the study.

Criteria for inclusion of patients in the study: age 18 years and older, presence of locally advanced non–metastatic esophageal cancer (stages T1–T3N0–N3M0) confirmed by histology, and a multidisciplinary committee decision for radical surgical treatment. Patients with a history of upper abdominal surgery, synchronous malignant neoplasms, or those requiring colo l reconstruction were excluded.

Most of the study participants were men – 138 (70.8%), while women accounted for 57 (29.2%). The average age of patients was (61.7 ± 11.5) years. Of the 193 (99.0%) patients who received neoadjuvant treatment, 14 (7.2%) received only chemotherapy, and 179 (91.8%) received chemoradiotherapy. Only 2 (1.0%) patients did not receive preoperative therapy.

Depending on the type of transplant (*Fig. 1*), patients were divided into three groups. Group 1 included 62 (31.8%) patients who underwent subtotal gastrectomy, group 2 included 79 (40.5%) patients who underwent typical gastric tube gastrectomy, and 54 (27.7%) patients in whom a cone–shaped gastric tube was used. A statistically significant ($p = 0.023$) association was found between the type of graft and the postoperative morbidity rate.

All operations were performed by experienced thoracic surgeons according to standardized protocols. In all patients, the Lewis technique was used with the formation of an intrathoracic esophagogastric anastomosis end–to–side (manual or combined). The choice of graft formation technique was based on maximum preservation of blood supply.

Hybrid esophagectomy according to Lewis (+ thoracotomy) was performed in 97 (49.7%) patients, completely minimally invasive esophagectomy in 13 (6.7%), and open surgery in 85 (43.6%). Multivisceral resection was performed in 42 (21.5%) patients and was also associated with a higher risk of complications ($p = 0.036$). Multivisceral resection was not performed in 153 (78.5%) patients.

All patients received standardized perioperative treatment, including early enteral nutrition via jejunostomy, early mobilization, and control of anastomotic integrity by endoscopy or contrast radiography. The primary endpoints were the incidence of anastomotic failure (assessed according to ECCG criteria) and intrathoracic complications (pneumonia, pleurisy, empyema). Secondary endpoints were the need for reintervention (endoscopic or surgical), 30–day mortality, and quality of life of patients.

Quality of life was assessed using the European Organization for Research and Treatment of Cancer (EORTC) QLQ–OES18 questionnaire at 3 months after surgery during scheduled visits or structured telephone interviews conducted by trained staff. If necessary, patients were assisted in completing the questionnaires. The QLQ–OES18 questionnaire consists of 18 questions grouped according to six symptoms: dysphagia (5 questions, Q31–Q35); dietary restrictions (4 questions, Q36–Q39); dry mouth/change in taste (2 questions, Q40–Q41); cough and difficulty swallowing saliva (2 questions, Q42–Q43); reflux (2 questions, Q44–Q45); pain and discomfort (3 questions, Q46–Q48).

All responses were rated on a four–point Likert scale, followed by a 0–100 point scale. Higher scores indicated

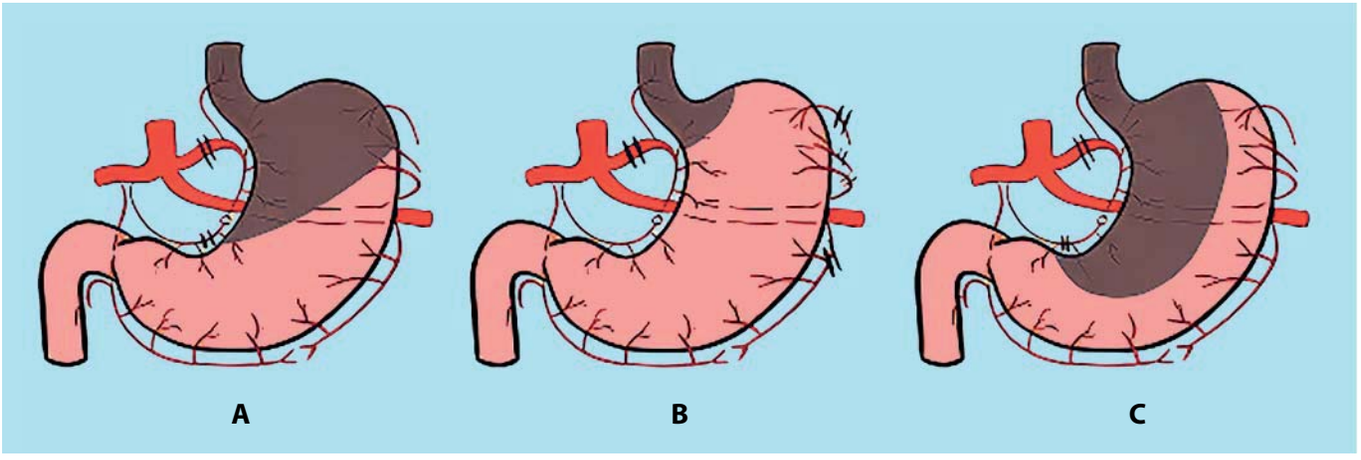

Figure 1.
Schematic representation of gastric grafts used for one-stage reconstruction after esophagectomy: A - conical gastric tube; B - subtotal stomach; C - typical gastric tube.

greater symptom severity, except for dysphagia, where higher scores indicated better swallowing function.

Data were collected prospectively and stored in a secure REDCap database. Statistical analysis was performed using SPSS version 28.0 (IBM Corp., Armonk, New York, USA). Continuous variables are presented as mean ± standard deviation (SD), categorical variables as absolute values with corresponding percentages. To compare groups, we used one–way analysis of variance (ANOVA) for continuous variables and the chi–square test or Fisher's exact test for categorical variables. A two–tailed p–value of <0.05 was considered statistically significant.

In order to minimize selection and observation bias, the criteria for patient inclusion in the study were strictly adhered to and standardized data collection procedures were used. Multivariate logistic regression models were constructed to correct for potential confounders such as age, comorbidities, clinical tumor stage, body mass index, and neoadjuvant therapy.

Results

The frequency of anastomotic failure was lowest (16.7%) in patients in group 3, who had a cone–shaped gastric tube; in group 2 (standard gastric tube), this rate was 18.9%, and in group 1 (subtotal stomach), it was 22.4%, although the difference was not statistically significant (p = 0.57). A similar trend was observed for the frequency of intrathoracic complications: 18.5% (10 patients) in group 3 (cone–shaped gastric tube), 20.2% (16 patients) – group 2 (typical gastric tube), 25.8% (16 patients) – group 1 (subtotal stomach) (p = 0.63).

The frequency of repeat interventions remained relatively stable in all study groups (p = 0.74): 13.9% (11 patients) – group 2 (typical gastric tube), 14.8% (8 patients) – group 3 (conical gastric tube), 17.7% (11 patients) – group 1 (subtotal stomach).

The 30–day mortality rate was low in all groups: 1st (subtotal stomach) – 2 (3.2%) patients died, 2nd (typical gastric tube) – 2 (2.5%) patients, 3rd (cone–shaped gastric tube) – 2 (3.7%) patients (p = 0.89).

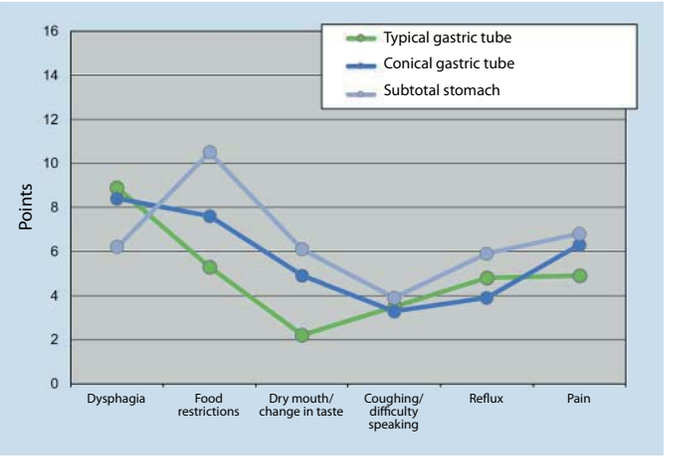

Fig. 2.
Evaluation of quality of life (EORTC QLQ-OES18) depending on the type of on the type of gastric transplant.

The length of hospitalization was shortest in the second group of patients who used a standard gastric tube – (15.3 ± 4.5) days. This indicator was (16.1 ± 5.1) days in the third group (cone–shaped gastric tube) and (17.5 ± 5.8) days in the first group (subtotal stomach). The difference was not statistically significant (p = 0.13).

A similar pattern was observed for the length of stay in the intensive care unit: (3.2 ± 1.4), (3.6 ± 1.5), and (4.0 ± 1.8) days, respectively (p = 0.22).

The overall incidence of postoperative complications was lowest in group 2 (typical gastric tube) — 25 (31.6%) patients. In group 1 (subtotal stomach), this indicator was 45.2% (28 patients), and in group 3 (cone–shaped stomach tube) – 50.0% (27 patients). The difference was also not statistically significant (p = 0.18).

In general, despite the statistically insignificant difference, patients who received a standard gastric tube had consistently better clinical outcomes: lower complication and mortality rates and shorter hospital stays.

The results obtained using the QLQ–OES18 questionnaire to assess quality of life three months after surgery were grouped into six symptoms: dysphagia; dietary restrictions; dry mouth and taste changes; cough/speech function; reflux; and pain. Patients who underwent reconstruction using a typical gastric tube (group 2) had the best functional scores in almost all categories (*Fig. 2*).

Patients in group 2 (standard gastric tube) had the best swallowing function – (8.9 ± 1.6) points (maximum score was 12). In group 3 (cone–shaped gastric tube), the level of dysphagia was assessed at (8.4 ± 1.7) points, and in group 1 (subtotal stomach) at (6.2 ± 2.4) points. The difference was close to statistical significance (p = 0.06), indicating a possible improvement in swallowing when using a tubular graft.

The assessment of dietary restrictions was statistically significant (p = 0.01) between the groups: it was lowest in group 2 (typical gastric tube) – (5.3 ± 2.1) points (the maximum number of points was 16), in group 3 (cone–shaped gastric tube) this indicator was (7.6 ± 2.5) points, in group 1 (total gastric bypass) – (10.5 ± 3.0) points. This reflects fewer dietary restrictions in patients with a more adapted gastric transplant geometry.

Dry mouth/change in taste also received the lowest score in group 2 (typical intestinal tube) – (2.2 ± 1.4) points (maximum score was 8) compared to (4.9 ± 1.7) points in group 3 (cone–shaped gastric tube) and (6.1 ± 1.9) points in group 1 (subtotal stomach). However, no statistically significant difference was achieved (p = 0.09).

Reflux was most often recorded in group 1 (subtotal stomach), and it was rated by patients at (5.9 ± 2.0) points (maximum score 8), while in the second group (typical intestinal tube) and the third group (cone–shaped intestinal tube), this indicator was lower – (4.8 ± 1.8) and (3.9 ± 1.6) points, respectively. However, the difference was not statistically significant (p = 0.12). This confirms the hypothesis about the advantage of adapted graft configurations in reducing reflux symptoms.

Pain intensity was lowest in patients in group 2 (typical intestinal tube) – (4.9 ± 1.9) points (maximum score was 12). In group 3 (cone–shaped intestinal tube), this indicator was (6.3 ± 2.0) points, in group 1 (subtotal stomach) – (6.8 ± 2.1) points. The difference was characterized by a tendency toward significance (p = 0.08).

Regarding the assessment of coughing and difficulty speaking (maximum score of 8), no statistically significant differences were found between the groups (p = 0.21): Group 2 (typical gastric tube) – (3.5 ± 1.2) points, Group 3 (cone–shaped gastric tube) – (3.3 ± 1.5) points, Group 1 (subtotal stomach) – (3.9 ± 1.4) points.

The overall quality of life score, calculated as the sum of the scores for all symptoms, was highest in group 2 (typical intestinal tube) at 29.6 points, followed by group 3 (cone–shaped gastric tube) at 34.3 points, and in group 1 (subtotal stomach) – 39.4 points. The identified trend confirms the superiority of the typical gastric tube from a functional and symptomatic point of view over the other two intestinal transplants studied.

Discussion

This prospective, single–center cohort study provides data confirming the assumption that the morphology of the transplant significantly affects both clinical and subjective treatment outcomes.

In particular, the typical gastric tube as a transplant had the best overall profile—patients in this group had the lowest incidence of postoperative complications (31.6%), shorter hospital stays, and the best quality of life scores based on the EORTC QLQ–OES18 questionnaire. Although the differences between the groups rarely reached statistical significance, the consistent trend in their numerical values indicated a real clinical advantage of this transplant configuration over the other transplants studied.

The use of a subtotal stomach as a transplant was associated with the highest complication rate (45.2%), the longest hospital stay, and the worst quality of life scores, especially with regard to dietary restrictions/taste changes, reflux, and pain. These results are consistent with other studies [12, 15] showing that preserving a large stomach volume can lead to increased intrathoracic pressure, delayed gastric emptying, and worsening symptoms of gastroesophageal reflux.

Despite anatomical adaptation to reduce "dead space" and improve the linearity of the lumen, the cone–shaped gastric tube [13], did not have any advantages over the typical gastric tube in terms of any of the symptoms, although this type of gastric anastomosis was characterized by a slightly lower incidence of anastomotic failure (16.7%). X. Zheng et al. [19] noted potential hemodynamic advantages and better anastomosis orientation when using a cone–shaped graft, but our results indicate that these theoretical advantages are not sufficiently supported by clinical evidence in real–world settings.

The results of the quality of life analysis are particularly important, according to which the typical gastric tube has significant advantages in terms of dietary restrictions/taste changes and pain. Although the difference was statistically significant only for dietary restrictions/taste changes (p = 0.01), the overall trend confirms the advantage of tubular grafts. This is consistent with the literature, which reports that long and narrow gastric tubes provide better gastric emptying, less reflux, and fewer stagnant phenomena [16, 17]. Improved functional recovery is particularly important for survival and quality of life in patients after esophageal cancer treatment [20].

It is also interesting that dysphagia was best rated (8.9 points, maximum score 12) in group 2 (standard gastric tube), indicating better swallowing function. Although the difference in this indicator did not reach statistical significance (p = 0.06), it is consistent with the literature data on the advantages of tubular configuration grafts in reducing stasis and congestive phenomena [12, 17].

The strengths of the study include its prospective design, standardized surgical protocols, and the use of a validation tool to assess quality of life. Its limitations include its single–center nature, small sample size, and short follow–up period. In addition, despite a consistent trend in favor of the typical gastric tube, statistical significance was only achieved for some of the parameters, which calls for cautious interpretation.

Thus, the results of the study indicate that the typical gastric tube provides a better balance between surgical safety and postoperative quality of life than the subtotal stomach and the cone–shaped gastric tube. Given the increased focus on quality of life and recovery after esophageal cancer treatment, the choice of graft type should be an integral part of surgical planning. Multicenter studies with larger samples and longer follow–up are needed for definitive conclusions.

Funding. No external funding was received. No fees or other forms of compensation were paid.

Authors' contributions. All authors contributed equally to this study.

Conflict of interest. None.

Approval for publication. All authors have read and approved the final version of the manuscript. All authors have given their consent for the publication of this manuscript.

Ethical aspects. All procedures performed in the study involving patients were in accordance with ethical standards for clinical practice and the 1964 Helsinki Declaration, as amended.

References

1. Napier KJ, Scheerer M, Misra S. Esophageal cancer: A Review of epidemiology, pathogenesis, staging workup and treatment modalities. World J Gastrointest Oncol. 2014 May 15;6(5):112–20. doi: 10.4251/wjgo.v6.i5.112 PMID: 24834141; PMCID: PMC4021327.
2. Then EO, Lopez M, Saleem S, Gayam V, Sunkara T, Culliford A, et al. Esophageal cancer: an updated surveillance epidemiology and end results database analysis. World J Oncol. 2020 Apr;11(2):55–64. doi: 10.14740/wjon1254. Epub 2020 Mar 29. PMID: 32284773; PMCID: PMC7141161.

3. Hirst J, Smithers BM, Gotley DC, Thomas J, Barbour A. Defining cure for esophageal cancer: analysis of actual 5–year survivors following esophagectomy. Ann Surg Oncol. 2011 Jun;18(6):1766–74. doi: 10.1245/s10434–010–1508–z. Epub 2011 Jan 7. PMID: 21213056.
4. Miyata H, Yamasaki M, Kurokawa Y, Takiguchi S, Nakajima K, Fujiwara Y, et al. Multimodal treatment for resectable esophageal cancer. Gen Thorac Cardiovasc Surg. 2011 Jul;59(7):461–6. doi: 10.1007/s11748–011–0780–6. Epub 2011 Jul 14. PMID: 21751104.
5. Pauthner M, Haist T, Mann M, Lorenz D. Surgical therapy of early carcinoma of the esophagus. Viszeralmedizin. 2015 Oct;31(5):326–30. doi: 10.1159/000441049. Epub 2015 Oct 16. PMID: 26989387; PMCID: PMC4789960
6. Kyrkylevsky SI, Krachmalev SN, Kondratsky YN, Krakhmalev SN, Zaitsev SL, Friedel RI, et al. Surgical treatment of patients with esophageal malignant tumor. Clinical Oncology 2013;2(10):24–30. Ukrainian.
7. Kalff MC, van Berge Henegouwen MI, Baas PC, Bahadoer RR, Belt EJT, Brattinga B, et al. Trends in Distal Esophageal and Gastroesophageal Junction Cancer Care: The Dutch Nationwide Ivory Study. Ann Surg. 2023 Apr 1;277(4):619–28. doi: 10.1097/SLA.0000000000005292. Epub 2021 Nov 11. PMID: 35129488.
8. Metzger R, Bollschweiler E, Vallböhmer D, Maish M, DeMeester TR, Hölscher AH. High volume centers for esophagectomy: what is the number needed to achieve low postoperative mortality? Dis Esophagus. 2004;17(4):310–4. doi: 10.1111/j.1442– 2050.2004.00431.x. PMID: 15569369.
9. Sharma S. Management of complications of radical esophagectomy. Indian J Surg Oncol. 2013 Jun;4(2):105–11. doi: 10.1007/ s13193–013–0215–1. PMID: 24426709; PMCID: PMC3693150.
10. Van der Wilk BJ, Hagens ERC, Eyck BM, Gisbertz SS, van Hillegersberg R, Nafteux P, et al. Outcomes after totally minimally invasive versus hybrid and open Ivor Lewis oesophagectomy: results from the International Esodata Study Group. Br J Surg. 2022 Feb 24;109(3):283–90. doi: 10.1093/bjs/znab432. PMID: 35024794; PMCID: PMC10364762.
11. Yibulayin W, Abulizi S, Lv H, Sun W. Minimally invasive oesophagectomy versus open esophagectomy for resectable esophageal cancer: a meta–analysis. World J Surg Oncol. 2016 Dec 8;14(1):304. doi: 10.1186/s12957–016–1062–7. PMID: 27927246; PMCID: PMC5143462.
12. Hung PC, Chen HY, Tu YK, Kao YS. A comparison of different types of esophageal reconstructions: a systematic review and network meta–analysis. J Clin Med. 2022 Aug 26;11(17):5025. doi: 10.3390/ jcm11175025. PMID: 36078955; PMCID: PMC9457433.
13. Flanagan JC, Batz R, Saboo SS, Nordeck SM, Abbara S, Kernstine K, et al. Esophagectomy and gastric pull–through procedures: surgical techniques, imaging features, and potential complications. Radiographics. 2016 JanFeb;36(1):107–21. doi: 10.1148/rg.2016150126. PMID: 26761533
14. Briel JW, Tamhankar AP, Hagen JA, DeMeester SR, Johansson J, Choustoulakis E, et al. Prevalence and risk factors for ischemia, leak, and stricture of esophageal anastomosis: gastric pull–up versus colon interposition. J Am Coll Surg. 2004 Apr;198(4):536–41; discussion 541–2. doi: 10.1016/j.jamcollsurg.2003.11.026. PMID: 15051003.
15. Kolh P, Honore P, Degauque C, Gielen J, Gerard P, Jacquet N. Early stage results after oesophageal resection for malignancy – colon interposition vs. gastric pull–up. Eur J Cardiothorac Surg. 2000 Sep;18(3):293–300. doi: 10.1016/s1010–7940(00)00524–8. PMID: 10973538.
16. Poh M, Selber JC, Skoracki R, Walsh GL, Yu P. Technical challenges of total esophageal reconstruction using a supercharged jejunal flap. Ann Surg. 2011 Jun;253(6):1122–9. doi: 10.1097/ SLA.0b013e318217e875. PMID: 21587114.
17. Booka E, Takeuchi H, Morita Y, Hiramatsu Y, Kikuchi H. What is the best reconstruction procedure after esophagectomy? A meta–analysis comparing posterior mediastinal and retrosternal approaches. Ann Gastroenterol Surg. 2023 May 2;7(4):553–64. doi: 10.1002/ags3.12685. PMID: 37416735; PMCID: PMC10319624.
18. Akiyama H, Miyazono H, Tsurumaru M, Hashimoto C, Kawamura T. Use of the stomach as an esophageal substitute. Ann Surg. 1978 Nov;188(5):606–10. doi: 10.1097/00000658–197811000– 00004. PMID: 718285; PMCID: PMC1396768.
19. Zheng X, Yang YS, Hu WP, Xiao X, Luan SY, Chen LQ, et al. Coniform gastric tube for end–to–end anastomosis during minimally invasive McKeown esophagectomy. Ann Thorac Surg. 2020 Apr;109(4):e297–e300. doi: 10.1016/j.athoracsur.2019.10.032. Epub 2019 Nov 30. PMID: 31794736.
20. Yuan F, Zhang Y, Qiu L, Zhang K. Application value of the fusiform tube stomach in the digestive tract reconstruction after thoracoscopic and laparoscopic radical resection of esophageal carcinoma. Chin J Dig Surg [Internet]. 2018;17(8):810–6. Chinese. Available from: http://wprim.whocc.org.cn/admin/article/articleDetail?WPRIMID=699203&articleId=699688.

Received 12.06.2025