

Dislocation of the Cervical Anastomosis toward the Mediastinum after McKeown Esophagectomy: A Single-Center Retrospective Study

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Abstract

Background: This study aimed to assess the frequency of cervical anastomosis dislocation toward the mediastinum after McKeown esophagectomy and the significance of this phenomenon for postoperative complications.

Methods and Results: The study included 82 patients with stage I-III esophageal cancer who underwent surgical intervention using McKeown esophagectomy in a completely open version (thoracotomy, laparotomy, cervicotomy) or hybrid esophagectomy (thoracoscopy on the right, laparotomy, cervicotomy).

After McKeown esophagectomy, dislocation of the cervical anastomosis (DCA) toward the posterior mediastinum was noted in 26.8% of cases. The overall incidence of anastomotic leakage was 18.3%. The groups of patients with and without DCA did not differ statistically in the incidence of anastomotic leakage ($P=0.205$). Mediastinal complications (mediastinitis, pleural empyema) were observed in 100% (6/6) of cases in the group with DCA and 33.3% (3/9) of cases in the group without DCA ($P=0.013$). Pulmonary complications (pneumonia, atelectasis) occurred in 5(22.7%) and 8(13.3%) of cases in groups with DCA and without DCA, respectively ($P=0.304$).

Conclusion: After McKeown esophagectomy, DCA toward the posterior mediastinum was noted in 26.8% of cases. Dislocation of the cervical anastomosis toward the posterior mediastinum does not significantly impact the anastomotic leakage. Mediastinal complications are more common in patients with DCA, but the incidence of pulmonary complications is not associated with this phenomenon. (International Journal of Biomedicine. 2024;14(2):335-337.)

Keywords: esophageal cancer • McKeown esophagectomy • anastomosis dislocation

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Introduction

Esophageal cancer is ranked as the seventh most common cancer worldwide.⁽¹⁾ In the Russian Federation, 6088 cases of esophageal cancer were registered in 2020, of which stage III-IV accounted for 65%.⁽²⁾ The most studied and effective

method for the treatment of stage I-III EC is multimodal therapy, which includes preoperative chemoradiotherapy followed by surgery.⁽³⁾

Esophagectomy is the most common radical treatment for esophageal cancer. Two types of surgical intervention are most often used in clinical practice. McKeown esophagectomy⁽⁴⁾ is a well-described procedure with right thoracotomy, upper abdominal laparotomy, and cervical anastomosis by left cervicotomy. Ivor Lewis esophagectomy⁽⁵⁾ is the classic transthoracic esophagectomy, which consists of laparotomy and right thoracotomy with intrathoracic anastomosis.

With cervical anastomosis formation, there is a risk of dislocation of the cervical anastomosis (DCA) toward the

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mediastinum, which occurs in 10-20%. This phenomenon is an important cause of leakage into the mediastinum with the subsequent development of mediastinitis and an unfavorable operation outcome.⁽⁶⁾

This study aimed to assess the frequency of DCA toward the mediastinum after McKeown esophagectomy and the significance of this phenomenon for postoperative complications.

Materials and Methods

The study included 82 patients with stage I-III esophageal cancer who underwent surgical treatment at the Regional Clinical Oncology Center, Ulyanovsk, from January 1, 2016, to November 1, 2023. The patients underwent surgical intervention using McKeown esophagectomy in a completely open version (thoracotomy, laparotomy, cervicotomy) or hybrid esophagectomy (thoracoscopy on the right, laparotomy, cervicotomy).

Retrospective analysis was carried out according to the developed protocol. We used the TNM 8 classification system approved by the Union for International Cancer Control (UICC) for staging.

Technical features of the formation of anastomosis

In all cases, the anastomosis was performed manually. When forming an anastomosis on the neck, the end of the esophagus was anastomosed with the anterior wall of the gastric graft with a double-row suture, with the formation of the second row of sutures using a sled U-shaped suture according to E.L. Berezov on a 24 Fr gastric tube.

There were two criteria for the anastomosis migration toward the posterior mediastinum:

- The displacement of more than 2/3 of the width of the gastric graft to the right from the line at the edge of the sternum and the thoracic vertebral body.

- The location of the anastomosis below the first thoracic vertebra 5-6 days after surgery in X-ray with contrast.

All patients at the prehospital stage were examined according to a standard recommended by the Association of Oncologists of Russia to exclude the presence of distant metastases and assess the extent of the process.

Statistical analysis was carried out using the StatTech software v. 2.8.8 (StatTech LLC, Russia). Baseline characteristics were summarized as frequencies and percentages for categorical variables and mean±SD for continuous variables. For data with normal distribution, inter-group comparisons were performed using Student's t-test. Group comparisons with respect to categorical variables are performed using the chi-square test. A probability value of $P < 0.05$ was considered statistically significant.

Results

Table 1 presents the main characteristics of the study patients. All patients were divided into 2 groups. Group 1 included 22(26.8%) patients with DCA toward the posterior mediastinum after McKeown esophagectomy, and Group 2 included 60(73.2%) patients without DCA. In our study, the overall incidence of anastomotic leakage was 18.3%.

In Group 1, the incidence of anastomotic leakage was 1.82 times higher than in Group 2 without statistical significance. Mediastinal complications (mediastinitis, pleural empyema) were observed in 100% of cases in Group 1 and 33.3% of cases in Group 2 ($P=0.013$). Pulmonary complications (pneumonia, atelectasis) occurred in 5(22.7%) and 8(13.3%) of cases in Group 1 and Group 2, respectively ($P=0.304$) (Table 2).

Table 1.

Characteristics of study patients.

Variable		Group 1 n=22	Group 2 n=60	P-value
Gender	Male	16 (72.7%)	46 (76.7%)	0.713
	Female	6 (27.3 %)	14 (23.3%)	
Age (years)		57.6 ± 4.8	60.1 ± 5.4	0.060
Charlson index (points)		4.32 ± 0.87	3.17 ± 0.66	0.000
ICD-10	C15.4	10 (45.5%)	29 (48.3%)	0.818
	C15.5	12 (54.5%)	31 (51.7%)	
Stage	IIA	8 (36.5%)	22 (31.8%)	0.404
	IIB	9 (40.9%)	19 (36.6%)	
	IIIA	3 (13.5%)	17 (28.3%)	
	IIIB	2 (9.1%)	2 (3.3%)	
Histological type	Adenocarcinoma	4 (18.2%)	9 (15%)	1*
	Squamous	18 (81.8%)	51 (85%)	
Type of operation	Hybrid McKeown	4 (18.2%)	8 (13.3%)	0.843*
	Open McKeown	18 (81.8%)	52 (86.7%)	

* - Yates' P-value

Table 2.

Anastomotic complications in study groups.

Variable	Group 1 n=22	Group 2 n=60	P-value
Anastomotic leak	6 (27.3%)	9 (15%)	0.205
Mediastinal complications	6 (100)	3 (33.3%)	0.013
Pulmonary complications	5 (22.7%)	8(13.3%)	0.304

Discussion

Despite advances in multimodal treatment of esophageal cancer in recent years, radical surgery remains the standard of care. Currently, minimally invasive esophagectomies are being actively introduced into clinical practice with satisfactory short-term and long-term results. The classic version of esophagectomy involves two operations: the Lewis operation, which forms an intrathoracic anastomosis, and the McKeown operation, which forms an anastomosis on the neck.

In a study by Low et al.,⁽⁷⁾ in 2704 esophagectomies, the overall complication rate was 59%, with the most common complications being pneumonia (14.6%) and arrhythmia (14.5%). Anastomotic leakage was 11.4%, and 30-day mortality was 2.4%.

A study by Nakajima M et al.⁽⁸⁾ found dislocation of the gastric conduit in 38.3% of 149 patients who underwent transthoracic esophagectomy. Multivariate analysis revealed that dislocation of the gastric conduit was an independent risk factor for anastomotic leakage (OR=4.840, 95% CI: 1.770-13.30, $P<0.001$). Sakai et al.⁽⁹⁾ examined 53 patients with thoracic esophageal cancer who underwent radical esophagectomy with gastric tube reconstruction and neck anastomosis. The displacement of anastomosis into the thoracic cavity was detected in approximately half of the patients with neck anastomosis.

In our study, out of 6 anastomotic leakages in the group with DCA, all 6 had mediastinal complications. In patients without DCA, the anastomotic leakage proceeded more smoothly, of which only 33.3% (3/9) experienced mediastinal complications.

In a study by Fumagalli et al.,⁽¹⁰⁾ the proportion of leakage was 10.5% and 9% after open and hybrid esophagectomy, respectively, and doubled (20%) after totally minimally invasive esophagectomy ($P=0.016$). Chen et al.⁽¹¹⁾ recommended a high cervical anastomosis using a narrow gastric tube to reduce leakage-related complications for patients undergoing a McKeown esophagectomy effectively.

The studied mechanisms ensuring dislocation of the anastomosis to the mediastinum are increased tone of the esophagus and stomach after the cessation of anesthesia, the suction effect of the diaphragm, which stimulates the migration of the graft into the abdominal cavity and, therefore, provides traction of the anastomosis into the mediastinum, and gravity when filling the graft with food.⁽¹²⁾ The fixation of cervical anastomosis on the neck may protect the anastomosis from distracting forces during the most vulnerable healing phase. Thus, esophagogastric anastomosis is subjected to several forces that create tension from the moment of recovery from anesthesia and act in the early postoperative period.

Conclusion

After McKeown esophagectomy, DCA toward the posterior mediastinum was noted in 26.8% of cases. Dislocation of the cervical anastomosis toward the posterior mediastinum does not significantly impact the anastomotic leakage. Mediastinal complications are more common in patients with DCA, but the incidence of pulmonary complications is not associated with this phenomenon.

Competing Interests

The authors declare that they have no competing interests.

References

1. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, Bray F. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality

Worldwide for 36 Cancers in 185 Countries. *CA Cancer J Clin.* 2021 May;71(3):209-249. doi: 10.3322/caac.21660. Epub 2021 Feb 4. PMID: 33538338.

2. Kaprin AD, Starinsky VV, Shakhzadova AO. The state of cancer care for the population of Russia in 2020. M.: MNIOI named after P. A. Herzen. 2021; 252. (In Russian.)

3. Rogers JE, Sewastjanow-Silva M, Waters RE, Ajani JA. Esophageal cancer: emerging therapeutics. *Expert Opin Ther Targets.* 2022 Feb;26(2):107-117. doi: 10.1080/14728222.2022.2036718. Epub 2022 Feb 12. PMID: 35119973.

4. McKeown KC. Total three-stage oesophagectomy for cancer of the oesophagus. *Br J Surg.* 1976 Apr;63(4):259-62. doi: 10.1002/bjs.1800630403. PMID: 1276657.

5. LEWIS I. The surgical treatment of carcinoma of the oesophagus; with special reference to a new operation for growths of the middle third. *Br J Surg.* 1946 Jul;34:18-31. doi: 10.1002/bjs.18003413304. PMID: 20994128.

6. Versteegen MHP, Bouwense SAW, van Workum F, Ten Broek R, Siersema PD, Rovers M, Rosman C. Management of intrathoracic and cervical anastomotic leakage after esophagectomy for esophageal cancer: a systematic review. *World J Emerg Surg.* 2019 Apr 4;14:17. doi: 10.1186/s13017-019-0235-4. PMID: 30988695; PMCID: PMC6449949.

7. Low DE, Kuppusamy MK, Alderson D, Ceconello I, Chang AC, Darling G, et al. Benchmarking Complications Associated with Esophagectomy. *Ann Surg.* 2019 Feb;269(2):291-298. doi: 10.1097/SLA.0000000000002611. PMID: 29206677.

8. Nakajima M, Muroi H, Kikuchi M, Fujita J, Ihara K, Nakagawa M, Morita S, Nakamura T, Yamaguchi S, Kojima K. Dislocation of the gastric conduit reconstructed via the posterior mediastinal route is a significant risk factor for anastomotic disorder after McKeown esophagectomy. *Ann Gastroenterol Surg.* 2021 Aug 12;6(1):75-82. doi: 10.1002/ags3.12496. PMID: 35106417; PMCID: PMC8786694.

9. Sakai M, Sohda M, Miyazaki T, Yoshida T, Kumakura Y, Honjo H, Hara K, Yokobori T, Kuwano H. Impact of the Level of Anastomosis on Reflux Esophagitis Following Esophagectomy with Gastric Tube Reconstruction. *World J Surg.* 2017 Mar;41(3):804-809. doi: 10.1007/s00268-016-3786-5. PMID: 27798723.

10. Fumagalli U, Baiocchi GL, Celotti A, Parise P, Cossu A, Bonavina L, et al. Incidence and treatment of mediastinal leakage after esophagectomy: Insights from the multicenter study on mediastinal leaks. *World J Gastroenterol.* 2019 Jan 21;25(3):356-366. doi: 10.3748/wjg.v25.i3.356. PMID: 30686903; PMCID: PMC6343094.

11. Chen C, Ding C, He Y, Guo X. High cervical anastomosis reduces leakage-related complications after a McKeown esophagectomy. *Eur J Cardiothorac Surg.* 2024 Mar 1;65(3):ezae050. doi: 10.1093/ejcts/ezae050. PMID: 38341665.

12. Walsh TN. The Esophagogastric Anastomosis: The Importance of Anchoring Sutures in Reducing Anastomotic Leak Rates. *Ann Surg Open.* 2023 Feb 1;4(1):e231. doi: 10.1097/AS9.0000000000000231. PMID: 37600864; PMCID: PMC10431275.