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Retrospective analysis of surgical outcomes of delayed pharyngeal defect reconstruction in patients with advanced laryngeal and laryngopharyngeal cancer after laryngectomy

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Abstract

Aim – to retrospectively analyze the results of surgical treatment of delayed reconstruction of pharyngeal defects in patients with advanced laryngeal and laryngopharyngeal cancer after laryngectomy.

Material and methods. We performed a retrospective analysis of 437 case histories of patients treated in Samara Regional Clinical Oncology Center in the period from 2015 to 2019 with malignant neoplasms of the larynx and laryngeal pharynx, who had previously undergone combined and extended-combined laryngectomies. In the retrospective analysis, we studied the structure of complications after delayed reconstructive surgeries of type 0-II pharyngeal and pharyngo-esophageal defects. Local tissue, pectoral flap, and deltopectoral flap were used as plastic material. Complications in the postoperative period were observed in all types of plasty.

Results. The most frequent complications included inflammation of the postoperative wound, anastomosis failure with subsequent formation of fistulas or secondary faryngostomas. In type 0 pharyngeal defects, plastic surgery with the use of local tissues showed a good result, postoperative complications occurred in 11% of cases. In I type pharyngeal defects, fistulas and secondary stomas in the postoperative period were formed in 83% of cases when local tissues were used, in 45.8% when pectoral flap was used and in 66.5% when deltopectoral flap was used. In type II of the defect, the percentage of postoperative complications when using a pectoral flap was 75% and deltopectoral flap – 100%.

Conclusion. Complications in the postoperative period were observed in all types of plasty. The study of risk factors and creation of the algorithm for selection of patients for delayed plasty will allow to determine the terms and indications for delayed reconstructive-reconstructive surgery, as well as to reasonably reduce the risk of postoperative complications.

Keywords: laryngeal cancer, laryngopharyngeal cancer, pectoral flap, deltopectoral flap, plastic material.

Conflict of interest: nothing to disclose.

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Ретроспективный анализ результатов хирургического лечения отсроченных реконструкций дефектов глотки у пациентов с распространенным раком гортани и гортаноглотки после ларингэктомии

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Аннотация

Цель – провести ретроспективный анализ результатов хирургического лечения отсроченных реконструкций дефектов глотки у пациентов с распространенным раком гортани и гортаноглотки после ларингэктомии.

Материал и методы. Проведен ретроспективный анализ 437 историй болезни пациентов, прошедших лечение в СОКОД в период 2015–2019 гг. со злокачественными новообразованиями гортани и гортанного отдела глотки, которым ранее были выполнены комбинированные и расширенно-комбинированные ларингэктомии. При ретроспективном анализе нами была изучена структура осложнений после отсроченных реконструктивных операций фарингеальных и фарингоэзофагеальных дефектов 0-II

типов. В качестве пластического материала применялись местные ткани, пекторальный лоскут, дельтопекторальный лоскут. При всех видах пластики наблюдались осложнения в послеоперационном периоде.

Результаты. Наиболее частыми осложнениями являлись воспаление послеоперационной раны, несостоятельность анастомоза с последующим формированием свищей или рефарингостом. При 0 типе дефекта глотки хороший результат показала пластика с использований местных тканей, послеоперационные осложнения возникли в 11% случаев. При I типе дефекта глотки свищи и рестомы в послеоперационном периоде сформировались в 83% случаев при использовании местных тканей, в 45,8% – при использовании пекторального лоскута и в 66,5% – при использовании дельтопекторального лоскута. При II типе дефекта процент послеоперационных осложнений при применении пекторального лоскута составил 75% и дельтопекторального лоскута – 100%.

Заключение. При всех видах пластики наблюдались осложнения в послеоперационном периоде. Изучение факторов риска и создание алгоритма отбора пациентов позволит определить сроки и показания к отсроченной реконструктивно-восстановительной операции, а также обоснованно снизить риск послеоперационных осложнений.

Ключевые слова: рак гортани, рак гортаноглотки, пекторальный лоскут, дельтопекторальный лоскут, пластический материал.

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ПЛ – пекторальный лоскут, ДЛП – дельтопекторальный лоскут, ПМ – пластический материал.

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INTRODUCTION

Laryngeal cancer and cancer of the hypopharynx are the most common diseases among malignant neoplasms of the head and neck. The incidence of malignant neoplasms of the larynx and the laryngeal part of the pharynx in Russia has been increasing over the years; in 2021, it reached 29.1 and 12.8 per 100 thousand people, respectively [1]. As many as 83% patients have stage III or IV of cancer of the larynx and the laryngeal part of the pharynx at the moment of diagnostics, and the overall 5-year survival is from 15% to 45% [1, 2]. Malignant neoplasms of the larynx and laryngopharynx are most often observed in men aged 50 to 65 years [2]. Patients with a locally advanced stage and complications in the form of stenosis and dysphagia receive surgical treatment at the first stage, which often leads to disability, namely, to disruption of the integrity of the alimentary tract, and requires subsequent surgical rehabilitation, viz. delayed reconstruction [3]. The stages of surgical rehabilitation and time of the delayed reconstruction depend on the time of completion of specialized treatment, usually, the radiotherapy. According to the literature, the average period of delayed reconstruction of pharyngeal defects is 3-4 months after completion of specialized treatment [4]. To restore the alimentary canal and reduce complications, it is necessary to determine the type of pharyngeal defects and the option of delayed reconstruction [5].

One of the papers suggests the following classification of defects: type 0 – small defects closed primarily without the introduction of tissue; type 1 – non-circumferential defects that preserve a viable strip of mucosa from the hypopharynx to the cervical esophagus; type 2 – circumferential defects extending from the vallecula, i.e. the depression between the root of the tongue and the lingual surface of the epiglottis, to the thoracic inlet; type 3 – circumferential defects that extend from the level of the vallecula cranially to the oropharynx; type 4 – extensive defects that extend below the clavicles to the thoracic esophagus. Depending on the type, different grafts are used. The following frequent complications are seen on the stage of delayed reconstruction: inflammation of the surgical wound, anastomotic leakage, marginal necrosis of the tissue flap, and restomas [7]. At the same time, there is no analysis of the treatment results for delayed reconstruction of pharyngeal defects depending on the timing, somatic status and a number of other factors affecting healing in the scientific literature, although it can help determine the indications, as well as the choice of material and method for plastic surgery for each patient based on the principle of a personalized approach [5, 8].

AIM

To retrospectively analyze the results of surgical treatment of delayed reconstruction of pharyngeal defects in patients with advanced laryngeal and laryngopharyngeal cancer after laryngectomy.

MATERIAL AND METHODS

A retrospective analysis of 437 case histories of patients treated at the head and neck tumor department of the Samara Region Clinical Oncology Dispensary in 2015–2019 with malignant tumors of the larynx and the laryngeal section of the pharynx, who had undergone combined and extended combined laryngectomies.

The group of patients (n=40) underwent delayed reconstruction of pharyngeal and pharyngo-esophageal defects after specialized treatment in various terms, from 3 to 6 months. Of the 40 patients, there were 38 men (95%) and 2 women (5%). The age of patients was from 42 to 74 years. The study included patients with advanced laryngeal (n=21) and laryngopharyngeal (n=19) cancer, T3-4N0-2M0. In their first stage, they had a radical surgical treatment and post-surgery radiotherapy (**Table 1**).

All patients underwent laryngopharyngectomy with selective cervical dissection and formation of the

Localization		Larynx		Laryngopharynx	
		n=21 (52,5%)		n=19 (47,5%)	
		Abs.	%	Abs.	%
T Symbol	T3	15	37.5%	8	20%
	T4	6	15%	11	27.5%
N Symbol	N0	17	42.5%	3	7.5%
	N1	3	7.5%	9	22.5%
	N2	1	2.5%	7	17.5%

Table 1. *Number of patients depending on localization and T and N criteria*

Таблица 1. *Количество пациентов в зависимости от локализации и критериев T, N*

pharyngostoma or pharyngo-esophagostoma. In 20 patients, metastases were confirmed to the regional lymph nodes. The patients in the incipient phases, remote metastases, severe concomitant pathologies were not included in the study. In 9 patients, minor defects of the pharynx were found that were of the Type 0. In 25 patients, the defects of the pharynx were non-circumferential, preserved a viable strip of mucosa and were of Type I. In 6 patients, there were minor circumferential defects of Type II. Patients with defects of Types III and IV were not included in this study due to the large size of defects that required several stages of reconstruction and use of free microvascular flaps. The types of pharyngeal defects depending on the tumor localization are shown in **Table 2**.

The patients underwent delayed reconstructions of pharyngeal defects with the use of local tissue, delta-pectoral and pectoral musculocutaneous flap on axial blood supply, depending on the defect type (**Fig. 1**).

The repair of pharyngeal defects with local tissue was used mainly in Type 0 and Type I defects as follows: at a distance of 1.0–1.5 cm from the edge of the defect, a bounding incision was made along the entire circumference of the defect with preparation of cutaneous edges to the center of the defect. The latter were drawn together and sewn with noose sutures with formation of the internal lining of the pharynx. The defect on the neck was then covered with the prepared cutaneous flaps from the cervical area. In pharyngeal defects of Types I and II, the reconstruction was performed with the use of deltopectoral and pectoral flaps with axial blood supply. The use of the deltopectoral flap involved a bounding incision along the entire circumference of the defect with preparation of cutaneous edges to the center of the defect. The latter were drawn together and sewn with noose sutures with formation of the internal lining of the pharynx. Afterwards, the defect on the neck was covered with the deltopectoral flap on axial blood supply from the perforating branches of the internal thoracic artery by rotating the flap. The cutaneous edges of the defect on the neck and the edges of the flap skin were sewn to the skin with noose sutures. In the case of the pectoral flap, the internal lining was also formed after a bounding incision along the entire circumference of the defect with

Localization	Defect type		
	Type I	Type II	II тип
Larynx (n=21)	8 (20%)	13 (32,5%)	0 (0%)
Laryngopharynx (n=19)	1 (2,5%)	12 (30%)	6 (15%)

Table 2. *Types of pharyngeal defects depending on tumor location*

Таблица 2. *Типы дефектов глотки в зависимости от локализации опухоли*

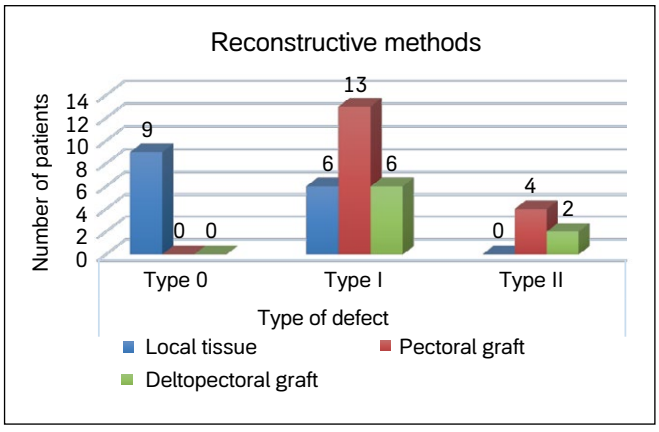

Figure 1. *Reconstruction methods depending on the type of pharyngeal defect.*

Рисунок 1. *Методы реконструкции в зависимости от типа дефекта глотки.*

preparation of cutaneous edges to the center of the defect, which were also drawn together and sewn with noose sutures. In the next step, the defect on the neck was covered with the pectoral musculocutaneous autogenous graft on axial blood supply from the descending branches of acromiothoracic vessels by rotating the flap. The cutaneous edges of the defect on the neck and the edges of the flap skin were sewn to the skin with noose sutures.

RESULTS

Plastic surgery of Type 0 pharyngeal defects was performed in 9 patients using only local tissues. Among these patients, only in one case there was seen an inflammation of the surgical wound, suture failure and, consequently, development of the fistula (**Fig. 2**).

Plastic surgery of Type I pharyngeal defects was performed in 25 patients. In 6 patients, the surgery involved local tissue, where 4 out of 6 (66.7%) patients had inflammation of the surgical wound, failure of the anastomotic suture in the early postoperative period; this resulted in one case out of six (16.7%) in the development of a fistula, and in three cases out of six (50%), development of a repharyngostoma (**Fig. 3**).

In one case out of six, the inflammation of the surgical wound, failure of the anastomotic suture and development of

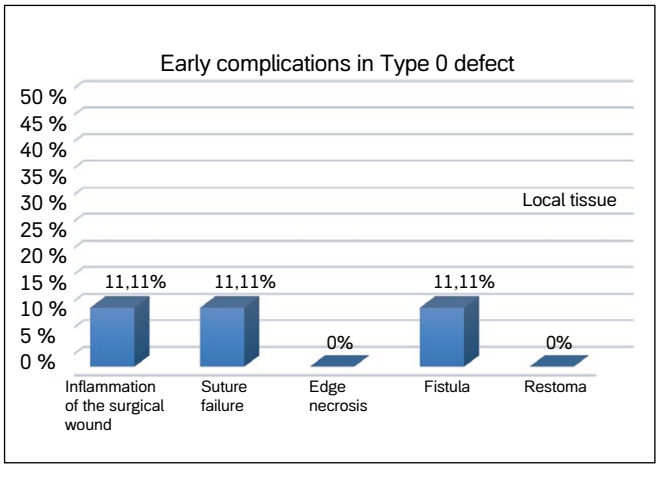

Figure 2. *Early complications in type 0 pharyngeal defect.*

Рисунок 2. *Ранние осложнения при 0 типе дефекта глотки.*

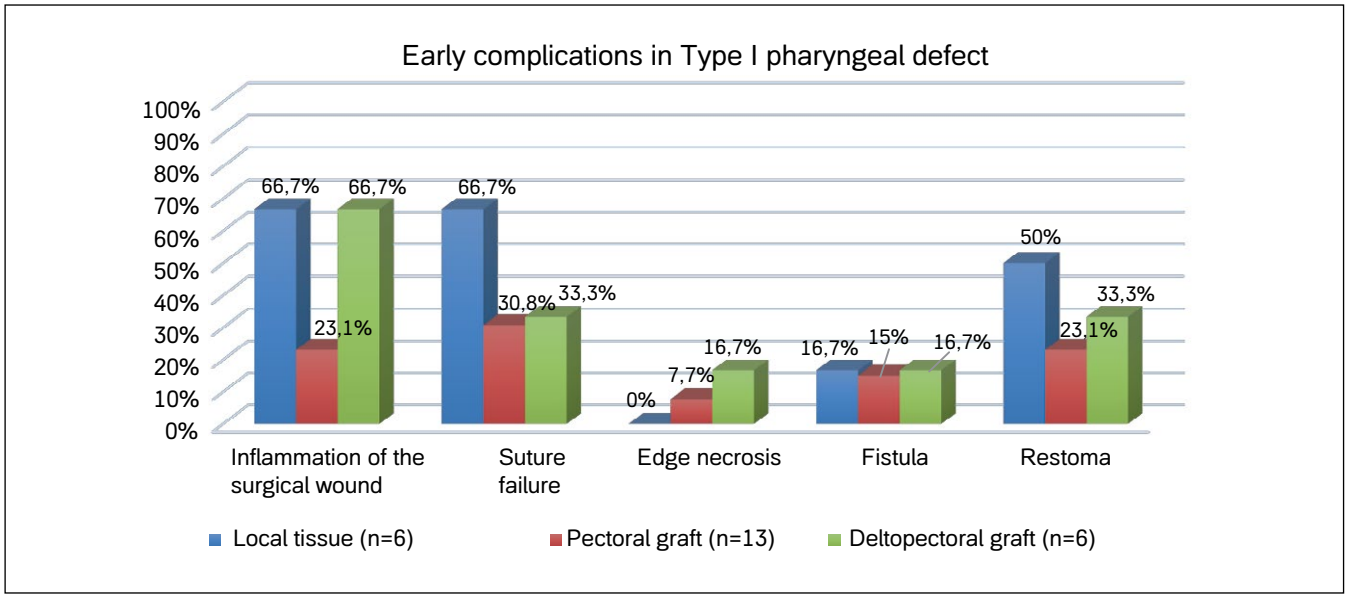

Figure 3. *Early complications in type I pharyngeal defect.*
Рисунок 3. *Ранние осложнения при I типе дефекта глотки.*

repharyngostoma were seen on the sixth day, i.e. in the late postoperative period (**Fig. 4**).

In 13 out of 25 patients, the pectoral flap was used as the grafting material. In the early postoperative period, in 3 cases out of 13 (23.1%), inflammation of the surgical wound was seen, in 4/13 cases (30.8%), failure of anastomotic suture, in 1/13 patients (7.7%), edge necrosis of the graft was observed, in 2/13 cases (15%), fistulae developed, and in 3/13 cases (23.1%), the repharyngostoma (Fig. 3). In the late postoperative period, in 1 patient out of 13 (7.7%) failure of anastomotic suture with formation of the fistula was observed (**Fig. 4**). In 6 out of 25 patients, the deltopectoral flap was used as the grafting material. In the early postoperative period, in 4 out of 6 (66.7%) patients, inflammation of the surgical wound was seen, in 2/6 cases (33.3%), failure of anastomotic suture, which resulted in one case in the formation of a fistula and in another, of a repharyngostoma; in 1 case out of 6 (16.7%), edge necrosis of the graft with formation of a repharyngostoma was observed (**Fig. 3**). In the late postoperative period, on the seventh day, in 1 case out of 6 (16.6%) the inflammation, edge necrosis of the flap, and formation of the repharyngostoma were observed (**Fig. 4**). Plastic surgery of Type II pharyngeal defects was performed in 6 patients. In 4 cases out of 6, the pectoral flap was used as the grafting material. In the early postoperative period, in 2 cases out of 4 (50%), failure of the surgical wound was seen, in 1 case out of 4 (25%), the inflammation of the surgical wound. In 1 patient out of 4 (25%), a fistula developed, and in 1 case out of 4 (25%), a repharyngostoma (**Fig. 5**).

In the late postoperative period, on the seventh day, in 1 patient out of 4 (25%), the inflammation of the surgical

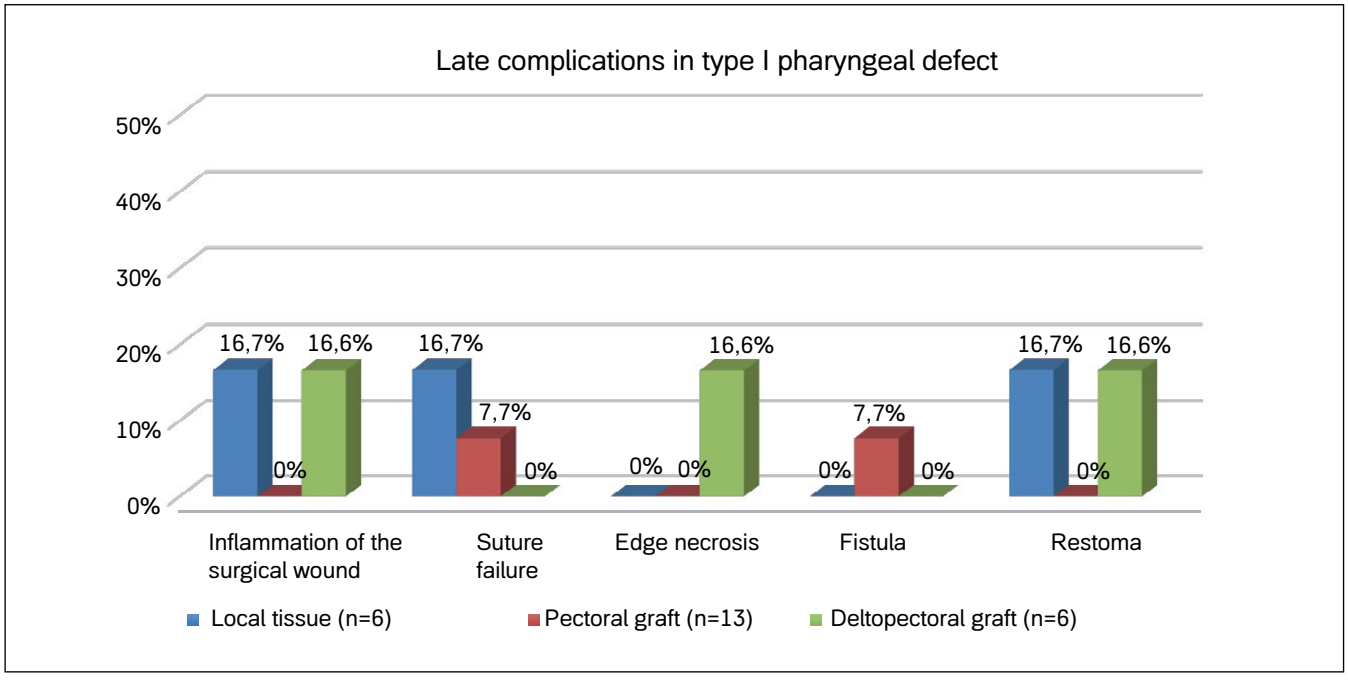

Figure 4. *Late complications in type I pharyngeal defect.*
Рисунок 4. *Поздние осложнения при I типе дефекта глотки.*

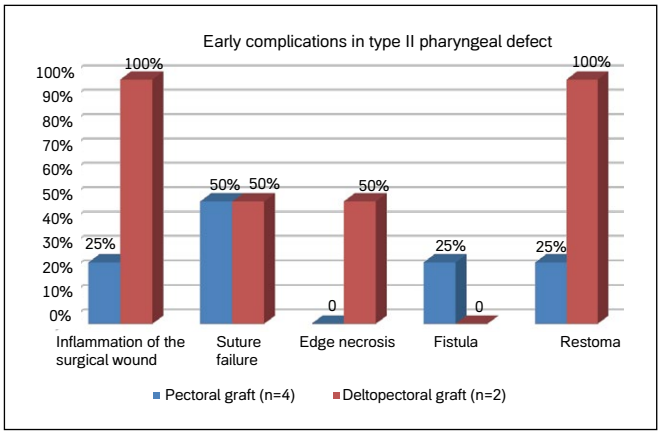

Figure 5. *Early complications in type II pharyngeal defect.*
Рисунок 5. *Ранние осложнения при II типе дефекта глотки.*

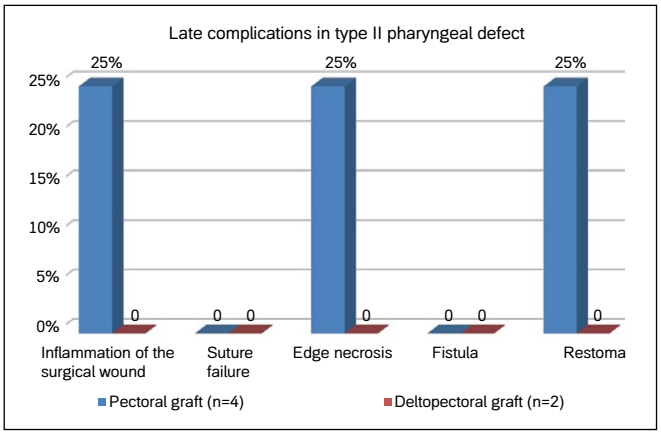

Figure 6. *Late complications in type II pharyngeal defect.*
Рисунок 6. *Поздние осложнения при II типе дефекта глотки.*

wound, edge necrosis of the graft and formation of the repharyngostoma were observed (**Fig. 6**).

In two patients out of six, the plastic surgery of the defect used the deltopectoral flap. In all cases, inflammation of the postoperative wound was observed in the early postoperative period, in one patient of two (50%), failure of anastomotic suture was observed, and in one patient of two (50%), the edge necrosis of the flap was seen. In both these patients, repharyngostomas formed (**Fig. 5**).

DISCUSSION

Reconstruction of pharyngeal and pharyngo-esophageal defects after laryngopharyngectomies is a complex task. The types of reconstructive techniques and types of grafts or flaps used can be divided into many categories depending on the size, shape, extent and whether the underlying defect being reconstructed is circumferential or not. Each type of plastic surgery has its own advantages and disadvantages [9].

In case of Type 0 pharyngeal defect, plastic surgery using local tissues showed a good functional result. The study of N. Süslü et al. (2016) used the data of 602 patients and showed that early that early enteral nutrition can be initiated even when using local tissue as the graft. In these patients, early enteral nutrition was initiated within 3 days of surgery, with a fistula incidence of approximately 11% [10]. In our study, during reconstruction of Type 0 pharyngeal defect with local tissues, only 1 patient out of 9 showed failure and fistula formation.

In type I pharyngeal defects, the best reconstructive method in terms of low probability of fistula and repharyngostoma formation is the use of the pectoral flap. Similar results were observed by other authors. Among 24 cases of pectoral flap use for non-circular pharyngeal defects described in the literature, swallowing was achieved in most patients within 7 to 14 days, and the incidence of fistula and repharyngostoma formation was 13% [3]. The use of the deltopectoral flap in the reconstruction of Type I pharyngeal defects has lower functional results. Some of the adverse postoperative complications reported in the literature are flap necrosis, fistula formation, and stenosis, with incidences of 67% among 12 patients who underwent pharyngeal reconstruction using the deltopectoral flap [11]. In our study, in 66% of cases, anastomotic suture failure and edge necrosis of the flap were observed; as a consequence, in all these cases, fistulas and refaryngostomas were formed.

In type II pharyngeal defects, the use of grafts on the axial blood supply led to a high rate of postoperative complications, resulting in the formation of fistulas and refaryngostomas. The incidence rate of postoperative complications was 75% with the use of the pectoral flap and 100% with the use of the deltopectoral flap. According to modern literature, the best options for reconstructing circular defects of the pharynx are free flaps (radial forearm flap, anterolateral thigh flap), and visceral flaps from fragments of intestinal tract. Complications in these types of grafting material may develop, according to different sources, in 7–26% cases [12, 13].

CONCLUSION

In this retrospective analysis, we studied the structure of complications after delayed reconstructive surgeries of pharyngeal and pharyngoesophageal defects of Types 0-II. Local tissue, pectoral and deltopectoral flaps were used as grafting material. Complications in the postoperative period were observed with all types of plastic surgery. The most common complications included: anastomotic failure with subsequent fistula formation and repharyngostoma. The reasons for the occurrence of these complications, given the viability of the grafting material, include post-radiation changes, the presence of an inflammatory process in the tissues in the area of the defect, the weakened nutritional status of the patient and a number of other reasons [14]. Thus, when planning delayed reconstruction of pharyngeal defects, in choosing the timing and type of grafting material, a personalized approach is needed in each clinical case, namely, determining the exact indications for delayed plastic surgery.

ADDITIONAL INFORMATION	ДОПОЛНИТЕЛЬНАЯ ИНФОРМАЦИЯ
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Conflict of interest. The authors declare that there are no obvious or potential conflicts of interest associated with the content of this article.	***Конфликт интересов.*** Авторы декларируют отсутствие явных и потенциальных конфликтов интересов, связанных с содержанием настоящей статьи.
Contribution of individual authors. A.O. Sidorenko: writing of the text. O.I. Kaganov, A.G. Gabrielyan: research design, editing of manuscript. A.A. Makhonin, A.E. Orlov: material processing. The authors gave their final approval of the manuscript for submission, and agreed to be accountable for all aspects of the work, implying proper study and resolution of issues related to the accuracy or integrity of any part of the work.	***Участие авторов.*** А.О. Сидоренко – написание текста. О.И. Каганов, А.Г. Габриелян – дизайн исследования, редактирование рукописи. А.А. Махонин, А.Е. Орлов – обработка материала. Все авторы одобрили финальную версию статьи перед публикацией, выразили согласие нести ответственность за все аспекты работы, подразумевающую надлежащее изучение и решение вопросов, связанных с точностью или добросовестностью любой части работы.

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