Chirurgia (2013) 108: 503-508
No. 4, July - August

Gastro-Omental Free Flap in Oro/Hypopharyngeal Reconstruction after Enlarged Ablative Surgery for Advanced Stage Cancer

N. Antohi[1], G. Tibirna[2], I. Suharski[3], C. Huian[4], S. Nae[4], V. Stan[4], F. Bodog[5]

[1]"Carol Davila" University of Medicine and Pharmacy, Bucharest, Romania
[2]Department of Head and Neck Surgery, Institute of Oncology, Chisinau, Republic of Moldova
[3]Department of General Surgery, Institute of Oncology, Chisinau, Republic of Moldova
[4]Emergency Hospital for Plastic Surgery and Burns, Bucharest, Romania
[5]Faculty of Medicine and Pharmacy, University of Oradea, Romania

Rezumat

Utilizarea lamboului gastroepiploic în reconstrucția oro/hipofaringelui după ablația chirurgicală extinsă postoncologică

Lamboul gastroepiploic poate fi folosit atât pentru reconstrucția tractului digestiv, cât și pentru acoperirea concomitentă a defectelor de părți moi la nivelul gâtului după exereza lărgită a tumorilor maligne avansate de orofaringe, hipofaringe și laringe (Stadiile III și IV după clasificarea TNM), iradiate preoperator. Reconstrucția efectuată concomitent cu exereza chirurgicală duce la îmbunătățirea calității vieții postoperator prin reducerea perioadei de spitalizare și reluarea deglutiției.

Fundamentare: Metodele de reconstrucție a defectelor complexe mucocutanate rezultate în urma ablației chirurgicale asociată cu radioterapie pentru tumorile maligne orofaringiene, hipofaringiene și laringiene trebuie să asigure atât reconstrucția tractului digestiv, cât și acoperirea simultană a defectului de părți moi de la nivelul regiunii cervicale. Lucrarea de față prezintă experiența noastră în utilizarea lamboului liber gastroepiploic pentru reconstrucția defectelor complexe de la nivelul orofaringelui, respectiv hipofaringelui.

Metode: În perioada 1990 – 2008, am folosit lamboul liber gastroepiploic pentru reconstrucția într-o singură etapă a unor defecte complexe rezultate în urma exciziei chirurgicale a unor tumori maligne orofaringiene în patru cazuri și hipofaringiene în 11 cazuri. Toți cei 15 pacienți fuseseră supuși și radioterapiei. În toate cazurile, ablația chirurgicală a tumorilor a fost asociată cu disecția regiunii cervicale.

Rezultate: Din cei 15 pacienți, am înregistrat necroza completă a lamboului într-un singur caz (6.67%). Alte complicații au mai fost: două cazuri de obstrucție pilorică, un caz de sângerare minimă superficială din mucoasa gastrică transplantată și trei fistule. Treisprezece pacienți au prezentat o funcție normală de deglutiție după această reconstrucție a tractului digestiv.

Concluzii: Lamboul liber gastroepiploic reprezintă o soluție valoroasă și sigură pentru acoperirea defectelor complexe extensive de la nivelul regiunii orale și cervicale, rezultate în urma ablațiilor tumorilor maligne avansate.

Cuvinte cheie: lambou gastroepiploic, faringe, reconstrucție cervicală

Abstract

Reconstruction of complex mucocutaneous defects after ablative surgery for advanced cancer of the oropharynx, hypopharynx and larynx (Stages III and IV of disease according to TNM classification) with previous radiotherapy is a challenging problem for the plastic surgeon. The gastro-omental free flap provides in these cases both a reliable mucosal lining of the digestive tract and soft tissue coverage in the neck. One-stage surgical excision and reconstruction

Corresponding author: Sorin Nae, MD
Emergency Hospital for Plastic Surgery and Burns, Bucharest
218 Calea Griviței, District 1, Bucharest
Romania
Fax.: 031 817 0921
E-mail: naedaniel@gmail.com
naesorin@yahoo.com

improves the quality of life by reducing the hospitalization and providing recovery of the swallowing function.
Background: The method of reconstruction of the complex mucocutaneous defects that usually occur after extensive ablative surgery associated with radiotherapy for advanced malignant lesions of the oropharynx, hypopharynx and larynx should provide both digestive tract reconstruction and soft tissue coverage of the neck. The purpose of the article is to report our experience with the use of the gastro-omental free flap for the reconstruction of such complex defects of the oro-and hypopharynx.
Method: Gastro-omental free flap was used for one-stage reconstruction of complex defects of the oropharynx in four cases and hypopharynx in eleven cases between December 1990 and December 2008 after extensive ablative surgery for cancer. All fifteen patients had received previous irradiation. In all cases the tumor ablation was associated with neck dissection.
Results: There was one flap failure in this series (6.67%). Complications included: two cases of gastric outlet obstructions, one case of mild superficial bleeding of the transplanted gastric mucosa and three fistulas formed. Thirteen patients had adequate swallowing function after reconstruction of the digestive tract.
Conclusion: Gastro-omental free flap represents a reliable and valuable solution in covering of extended and complex defects in the oral and cervical area following advanced cancer ablation.

Key words: gastro-omental flap, pharynx, neck reconstruction

Introduction

Ablative surgery for stage III-IV malignancies of the oropharynx, hypopharynx and larynx usually results in complex defects with loss of function and continuity in the upper digestive tract and soft tissue deficiency. Wound healing could be also compromised by previous radiotherapy.

The method used for reconstruction should reestablish the integrity of the digestive tract and cover the cervical defect with healthy and well vascularized tissue (1,2).

Unfortunately no flap possesses all of the characteristics of native tissues with respect to sensation, pliability, thickness, muscular activity, or secretory capacity (3).

The purpose of this article is to report our experience in the reconstruction of such complex defects using a free gastro-omental flap.

Material and Methods

From 1990 to 2008, fifteen patients underwent extensive ablative surgery for advanced oropharyngeal, hypopharyngeal and laryngeal cancer and reconstruction with a free gastro-omental flap. There were fourteen men and one woman with a mean age of 57 years (range between 41 and 64 years). The primary site of the tumor was the oropharynx in four cases, the hypopharynx in three cases and larynx with hypopharyngeal invasion in eight cases. Nine patients had Stage III disease, and six had Stage IV, according to TNM classification. Histologic examination revealed squamous cell carcinoma in fourteen cases and adenocarcinoma in one case.

All patients had been irradiated preoperatively (40-60 Gy). Seven patients needed postoperative irradiation as well. The magnitude of the ablative surgery was determined according to the site and size of the primary tumor, invasion of the adjacent structures and involvement of the cervical lymph nodes. Neck dissection was performed in all cases (*Table 1*). All patients have undertaken a preoperative gastroscopy for evaluating the integrity of the gastric lining and secondary gastric cancer exclusion.

In four cases the gastric mucosa restored the integrity of the oropharynx and in eleven cases it restored the continuity of the hypopharynx. In twelve cases the gastric mucosa was applied as a patch and in the remaining three cases it was tubed to reconstruct the circumferential defect of the hypopharynx. The part of omentum used covered in all cases the antero-lateral cervical defects resulting from neck dissection.

The surgical team was comprised of a plastic surgeon, a general surgeon and an oro-maxillo-facial surgeon. Two simultaneous teams resected the tumor and elevated the flap.

Flap anatomy

The greater curvature of the stomach has a rich vascular supply from the right and left gastroepiploic arteries and veins. These vessels are closely located to the inferior aspect of the greater curvature. Both arterial systems provide an extensive network to the gastric mucosa and greater omentum. Of the two gastroepiploic arteries, the right one is usually dominant in calibre (between 1.5 – 3 mm) and length (up to 20 cm). The right gastroepiploic artery arises from the gastro-duodenal artery, which is a branch of the common hepatic artery.

Gastric parietal cells are concentrated in the body of the stomach and there are substantially fewer parietal cells in the mucosa of the greater curvature. That makes the secretory effect of the gastric mucosa less important to the recipient site.

Technique

The gastro-omental free flap is harvested as a composite flap, consisting of a segment of great curvature of the

Table 1. *Type of neck dissection*

Neck dissection	No. of cases
Modified radical, unilateral	3
Modified radical, bilateral	4
Radical unilateral	3
Simultaneous homolateral radical and contralateral modified radical	5

stomach together with a segment of the greater omentum based on the right gastroepiploic vessels. The flap is harvested through a supraumbilical midline laparotomy with the patient placed in supine position. Once the stomach and omentum are mobilized free of the gastrocolic ligament, the right gastroepiploic vessels are defined and the desired amount of omentum is harvested on this vascular pedicle. Proximal and distal gastrotomies are designed along the greater curvature of the stomach to obtain the desired surface to reconstruct the primary mucosal defect in the recipient area. Gastric outlet obstruction is avoided by taking care not to place the distal gastrotomy too close to the pylorus (*Fig. 1*).

When a tubed mucosal flap is required to provide a conduit for circumferential pharyngeal reconstruction, a tube of appropriate calibre is inserted via proximal and distal gastrotomies and a gastrointestinal stapling device is used to harvest the flap while simultaneously closing the gastric defect (4). Following careful dissection and division of the vascular pedicle, the gastric flap and attached omentum are transferred to the neck.

A gastrojejunostomy tube is inserted at the time of harvest to allow for early postoperative jejunal feeding and simultaneous gastric decompression, limiting the period of postoperative ileus.

Mucosal and vascular anastomoses

The gastric patch is positioned with the mucosa inside the digestive tract. When the tube gastric flap was used, its caudal end was placed at the esophageal stump and the cranial end was placed at the tongue base. The mucosal anastomoses were performed in two layers with 4/0 Vicryl.

Vascular anastomoses were performed with Nylon 8/0 and 9/0 to a single recipient artery and vein. We have used more frequently the inferior thyroid artery (n=11) and then the transverse cervical artery (n=4). Venous anastomoses were performed to the external jugular vein. All the vessels were connected end-to-end. Following completion of microvascular vessel anastomosis, the omentum is trimmed and draped over the mucosal anastomoses and antero-lateral neck. If necessary, a layered closure with either local or regional cutaneous flaps or split thickness skin graft is performed. A small portion of the transferred omentum is left outside for monitoring the flap.

Swallow function

Fifteen days after the reconstruction surgery X-ray barium -swallow study was performed, and if no leak was demonstrated the patient started an oral diet.

Case reports

Case 1. (*Fig. 2*). A 55 year-old-man was admitted with a scuamous cell carcinoma of the larynx invading the hypopharynx – $T_3N_3M_0$. After 40Gy preoperative radiotherapy, total laryngectomy with partial hypopharyngeal resection and bilateral neck dissection was performed. The alimentary tract was reconstructed with patch-on gastric mucosa. The greater omentum covered the cervical defect protecting the exposed important structures. Due to skin insufficiency, a skin graft of 2.5/3 cm was applied on the omentum. The vascular anastomoses were performed end-to-end with the transverse cervical artery and external jugular vein. The postoperative period was uneventful. The patient started oral feeding on the 16th postoperative day.

Case 2. (*Fig. 3*). A 58-year-old patient was admitted with a squamous cell carcinoma of the tonsillar pillar – $T_3N_3M_0$. Preoperative radiotherapy of 40 Gy was applied to the primary tumor and to the right lateral side of the neck two months before surgery. Ablative surgery consisted of large resection of the primary tumor with partial mandibular resection, right radical neck dissection and reconstruction with a free gastro-omental flap. The gastric mucosa lined the oropharynx and the omentum covered the right lateral neck. The vascular anastomoses were performed end-to-end with the inferior thyroid artery and the external jugular vein. Postoperative curse was uneventful. The patient started liquid oral feeding on the 15th postoperative day.

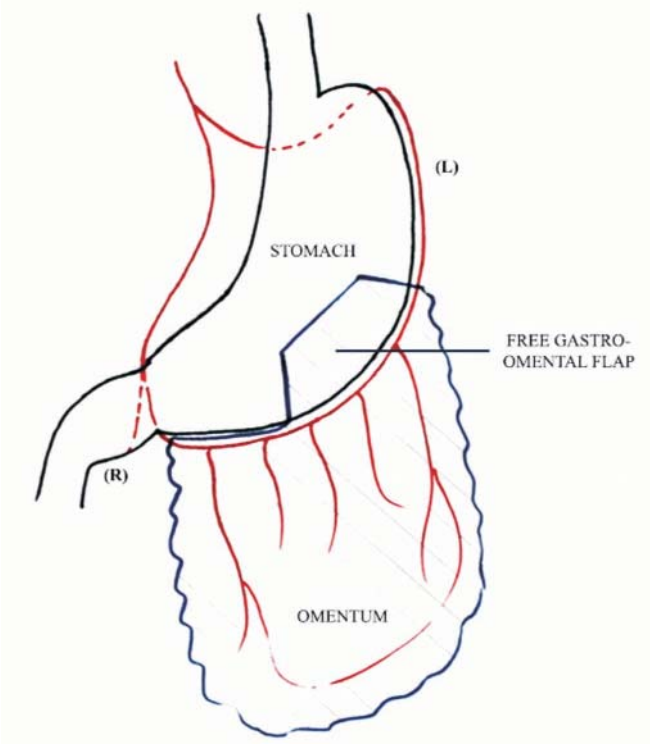

Figure 1. *Figure 1. Scheme of the gastro-omental flap*

Results

From 1991 to 2008, 15 gastro-omental free flaps were used for reconstruction of composite oropharyngeal and hypopharyngeal defects resulting from tumor ablation.

There was one flap failure early in this series due to thrombosis of the vascular pedicle. After flap removal, the remaining skin was approximated to the pharyngeal edges creating an extensive pharyngostoma. Later on, a combined latissimus dorsi and scapular free flap transfer was used for secondary

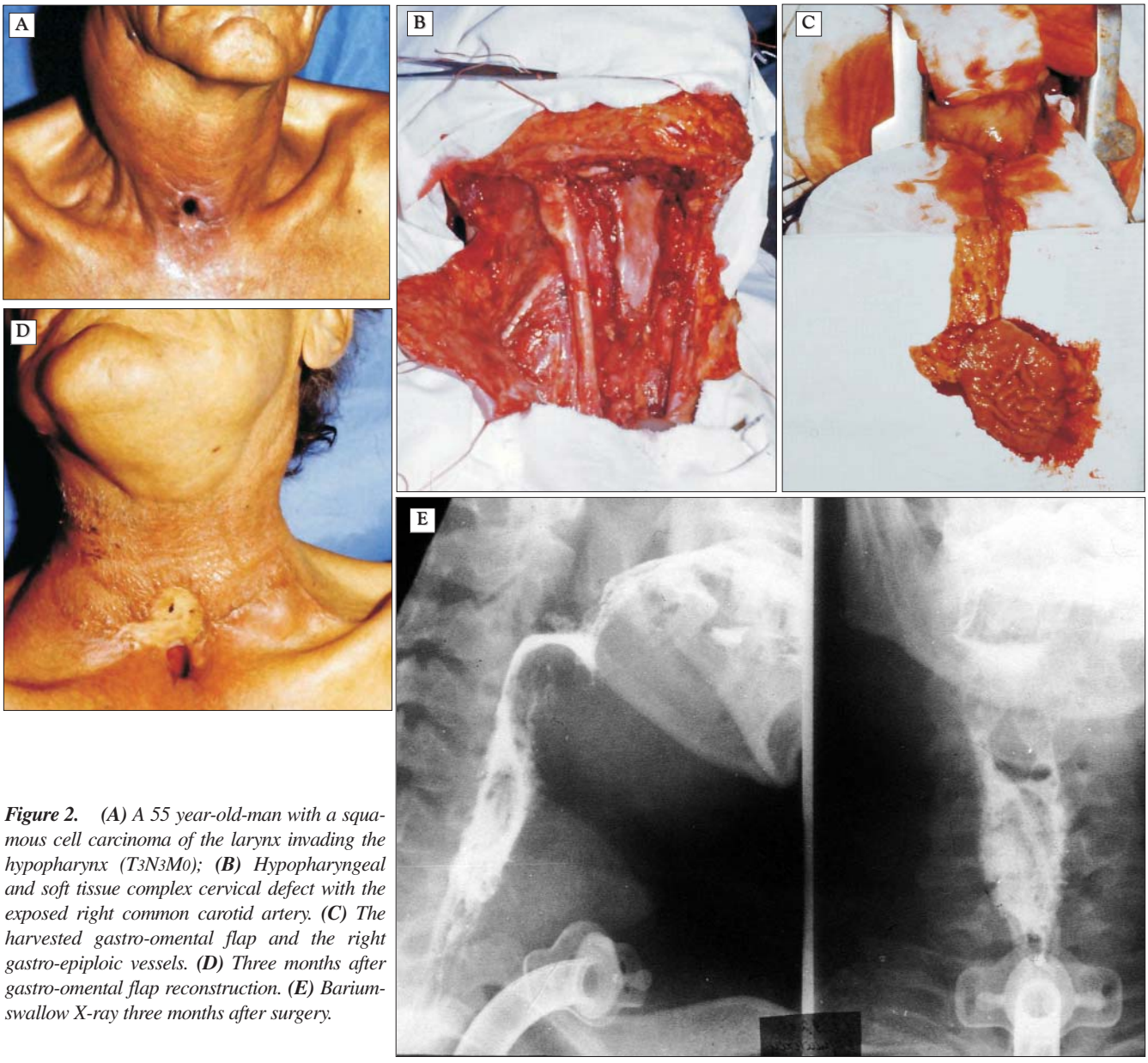

Figure 2. *(A) A 55 year-old-man with a squamous cell carcinoma of the larynx invading the hypopharynx (T3N3M0); (B) Hypopharyngeal and soft tissue complex cervical defect with the exposed right common carotid artery. (C) The harvested gastro-omental flap and the right gastro-epiploic vessels. (D) Three months after gastro-omental flap reconstruction. (E) Barium-swallow X-ray three months after surgery.*

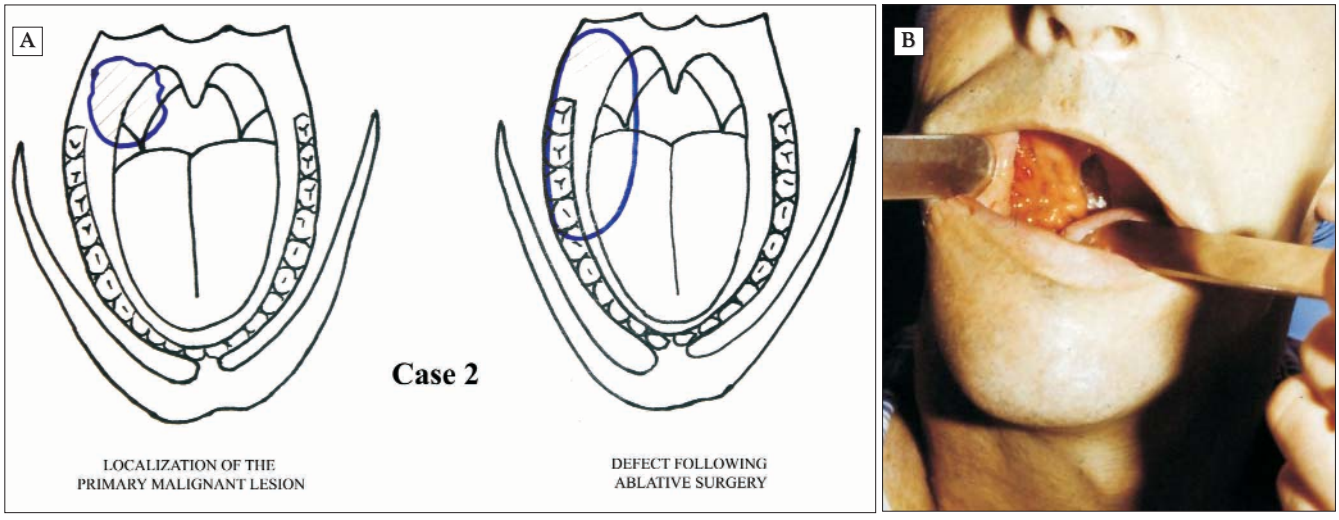

Figure 3. *(A) Scheme of the primary tumor localization and ablative resection of a 58 year-old patient with squamous cell carcinoma of the right tonsillar pillar (T4N3M0). (B) Four months after gastro-omental flap reconstruction*

reconstruction with good final result (5). Local wound complication with salivary pharyngocutaneous fistula formation occurred in three cases. Two of them healed spontaneously with local wound care. In one case the pharyngocutaneous fistula was successfully treated with pectoral major myocutaneous pedicle flap (6). There was one case of mild superficial bleeding of the transplanted gastric mucosa which responded well to proton-pump inhibitor therapy. No complications related to laparotomy occurred. Respiratory tract complications were the most frequent systemic complications and occurred in two cases (13.3%). Cardiovascular complications occurred in one case (6.6%).

Late complications consisted in two cases of gastric outlet obstructions solved by balloon pyloric dilatation. Analysis by physical examination, history and radiology (barium-swallow) revealed that thirteen patients had adequate swallowing function. Adequate function is defined as the ability to maintain nutrition without tube feeding. Two patients had inadequate deglutition, needing tube feeding. A pharyngo-esophageal stricture developed in two cases. It was solved in both cases with endoscopic dilatation with good functional result. The median length for hospital stay was 19 days. Postoperatively six patients with local recurrence were irradiated. All of them tolerated well this procedure and no trophic lesions on the transplanted tissues occurred.

Survival rate at 12 months after the surgery was 86.6%. Two patients died at that time because of distant metastatic disease. Eight of fifteen operated patients survived more than three years (53.3%). Five patients survived more than five years (33.3%).

Discussion

Treatment of advanced malignant lesions of the pharynx and larynx with metastatic involvement of the cervical lymph nodes includes wide primary tumor resection, different types of neck dissection, radiotherapy and, sometimes, chemotherapy (7,8). It has become obvious that, during the last 30 years, reconstructive surgery has become a part of the treatment bringing its contribution not only to quality of patient life after surgery, but also influencing the survival rate. In such advanced cases the effectiveness of ablative surgery could be determined by the possibility to reconstruct the organ and to cover the coexisting defect. With the advent of plastic surgery it has become possible to operate even cases so advanced that were considered out of surgical treatment a short time before.

Selected method of reconstruction should ideally be associated with low mortality and morbidity, performed in a single stage, be effective in restoring normal deglutition and provide good wound healing (1,9). The solution in these problems largely depends on the size of the defect and the state of the skin and adjacent soft tissue. In our series of 15 patients we included only those with complex defects and previous radiotherapy.

The selected methods of reconstruction employed local skin flaps. Cervical skin flaps were limited by their size and viability especially following radiotherapy. Over the past four decades the solutions progressed considerably from the use of cervical skin and different multistage procedures to the development of microvascular techniques in free flap transfer (10,11,12).

The microvascular transfer of the gastro-omental flap is an important acquisition among cervicofacial methods of reconstruction (3,9,10,13). Romanian surgeon Ion Kiricuta was the first who demonstrated the possibility of combining a part of the gastric lining with the great omentum using the same vascular pedicle (14). Baudet (1979) used for the first time microvascular transfer of the antral lining and omentum for a pharynx defect (15). Later on, this method was popularized by Panje and all (1,2). They stated that tissue characteristics of the transplanted material were rather similar to those of the removed pharyngeal tissue. The advantages of this flap are numerous: it brings thin, pliable gastric lining, which can widely vary in dimensions and can be easily tubulised for circumferential organ reconstruction. There was no problem with our patients related to gastric mucous secretion. We concur with other authors that it has beneficial effect on swallowing, particularly in patients whose salivary glands were affected by radiotherapy (16).

The greater omentum which is attached to the antrum has an important role in covering the remaining complex defects, protecting the mucosal anastomoses, great vessels and trachea and filling the dead spaces. The greater omentum is a well vascularised organ with a rich source of angiogenic factors that promote the growth of blood vessels into irradiated tissue (17,18). The greater omentum has a good immunologic capacity with infection resistance. This capacity is important in preventing wound breakdown and fistula formation. It also serves as a good bed for skin graft when there is not enough cervical skin for direct closure. A segment of exteriorised omentum was used in fourteen cases for flap monitorisatioin. The only one lost flap monitorization. The lost flap was the only one not monitorized. This led to late detection of arterial thrombosis and flap failure.

The length of the vascular pedicle is another advantage of the greater omentum. It allows one to perform microvascular anastomosis outside the irradiated area, decreasing the risk of vascular trombosis. In our series we have used as recipient vessels the inferior thyroid and transverse cervical arteries and the external jugular vein. The flap must be handled with care once the anastomoses are performed and must be secured with additional tacking sutures in a convenient position.

Functional results concerning the swallowing reflex are comparable with those of fasciocutaneous flap reconstruction of this area (11,12). The gastric part of the flap creates an adynamic passage of food and can be tailored according to local requirements.

Swallowing function rehabilitation registers a continuous progress between 1 and 6 months. Six cases were irradiated after reconstruction with gastro-omental free flap. The transplanted gastric mucosa tolerated radiation well maintaining its secretory capacity (16). Donor site morbidity is relative and provides an aesthetic result acceptable to the patient. Laparotomy incision can theoretically predispose the patient

to intraabdominal adherences, intraperitoneal abscesses or peritonitis. None of these complications were encountered in our cases, nor described in specialized literature describing the gastro-omental flap harvest.

The high morbidity, rather high rate of recurrence and distant metastasis in our series could be considered in some ways disappointing. However, it is a real salvage surgery for most of these patients with very advanced cancer of the pharynx and larynx with high risk of postoperative complication and recurrence of disease.

The contraindications to free transfer of the gastro-omentum include: history of gastric outlet obstruction, peptic ulcer and concomitant gastric malignant tumor.

Conclusions

Complex pharyngeal defects after enlarged ablative surgery for advanced cancer of pharynx and larynx, requiring large amounts of soft tissue replacement, can be safely reconstructed with gastro-omental free flap. Reconstruction of the alimentary tract by transferred gastric mucosa and the capacity of the omentum to protect the anastomosis and the great vessels represent good indications of this flap in complex irradiated defects of the cervical area.

References

1. Panje WR, Little AG, Ferguson MK, Moran WJ, Scher N. Immediate gastroomental reconstruction of the mouth and throat. Ann Otol Rhinol Laryngol. 1987;96(1 Pt 1):15-21.
2. Panje WR, Pitcock JK, Vargish T. Free omental flap reconstruction of complicated head and neck wounds. Otolaryngol Head Neck Surg. 1989;100(6):588-93.
3. Chahine KA, Chaffanjon P, Bettaga G, Lebeau J, Reyt E, Righini CA. Gastro-omental free flap in the reconstruction of the unfavourable hypopharyngeal defects: A functional assessment. J Plast Reconstr Aesthet Surg. 2009;62(11):1367-73.
4. Genden EM, Kaufman MR, Katz B, Vine A, Urken ML. Tubed gastro-omental free flap for pharyngoesophageal reconstruction. Arch Otolaryngol Head Neck Surg. 2001;127(7): 847-53.
5. Antohi N, Tîbîrnă G. The combined latissimus dorsi and scapular free flap for the complex anterior neck defect after enlarged total laryngectomy. Ann Plast Surg. 1994;33(3):317-9.
6. Antohi N, Tibirna G, Suharski I, Bejan A, Marina S, Pogonet V, et al. Free flaps for type III complex pharyngoesophageal defects after enlarged ablative surgery for advanced cancer of larynx and hypofarynx. Microsurgery. 2003;23(3):189-93.
7. Bova R, Goh R, Poulson M, Coman WB. Total pharyngolaryngectomy for squamous cell carcinoma of the hypopharynx: a review. Laryngoscope. 2005;115(5):864-9.
8. Berteşteanu SV, Popescu CR, Grigore R, Popescu B. Pharyngoesophageal junction neoplasia - therapeutic management. Chirurgia (Bucur). 2012;107(1):33-8.
9. Mixter RC, Rao VK, Katsaros J, Noon J, Tan E. Simultaneous reconstruction of cervical soft tissue and esophagus with gastro-omental free flap. Plast Reconstr Surg. 1990;86(5):905-9.
10. Gallagher J, Webb A, Ilankovan V. Gastro-omental free flaps in oral and oralpharyngeal reconstruction: surgical anatomy, complications, outcomes. Br J Oral Maxillofac Surg. 2002; 40(1):32-6.
11. Scharpf J, Esclamado RM. Reconstruction with radial forearm flaps after ablative surgery for hypopharyngeal cancer. Head Neck. 2003;25(4):261-6.
12. Lewin JS, Barringer DA, May AH, Gillenwater AM, Arnold KA, Roberts DB, et al. Functional outcomes after laryngopharyngectomy with anterolateral thigh flap reconstruction. Head Neck. 2006;28(2):142-9.
13. Patel RS, Gilbert RW. Utility of the gastro-omental free flap in head and neck reconstruction. Curr Opin Otolaryngol Head Neck Surg. 2009;17(4):258-62.
14. Kiricuta I, Galatar S. Chirurgia marelui epiploon și importanta cunoasterii vascularizatiei sale. Surgery of greater omentum and the importance of knowing its vascular anatomy. Chirurgia (Bucur). 1970;10:881-92.
15. Baudet J. Reconstruction of the pharyngeal wall by transfer of the greater omentum and stomach. Int J Microsurg. 1979;1: 53-9.
16. Devineni VR, Hayden R, Fredrickson J, Sicard G. Tolerance of gastric mucosal flap to postoperative irradiation. Laryngoscope. 1991;101(5):462-4.
17. Kiricuta I, Use of the omentum in plastic surgery. Bucuresti: Editura medicala; 1980.
18. Moran WJ, Panje WR. The free greater omental flap for treatment of mandibular osteoradionecrosis. Arch Otolaryngol Head Neck Surg. 1987;113(4):425-7.