

ORIGINAL ARTICLE

RESULTS OF PREVENTIVE METHODS OF OCCURRENCE CERVICAL ANASTOMOTIC COMPLICATIONS IN ESOPHAGOPLASTY

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ABSTRACT

The aim: The aim of the study was to improve the results of surgical treatment in patients with corrosive esophageal strictures using the designed comprehensive surgical management program in esophagoplasty to decrease cervical anastomotic complications.

Materials and methods: The results of surgical treatment of 116 patients with esophageal strictures were studied. 45 patients had post-burn corrosive strictures, 17 – postoperative corrosive strictures, 10 – peptic strictures due to reflux esophagitis and 44 patients – esophageal cancer. All patients were divided into two groups: the control group, consisting of 55 patients who underwent conventional surgical treatment of corrosive esophageal strictures during 2005–2011, and experimental group involving 61 patients operated on during 2012–2020, in whom an individual approach to the choice of surgical method was applied using diagnostic and treatment algorithm as well as the designed surgical management program.

Results: In early postoperative period the proportion of specific and non-specific complications was significantly lower in experimental group as compared to the control group: cervical anastomotic leak – 16.36 % versus 4.392 %; strictures of cervical anastomosis – 20.0% versus 6.56 % ($p < 0.05$). There were six postoperative deaths – four in the control group and two in experimental group.

Conclusions: To prevent the development of cervical anastomotic complications and mortality in esophagoplasty proper therapeutic approach with consideration of all prognostic criteria and risk factors should be chosen and designed surgical management program should be applied.

KEY WORDS: anastomotic leak, stricture, treatment program

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INTRODUCTION

Although esophageal corrosive strictures most often develop after esophageal burns, surgery, reflux-esophagitis, esophageal cancer, they can also result from radiation therapy, sclerosis of esophageal varices, mycosis, infectious diseases, collagen disease etc. Those conditions associated with III-IV degrees of esophageal obstruction require reconstructive surgery on the esophagus – esophagoplasty [1-3]. The most common specific complications after subtotal esophagoplasty are complications associated with esophago-organ anastomotic leakage, especially cervical anastomosis. The incidence of cervical esophago-organ anastomotic leaks reaches 15%, and that of the strictures – 10% [4, 5].

THE AIM

The aim of the study was to improve the results of surgical treatment in patients with corrosive esophageal strictures using the designed comprehensive surgical management program in esophagoplasty to decrease cervical esophageal anastomotic complications.

MATERIALS AND METHODS

The research was conducted in compliance with the major principles of GCP guidelines (1996), Council of Europe

Convention on Human Rights and Biomedicine (1997), World Medical Association Declaration of Helsinki on ethical principles for medical research involving human subjects (1964-2000) and Order of Ministry of Health of Ukraine № 281 of November 1, 2000, being approved by the Committee on Bioethics of National Pirogov Memorial Medical University, Vinnytsia.

116 patients with corrosive esophageal strictures operatively treated at surgery clinic of Vinnytsia National Pirogov Memorial Medical University and the Department of esophagus and gastro-intestinal tract surgery of state institution “V.T. Zaitsev Institute of General and Emergency Surgery of National Academy of Medical Sciences” during the period of 2005–2020 were studied. The majority of patients were 21–60 years old, i.e. working-age individuals. There were 79 males (68.10 %) and 37 females (31.90 %). 45 patients had post-burn strictures, 17 – postoperative corrosive strictures, 10 – peptic strictures due to reflux-esophagitis, 44 – esophageal cancer.

All patients were divided into two groups: the control group, consisting of 55 patients who underwent conventional surgical treatment of corrosive esophageal strictures during 2005–2011, and experimental (study) group, matched by sex, age and pathologic conditions, involving 61 patients (52.59 %) operated on during 2012–2020, in whom an individual approach to the choice of surgical procedure was

Table I. Types of esophagoplasty in patients of experimental and control groups

Pathology	Type of surgery	Control group (n=55)	Experimental group (n=61)
Post-burn corrosive strictures	Clinically modified colon patch esophagoplasty	-	15
	Retrosternal plastics with the right half of the colon	20	3
	Clinically modified gastric tube esophagoplasty	2	5
Postoperative corrosive strictures	Reconstruction of esophagogastric anastomosis	0	2
	Gastric tube esophagoplasty	8	-
Strictures after reflux-esophagitis (peptic)	Clinically modified gastric tube esophagoplasty	-	7
	Gastric tube esophagoplasty	5	-
	Clinically modified gastric tube esophagoplasty	-	5
Esophageal cancer	Clinically modified colon patch esophagoplasty	-	7
	Retrosternal plastics with the right half of the colon	-	-
	Gastric tube esophagoplasty	6	-
	Transhiatal esophageal resection and clinically modified gastric tube esophagoplasty	14	-
		-	17

Table II. Nonspecific and specific postoperative complications

Complications	Control group	Experimental group
	(n=55)	(n=61)
Nonspecific complications		
Pleurisy	18 (32.73 %)	10 (16.39 %)**
Pneumonia	14 (25.45 %)	6 (9.84 %)**
Pleural empyema	2 (3.64 %)	.*
Mediastinitis	2 (3.64 %)	.*
Pneumothorax	7 (12.73 %)	3 (4.92 %)*
Postoperative seroma	7 (12.73 %)	6 (9.84 %)*
Postoperative wound abscess	12 (21.82 %)	5 (8.20 %)**
Recurrent laryngeal nerve paralysis	2 (3.64 %)	.*
Bleeding	3 (5.45 %)	.*
Anastomotic leaks after intestinal anastomosis	1 (1.82 %)	.*
Acute intestinal obstruction	2 (3.64 %)	1 (1.64 %)*
Acute pancreatitis	1 (1.82 %)	1 (1.64 %)*
Pulmonary embolism	2 (3.64 %)	1 (1.64 %)*
Myocardial infarction	1 (1.82 %)	.*
Anaphylactic shock	1 (1.82 %)	.*
Multiple organ failure	2 (3.64 %)	.*
Sepsis	2 (3.64 %)	.*
Specific complications		
Esophago-organ anastomotic leakage	9 (16.36 %)	3 (4.92 %)**
- esophagoplasty with gastric tube	8	2
- colon patch esophagoplasty	1	1
Strictures of esophago-organ anastomosis	11 (20.0 %)	4 (6.56 %)**
- esophagoplasty with gastric tube	9	3
- colon patch esophagoplasty	2	1

Notes: * – p>0.05 – insignificant difference; ** – p<0.05 – significant difference.

applied using diagnostic and treatment algorithm, as well as the designed surgical management program.

Minimally invasive methods of treatment and stenting were required in patients of experimental group having

increased risk for the development of cervical anastomotic complications. Such patients were selected according to the following prognostic criteria: anemia, decreased albumin level below 25 g/l, diabetes mellitus, complete esopha-

geal obstruction, non-use of the designed management program and suggested instrumental method of forming cervical anastomosis. Distribution of patients according to pathologic conditions and types of surgical procedures in study groups is presented in table I.

Three-stage comprehensive surgical management program was developed and introduced in clinical practice for patients of experimental group with esophageal strictures.

The first stage implied careful preoperative preparation of the patient. It involved correction of protein metabolism in verified hypoproteinemia, particularly in albumin level decrease below 25 g/l, correction of anemia, hyperglycemia and other types of metabolism. The changes in administered therapy of the patient were made by anesthesiologist to improve laboratory and biochemical parameters. In severe debilitation, parenteral nutrition ("all-in-one" systems) was instituted as well, using the systems of multicomponent mixture "Oliclinomel" and "Nutriflex Lipid Pery". To reduce ischemic changes in the graft and prevent complications (leaks and strictures of cervical anastomosis), solutions of pentoxifylline, reosorbilact and tivortin were administered. This infusion therapy was performed for five days before surgery by intravenous drip of 100 ml of tivortin twice a day, 200 ml of reosorbilact twice a day and 200 mg of pentoxifylline per 200 ml of 0.9% sodium chloride solution intravenously twice a day (useful model patent of Ukraine № 141214 of 25.03.2020). When pathogenic oropharyngeal microflora was detected, decontamination with decamethoxine solution (Decasan) was performed three times a day for 5 days to prevent postoperative complications.

The second stage involved the procedure of reconstructive surgery. Esophagoplasty with the stomach was performed in 63 patients, 35 of them - clinically modified gastric tube esophagoplasty. During surgery transhiatal extirpation of the esophagus was performed with subsequent formation of gastric tube. To achieve the sufficient length of gastric tube, the proposed technique was used consisting of transverse incision of gastric tube up to 2 cm in the pyloric area, longitudinal closure and additional mobilization of the duodenum and tissues around head of the pancreas. After formation of the graft and its placement on the neck area through the posterior mediastinum, instrumental circular cervical esophago-gastric anastomosis was formed through cervical approach according to the designed technique (useful model patent of Ukraine № 132523 of 25.02.2019). If the formation of such mechanical anastomosis was considered technically impossible, hand-sewn esophago-gastric anastomosis was formed, mainly end-to-end anastomosis by invagination technique.

Colon patch esophagoplasty was performed in 48 patients, predominantly by the technique developed in clinic - hepatic flexure, transverse colon, splenic flexure and part of descending colon were included in the graft with preservation of the left colic artery. The graft was placed in isoperistaltic orientation on the neck area through artificially created retrosternal tunnel. The graft length was sufficient to form proximal cervical anastomosis. During

mobilization and formation of colon graft, mesenteric vessels were assessed by illumination of colon mesentery from the opposite side using additional weak light source. After placement of colon graft via retrosternal approach on the neck area, instrumental circular stapler cervical esophagocolonic anastomosis was formed according to the developed method. When technical difficulties during the formation of the anastomosis occurred, hand-sewn end-to-end anastomosis was created by invagination technique.

The third stage of comprehensive surgical treatment program was the postoperative management of patients according to the suggested method. Postoperative intravenous administration of tivortin, reosorbilact and pentoxifylline solutions was continued twice a day for seven days to prevent ischemic complications of the graft. In addition, antibacterial, antisecretory, detoxification, anti-inflammatory infusion therapy was administered. Nutritional support was provided using commercially prepared formulas (Peptamen, etc.) through intraoperative nasogastric tube. On postoperative day seven, esophagography with water-soluble contrast agent was performed to assess the status of cervical esophago-organ anastomosis and the graft.

RESULTS

Early and late postoperative complications, specific and nonspecific, occurred in patients of both groups. The major nonspecific complications in both groups were: pleurisy - in 18 (32.73%) patients of the control group and 10 (16.39%) patients of experimental group, pneumonia - in 14 (25.45%) and 6 (9.84%) patients, respectively. Besides, pleural empyema and mediastinitis were registered in 2 control subjects each (3.64%), while no such complications developed in study patients of experimental group. Other nonspecific complications included: pneumothorax - in 7 (12.73%) and 3 (4.92%) patients, postoperative seroma - in 7 (12.73%) and 6 (9.84%) patients, postoperative wound abscess - in 12 (21.82%) and 5 (8.20%) patients, acute pancreatitis - in 1 (1.82%) and 1 (1.64%) patient, acute intestinal obstruction - in 2 (3.64%) and 1 (1.64%) patients, pulmonary embolism - in 2 (3.64%) and 1 (1.64%) patients of experimental and control groups, respectively. In addition, the following complications developed in control subjects: bleeding - in 3 (5.45%), recurrent laryngeal nerve paralysis - in 2 (3.64%), anastomotic leaks after intestinal anastomosis - in 1 (1.82%), myocardial infarction - in 1 (1.82%), anaphylactic shock - in 1 (1.82%), sepsis - in 2 (3.64%), multiple organ failure - in 2 (3.64%) patients (Table II).

Leakage of cervical anastomosis in early postoperative period and strictures in late postoperative period were major specific complications. Anastomotic leaks occurred in 4.92% of patients in experimental group and 16.36% of those in the control group.

DISCUSSION

Anastomotic leakage was found to be more common in gastric tube esophagoplasty - in 8 patients of comparison

group versus 2 patients of experimental group, than in colon patch esophagoplasty - in 1 and 1 patient, respectively. Thus, the results obtained proved the frequency of cervical anastomotic leakage to be significantly higher in gastric tube esophagoplasty than in colon patch esophagoplasty ($p < 0.05$). No cases of anastomotic leaks were registered in cervical anastomosis formed by the proposed instrumental method [6-8].

Strictures developed in 20.0% of patients in the control group and 6.56% of those in experimental group. Strictures of cervical anastomosis were observed more often in gastric tube esophagoplasty - in 9 patients of the control group and 3 patients of experimental group, than in colon patch esophagoplasty - in 2 and 1 patient, respectively. Thus, the results obtained demonstrated the occurrence of strictures to be significantly higher in gastric tube esophagoplasty than in colon patch esophagoplasty ($p < 0.05$).

Complications developed after esophagoplasty in patients of experimental group were treated using minimally invasive methods, stenting in particular, which was performed in seven patients: in 3 - with anastomotic leaks and in 4 - with strictures. It should be noted that in early postoperative anastomotic leaks, stenting insures complete sealing of the defect in the area of leakage, prevents the outflow of esophageal contents, provides proper conditions for fistula healing and adequate tube feeding, thus resulting in decreased duration of hospital stay and postoperative mortality. In addition to stenting, antibacterial, anti-inflammatory, infusion therapy was administered to correct metabolism disorders.

There were six deaths in the postoperative period: four in the control group and two in experimental group.

CONCLUSIONS

To prevent the development of postoperative complications and mortality, proper therapeutic approach should be chosen with consideration of all prognostic criteria and risk factors. Comprehensive three-stage management program for surgical patients with esophageal strictures was suggested. It involves conservative prevention of ischemic changes in the graft; use of improved mobilization methods in formation of gastric tube and colonic graft, the designed instrumental method of cervical esophago-organ anastomosis, modern method in treatment of cervical anastomotic complications - stenting. Introduction of such comprehensive program was associated with significantly lower incidence of leaks and strictures of esophago-organ anastomosis, reduced duration of hospital stay - from 28.2 ± 1.1 to 21.5 ± 0.5 bed-days ($p < 0.001$), decreased postoperative period - from 20.5 ± 1.1 to 16.1 ± 0.7 bed-days ($p < 0.01$), decreased postoperative mortality rate - from 7.27% to 3.28%.

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The Authors declare no conflict of interest.

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