Reconstructive procedures in maxillofacial oncosurgery

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Objective. Oropharyngeal cancers are a biologically heterogeneous group of tumors with diverse risk factors including tobacco, alcohol, HPV, inherited disorders, the acquired immunodeficiency of Kaposi's Sarcoma and non Hodgkin's lymphoma. In the Czech Republic, oropharyngeal cancers represent around 2% of all cancers. The treatment of these tumors is long and complex. Reconstructive procedures in maxillofacial oncosurgery demand good interdisciplinary collaboration and great professional preparedness of the surgical and nursing team. Patient age and stage of disease, including the presence of metastases are of key importance. A prerequisite for the success of surgical treatment is removal of the tumor with a sufficient safety margin. Reconstructive procedures then follow.

Aim. To highlight the importance of radical tumor resection and describe reconstruction of the defect in a group of our patients.

Methods and Results. From 2008 to 2013, 23 patients with oropharyngeal carcinoma underwent radical surgical removal of tumor, followed by reconstruction of postoperative defects using distant and free flaps. The histopathology showed predominantly squamous cell carcinomas and one of Merkel cell carcinoma. 16 patients had malignant disease detected in III-IV.

In only 7 cases was treatment initiated in the first and second stages of the disease. In these patients, the tumors were removed with a safety margin of healthy tissue and in none, did the basic cancer recur. The postoperative course in terms of flap engraftment and overall condition of the patient was uneventful. All of these patients still enjoy a good life quality with a current mean survival in range 5 – 76 months. Radical surgical removal of a malignant tumor in the early stages of the disease is associated with fewer postoperative complications and longer survival.

Conclusion. To avoid the risk of local and/or systemic postoperative complications, appropriate patient selection is important. Overall, the traditional, classic reconstructive procedures with the use of prostheses, in many cases is still the best option in our experience.

Key words: reconstruction of defects, free flaps

Received: April 11, 2014; Accepted: October 15, 2014; Available online: November 7, 2014
<http://dx.doi.org/10.5507/bp.2014.055>

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INTRODUCTION

Oropharyngeal cancers are among the 10 most frequent cancers in the world with increases every year of around 500,000 new cases. Only about one third of patients survive 5 years following diagnosis. The percentage of these tumors in the Czech Republic is around 2% (3% in the USA, in the countries of Southeast Asia from 35 to 40%). Rational treatment of oropharyngeal cancers is complex and long. Selection of optimal treatment modalities depend on the biological nature of the tumor, its size and location. From a therapeutic viewpoint, patient age, overall health and stage of malignancy are of paramount importance.

Currently, surgical treatment of malignant tumors of the head and neck still dominates. A prerequisite is to remove the whole tumor with a sufficient safety margin^{1,2}. Reconstruction surgical procedures in oncosurgery include local flap, reconstruction of soft tissue defects using free dermo-epidermal grafts and complex microsurgical procedures. Small tumors usually do not require reconstruction of defects. In advanced cancer, however,

simple reconstruction is inadequate and we use free flaps. The principle is to take tissue from a remote location and transfer it to the defective site after careful vascular anastomosis. The immediate postoperative period is of great importance requiring continuous monitoring of blood supply and patency of graft, using direct and indirect techniques. With the lapse of time after surgery, the patient usually requires additional surgical treatment (remodeling) of transferred flap.

A total of 23 reconstructive procedures using free flaps (Table 1) were carried out at the Department of Oral and Maxillofacial Surgery in the years 2008 - 2013 in collaboration with the Department of Plastic and Aesthetic Surgery, both of the University Hospital Olomouc. The sample included 18 men and 5 women, in the majority of cases smokers with a positive attitude towards alcohol. 22 patients were treated for squamous cell carcinoma and one patient was treated for Merkel cell carcinoma.

Selecting the reconstruction process depends on the general health of the patient and the stage of the malignancy. For reconstruction we used free osteomyocutaneous, myocutaneous flaps or remote flaps (Fig. 1) For

reconstruction of the lower jaw and surrounding soft tissues we mostly use bone grafts from the fibula, which, compared with the iliac crest have a lower tendency to resorption (Fig. 2-4).

After surgery, we monitored the patency of the grafts, mainly by direct methods (visualisation, palpation) or by localized cutaneous island in the mouth. The indirect method we used was Doppler flowmetry.

For the free flaps for reconstruction of the defects, we used pectoral flaps. In two patients, this flap reconstructed the face and in one case, defects after subtotal resection of the base of the tongue and oral cavity.

RESULTS

Sixteen of patients had malignant disease detected in III-IV stage (Table 2). In only 7 cases (Table 1, patients No. 2, 5, 10, 18, 19, 20, 21), was treatment initiated in the first and second stages of the disease. In all these patients, the tumors were removed with a safety margin of healthy tissue and in none, did the basic cancer recur. The postoperative course in terms of flap engraftment and overall condition of the patient was uneventful. All of these patients still enjoy a good life quality with a current mean survival in range 5 - 76 months. Sixteen patients started treatment in stages III. - IV. of malignancy. Ten (Table 1, patients No. 1, 6, 7, 9, 11, 12, 13, 14, 15, 22) died of locoregional recurrence with a median survival of 19 months. Except for one patient treated for Merkel cell carcinoma, all these patients had positive resection margins, and local and systemic complications of surgical

treatment were common (Table 2). One patient (No. 12) died on the second postoperative day of pulmonary embolism. In patient No. 6, the free fibula flap failed to engraft and the defect had to be subsequently reconstructed using an m. latissimus dorsi flap. The mandibular defect in patient (No. 7) was reconstructed after osteomyelitis of the mandible with chin extraoral fistula. The osteomyelitis was treated with systemic and local antibiotics (Dalacin 600 mg iv, Garamycin) and skin defect in the submental area after excision of the oral cutaneous fistula was reconstructed using free flap - musculus rectus abdominis. In one case (No. 8) there was fracture of titanium osteosynthetic plate in the angle of the mandible and subsequent osteomyelitis of the fibula. This complication we managed by removal of the plate, fibula and mandibular resection margins and replaced it with more rigid material. The patient treated for Merkel cell carcinoma (No. 14) died two years after surgery. The cause of death was generalised primary oncological disease (lymphoma).

DISCUSSION

The technique of microvascular free flap was first used by Seidenberg in 1959 for reconstruction of the esophagus (jejunal flap) (ref.³). Later the Australian team led by Taylor in 1975 succeeded in reconstruction of bone defect using free fibula. Reconstruction of the lower jaw using the fibula was first done by Hidalgo^{4,5}. Then in the 1980s began a period of rapid development in microvascular reconstructive surgery

Table 1. Summary of patients after reconstruction with free and distant flaps.

Patient	Gender	pTNM	Tumor type	Localisation	Primary/secondary surgical procedure	Type of flap
1.	male	pT3N1Mx	SCC	Base of mouth	primary	Iliac crest flap
2.	female	pT2N0Mx	SCC	Madibule alveolus	Primary	Free fibula flap
3.	female	pT4N2cMx	SCC	Base of mouth + alveolus	Primary	Free fibula flap
4.	male	pT4N2bMx	SCC	Alveolus	Secondary/recidivism	Anterolateral flap
5.	male	pT2N0Mx	SCC	Alveolus	Secondary/recidivism	Anterolateral flap
6.	male	pT3N0Mx	SCC	radix of tongue	Secondary	Free fibula+latissimus dorsi flap
7.	male	pT4N0Mx	SCC	Base of mouth	Primary	Free fibula/rectus abdomis flap
8.	male	pT4N1Mx	SCC	Base of mouth	Primary	Free fibula flap
9.	male	pT4N1Mx	SCC	Mandible alveolus	Primary	Free fibula flap
10.	female	pT1N0Mx	SCC	Mandible alveolus	Secondary	Free fibula/latissimus dorsi flap
11.	male	pT3N2bMx	SCC	cheek	Secondary	Anterolateral flap
12.	male	pT4N2bMx	SCC	Tonsils + radix of tongue	Primary	latissimus dorsi flap
13.	male	pT3N2bMx	SCC	Alveolus	Secondary	free fibula flap
14.	female	pT3N3Mx	MCC	cheek	Primary	latissimus dorsi flap
15.	female	pT4N2Mx	SCC	Tuber maxilla	Primary	latissimus dorsi flap
16.	male	pT4N3Mx	SCC	Maxillary sinus	Primary	latissimus dorsi flap
17.	male	pT4N0Mx	SCC	Upper lip	Secondary	Radial forearm flap
18.	male	pT2N0Mx	SCC	cheek	Primary	Rectus abdominis flap
19.	male	pT2N0Mx	SCC	cheek	Primary	Latissimus dorsi flap
20.	male	pT1N0Mx	SCC	Floor of mouth	Primary	Pectoralis major flap
21.	male	pT2N1Mx	SCC	cheek	Primary	Pectoralis major flap
22.	male	pT3N2bMx	SCC	cheek	Primary	Pectoralis major flap
23.	male	pT3N1Mx	SCC	Floor of tongue	Primary	Pectoralis major flap

SCC – Squamous cell carcinoma, MCC – Merkel cell carcinoma

Table 2. Results (recurrence, positivity of the margins, complications) of the patients after reconstruction.

Patient	Margins	Recurrence	Complications	Survival/death
1	-	Yes in 9 months		Death after 12 months
2	-	Yes in 60 months		Alive at 76 months
3	-	No		Alive at 82 months
4	+	No		Alive at 19 months
5	-	No		Alive at months
6	+	Yes in 9 months	Total failer	Died after 42 months
7	+	Yes in 29 months	Osteoradionecrosis of fibula	Died after 36 months
8	-	No	Osteoradionecrosis of fibula	Alive at 43 months
9	+	Yes in 29 months	Osteoradionecrosis of fibula	Died after 40 months
10	-	No		Alive at 49 months
11	+	Yes in 4 months		Died after 5 months
12			Embolism	Died second day after operation
13	+	Yes in 5 months		Died after 7 months
14	-	No		Died after 20 months
15	+	Yes in 16 months		Died after 20 months
16	-	No		Alive at 23 months
17	-	No		Alive at 39 months
18	-	No		Alive at 16 months
19	-	No		Alive at 13 months
20	-	No		Alive at 5 months
21	-	No		Alive at 5 months
22	+	Yes in 3 months		Died after 4 months
23	-	No		Alive at 3 months

+ positive margin, - negative margin

Fig. 1. Distribution of flaps used for reconstruction.

Defects in the head and neck can, according to anatomical location and reconstructive technique, be divided into six: intraoral, mandibular, middle face, mouth and tongue floor defects and scalp defects⁶.

Intraoral defects include tongue, base of the oral cavity, face, hypopharynx, larynx and cervical esophagus. Experience shows that defects of the tongue of less than 50%, can be reconstructed primarily by simple suture or sculptured local flap⁷. For large defects of the tongue (50-70%) reconstruction using free flap is a virtual necessity but questionable in the case of large tumors involving subtotal to total glossectomy. It is an extensive, mutilating performance to remove the tumor and as the literature attests to, total rehabilitation of lobar structure of the tongue is very difficult, if not impossible^{8,9}. The results of

reconstruction of the tongue (swallowing, phonation) using free flap depend on the amount of remaining healthy tissue to ensure its mobility¹⁰. In our department, we encounter tumors in the early stages (T1 favorable sites) requiring mostly extirpation with primary suture and possibly local flap reconstruction. After surgical removal of large tumors, for satisfactory functional rehabilitation, reconstruction of the defect is usually essential. For large tumors of the tongue (T4) radical surgical therapy is often the only treatment option. In the oral cavity the flap should be soft and malleable, and therefore frequently used is the Chinese forearm flap, first done in practice in the early 1980s¹¹. The advantage of this flap is long pedicle (a. et v. radialis) and accompanying superficial venous blood vessels which can be used for additional ve-

Fig. 2. Free fibula after fixation in defect.

Fig. 3. Frontal image of skull after reconstructive surgery.

nous anastomosis and prevent venostasis. Along with the flap, we can also remove the palmaris longus tendon or bone part of the spindle, which can be used to reconstruct the lip muscle or for jaw bone defects. This option was employed in one of our patients after partial resection of the upper lip and premaxilla with large cell carcinoma of the upper lip. In our patients with intraoral tumors and depending on the size of the defect, we use both latissimus dorsi muscle and rectus abdominis and forearm flap. For reconstruction of the tongue after subtotal glossectomy in one case we used the pectoral flap with very good functional and aesthetic results.

Defects of the hypopharynx, larynx and cervical esophagus can be reconstructed for example using free jejunum, colon or anterolateral thigh flap.

For reconstruction of mandibular defects most used is vascularized bone. Reconstruction is necessary especially in postoperative defects localized in the frontal parts of the jaw, where we have to avoid instability of the tongue, with the subsequent risk of asphyxia^{8,12}. Osteomyocutaneous flap which includes free fibula can be used to reconstruct the body of the mandible, the alveolar mucosa and lower lip, oral cavity and the base of the tongue. In the lateral section of the lower jaw we have more options. In young individuals we try to reconstruct the defects usually using vascularised bone (free fibula, iliac crest) or reconstruction plates¹³. In elderly patients with uncertain prognosis the mandibular defects are left without reconstruction and soft tissue is replaced using local flap.

Opinions on the reconstruction of defects of the upper jaw and middle face vary. Devin et al. divide the defects of the upper jaw according to extent into three categories¹⁴.

Fig. 4. Results after reconstruction of lower jaw and defect of soft tissue in floor of mouth.

Small defects I. and II. category can most elegantly be solved by prosthesis and dentures. In some patients, however, prosthetic rehabilitation is poorly tolerated and may require surgical alternatives to local or free flap. In some cases (e.g. defects of the hard palate with the transition to the alveoli) the lobar sculpture may complicate visual inspection of the surgical field in the oncological department and be an obstacle to satisfactory future denture retention. For large defects of III. category where more than half of the upper jaw is missing, recommended is reconstruction of the defect using free osteomyocutaneous flap. In this way, it is possible to reconstruct the alveolar process and create the conditions for dental implants.

CONCLUSIONS

Challenging reconstructive procedures in orofacial oncosurgery require very good interdisciplinary cooperation, high clinical expertise of the surgical team composed of maxillofacial and plastic surgeons, dedication, and hard-working nurses. Very important is the responsibility of patient selection, awareness and motivation for surgery. It is also important to realize that free flaps may not always be the only possible solution the use of conventional dentures or prosthetic devices may be in some cases easier and much more efficient.

Author contributions: RP, JP: manuscript writing; PM: data collection, data analysis; MM, BZ: study design; PT, VZ: final approval.

Conflict of interest statement: None declared.

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