

# The role and selection of local and regional pedicled flaps in head and neck reconstruction

M. Almaši<sup>1</sup>, M. Šuchaň<sup>2</sup>, L. Kaliarik<sup>2</sup>

<sup>1</sup> ENT Department, East Slovak Oncology Institute, Košice, Slovak republic

<sup>2</sup> Clinic of Otorhinolaryngology and Head and Neck surgery, Luis Pasteur University Hospital and Medical Faculty of P. J. Šafárik University Košice, Slovak Republic

## Summary

**Introduction:** Pedicled flaps are prioritized in the free flap era for reconstruction only in institutions without sufficient microsurgical support. They are reliable for reconstruction, but with a lot of advantage, including cost, operating and hospitalization time, easy learning curve and better management of older and polymorbid patients, not suitable for the free flap reconstruction. The experience from two institutions with various types of pedicled flaps are presented in this retrospective study. **Material and methods:** A total of 62 patients were enrolled in this study. With 63 flaps harvested, 1 patient underwent two reconstructions. Operations were performed in two centers. Evaluation of parameters, like age and gender of patients, indication for reconstruction, type and extent of the primary surgery, type of the pedicled flap, the primary or salvage reconstruction, complications of reconstruction and survival of flaps, was included. **Results:** The median age of this cohort was 64 years (range 30–82 years) with male predominance (53 male to 9 female patients). Five groups of flaps were designed: myocutaneous, myofascial, myomucosal, fasciocutaneous and muscular flaps. Thirteen types of pedicled flaps were utilized. The most frequent flap was the infrahyoid myocutaneous flap (IHMF) in 26 patients, followed by the pectoralis major myocutaneous flap (PMMC) in 14 patients, including 15 flaps. In 1 patient, the second reconstruction was required with harvesting PMMC from the other side. Indications for reconstruction were defects after either primary or salvage surgery in 30 and 32 patients respectively. Reconstructions of the mobile tongue (13 patients) and floor of the mouth (13 patients) with IHMF predominated after primary resection in this area, followed by PMMC (three patients). In a group of defects after salvage surgery, the most frequent reconstructed area was the neck, where PMMC was preferred in 5 patients. PMMC was otherwise the most frequent type of flap utilized in salvage reconstruction (14 flaps in 13 patients). The overall cumulative flap survival was 96.8% with total flap loss in 2 patients. **Conclusion:** Various flaps are favored according to institutions, however, the alternative flaps should be considered, if necessary. Pedicled flaps are still valuable options in the most of minor reconstructive centers even in well developed countries and should be reserved for reconstruction in major centers, primarily utilizing free flaps, for indicated patients, not suitable for a microsurgical reconstruction.

## Key words

pedicled flap – head and neck reconstruction – pectoralis major myocutaneous flap – infrahyoid myocutaneous flap

Almaši M, Šuchaň M, Kaliarik L. The role and selection of local and regional pedicled flaps in head and neck reconstruction. *Acta Chir Plast* 2024; 66(4): 147–153.

## Introduction

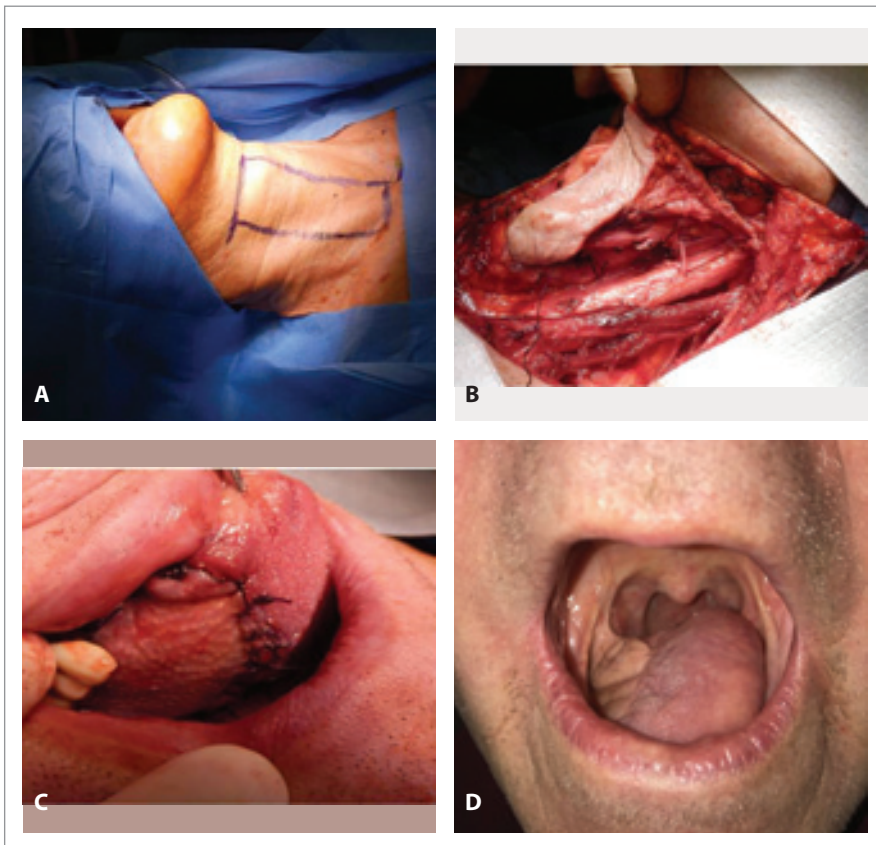
Surgical treatment of the head and neck cancer is a real challenge due to the complexity of this anatomical area. Only minor defects after resection of early tumors can be sutured primarily without restricting function and cosmesis. Major defects must be managed by using some of the reconstruction methods, mostly either free or pedicled flaps. Reconstruction after resection of advanced tumors is inevitable because of maintaining the integrity of the upper aero-digestive

tract and preserving speech and swallowing functions, and thus having a significant impact on the quality of life of the patient [1,2]. However, reconstruction is occasionally required in cases with a complicated wound healing after ablative surgery with the primary closure, or even as a prevention of anticipated complications, e.g pharyngocutaneous fistulas, particularly after salvage surgery.

Although free flaps have been referred to as the preferred head and neck reconstruction modality, pedicled flaps

still remain a gold standard in those institutions with a lack of a microvascular surgery support. Moreover, pedicled flaps seem to be almost as reliable as free flaps, but with a lot of advantage, including cost, operating and hospitalization time, easy learning curve and better management of older and polymorbid patients, not suitable for the free flap reconstruction.

Experience in harvesting of various flaps encourages surgeons to more extensive resection during the ablative



**Fig. 1. Infrahyoid myocutaneous flap in reconstruction of the hemitongue. A) Design of the skin paddle; B) raising of the flap on the superior thyroid vascular pedicle with fascial attachments to the hyoid bone; C) inset of the flap on the right side; D) outcome of the reconstruction after 2 months.**

phase of surgery and thus achieving clearance of surgical margins – R0 resection, the only prognostic factor under surgeon's control. Some flaps are favored more, from institution to institution, but sometimes the utility of alternative flaps is inevitable. Therefore, selection of the most appropriate flaps and management of reconstruction can be a challenge for a reconstructive surgeon.

The aim of this study is to present our experience with some local and regional pedicled flaps and their selection according to the primary defect site of the head and neck.

### Material and methods

A retrospective study of the patients reconstructed with pedicled flaps due to head and neck defects between 2006 and 2023 is presented. The data from two institutions were collected. Pa-

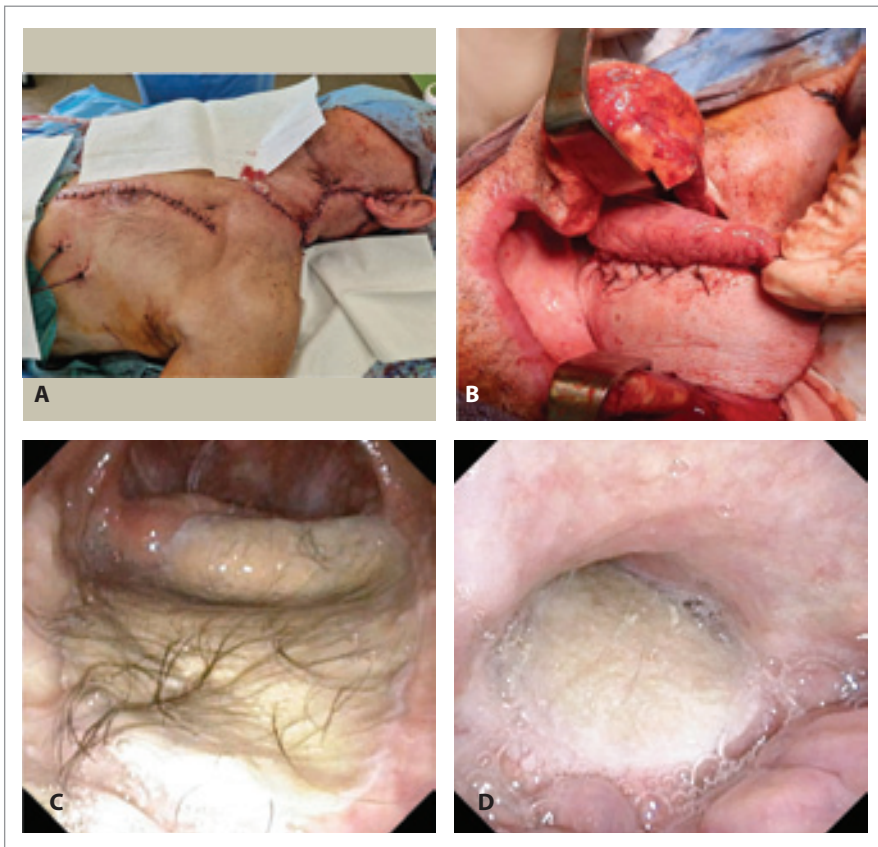
tients were indicated for reconstruction of defects for three main reasons: ablative cancer surgery, complications of the healing after tumor resection and prevention of such complications. All defects were reconstructed with either local or regional pedicled flaps. A flap selection depended on location of the defect site and size with emphasis on the best functional and cosmetic outcomes. Other reconstruction options like local flaps (e.g. transposition or rotation flaps) or microvascular flaps were excluded. Evaluation of other parameters, like age and gender of patients, type and extent of the primary surgery, type of the pedicled flap, the primary or salvage reconstruction, complications of reconstruction and survival of flaps, was also included. All procedures complied with ethical standards recommended by the Declaration of Helsinki.

### Results

A total of 62 patients were enrolled in this study. A total of 63 flaps were harvested, 1 patient underwent two reconstructions. The operations were performed in two centers. The median age of this cohort was 64 years (range 30–82 years) with male predominance (53 male and 9 female patients). Five groups of flaps were designed: myocutaneous, myofascial, myomucosal, fasciocutaneous and muscular. The most frequent flap utilized for reconstruction was the infrahyoid myocutaneous flap (IHMF) in 26 patients (Fig. 1), followed by the pectoralis major myocutaneous flap (PMMC) in 14 patients, including 15 flaps (Fig. 2). In 1 patient the second reconstruction was required with harvesting PMMC from the other side. All types of flaps are included in Tab. 1.

The indications for reconstruction included defects after either primary or salvage surgery in 30 and 32 patients, respectively. Reconstructions of the mobile tongue (13 patients) and floor of the mouth (13 patients) with IHMF predominated after primary resection in this area, followed by PMMC (3 patients). In a group of the defects after salvage surgery, the most frequent reconstructed area was the neck, where PMMC was preferred in 5 patients. PMMC was otherwise the most frequent type of flap utilized in salvage reconstruction (14 flaps in 13 patients). All the data are detailed in Tab. 2 and 3.

The overall cumulative flap survival was 96.8% with total flap loss in 2 patients. In one of them, after trapezius myocutaneous flap necrosis, local debridement and replacement with other type of flap was performed, when the patient was admitted to the Department of Plastic Surgery. In the other case, after IHMF reconstruction, only local debridement and removal of the necrotic skin island was sufficient. Minor complications included partial flap loss, wound dehiscence and hematoma of the skin island, and were present in 9 patients (14.3%



**Fig. 2.** Examples of the pectoralis major myocutaneous flap utility in the head and neck reconstruction. A) Covering of the defect in the parotid region and lateral neck; B) reconstruction of the defect after hemiglossectomy and buccopharyngectomy via paramedian mandibulotomy; C) endoscopic view on the flap covering the defect after near total glossectomy; D) reconstructed anterior hypopharyngeal wall with the U-shaped flap due to pharyngostoma.

out of all reconstructions), all of them after IHMF reconstructions.

Selection of the flap was adjusted to the region of reconstruction (Tab. 4). For the reconstruction of the defects in the mouth and oropharynx, IHMF was the first choice option. Other regional flaps utilized in this region were the submental artery flap, platysmal flap, supraclavicular artery island flap and PMMC. From local flaps, the buccinator myomucosal flap was preferred. For the region of anterior and lateral neck excluding peritracheostomal defects, PMMC dominated, followed by the trapezius muscle flap, which was moreover utilized in the defects extended to the parotid region. Peritracheostomal defects were reconstructed with modification of the deltopectoral flap, the internal mammary

artery perforator propeller flap (IMAP). In the midface and orbit, only salvage reconstruction procedures were performed after failed oncological treatment or the primary surgery elsewhere, utilizing the paramedian forehead flap, nasolabial flap and temporalis muscle flap. The hypopharynx was reconstructed mainly due to complicated healing, which resulted in the pharyngostoma formation. The U-shaped PMMC or sternocleidomastoid muscle flap were selected for the hypopharyngeal reconstruction.

**Discussion**

The choice of reconstruction in the head and neck is always a challenge, especially in this era of free flaps. However, free flaps were sometimes indicated ex-

**Tab. 1. Types of the utilized flaps**

<b>Myocutaneous flaps</b>	<b>50</b>
IHMF	26
PMMC	15
submental island flap	2
trapezius muscle flap	4
platysmal flap	2
forehead paramedian flap	1
<b>Myofascial flaps</b>	<b>6</b>
PMMF	5
temporalis muscle flap	1
<b>Myomucosal flaps</b>	<b>2</b>
buccinator flap	2
<b>Muscular flaps</b>	<b>2</b>
sternocleidomastoid flap	2
<b>Fasciocutaneous flaps</b>	<b>3</b>
supraclavicular flap	1
IMAP	1
nasolabial flap	1
<b>Total</b>	<b>63</b>

IHMF – infrahyoid myocutaneous flap, IMAP – internal mammary artery perforator propeller flap, PMMC – pectoralis major myocutaneous flap, PMMF – pectoralis major myofascial flap

pansively, even in cases, where it is not absolutely inevitable. Before each reconstruction, selection criteria as a defect size, type of tissue, function and appearance, physical condition of the patient, availability of resources and microsurgical support must be kept in mind [3].

The first author has also a personal experience with the free tissue transfers, particularly radial forearm free flaps, which were performed in the ENT Department more than 20 years ago. Unfortunately, for various reasons, free flap reconstructions were interrupted and did not continue any further. This experience has provided us the possibility to compare both techniques: free and pedicled flaps.

The main advantage of free flap reconstruction is undoubtedly a cover-

**Tab. 2. Indications for reconstruction.**

mobile tongue surgery	16
CTS	13
hemiglossectomy	2
subtotal glossectomy	1
floor of mouth resection	18
base of tongue resection	1
oropharyngeal resection	1
defects of neck	8
lateral neck	5
anterior neck	2
peritracheostomal defect	1
hypopharyngeal suture reinforce	5
hypopharyngeal reconstruction	6
facial and head defects	8
parotid and temporal region defects	5
midface defects	2
exenteration of orbit	1
<b>Total</b>	<b>63</b>

CTS – compartmental tongue surgery

age of some defect with a full-valued tissue, which has a sufficient length of the vascular pedicle. The tissue is harvested during an ablation phase of the operation by the second team, and that way the operation time can be spared. The other advantage could be the insertion of partly reinnervated tissue for achievement of functional restoration, e.g. motility and sensation of the tongue. The question is a free flap reconstruction of the large skin defect on the face and neck, which seems to be cosmetically inappropriate, referring to a rather different color and texture of the skin island and to a frequently non-corresponding flap thickness and pliability. For these reasons, free flaps are obviously not recommended in the reconstruction of facial defects. Free flaps utility should be meticulously considered particularly in

**Tab. 3. Reconstruction after primary and salvage surgery.**

Primary surgery reconstruction		Salvage surgery reconstruction	
mobile tongue	11	mobile tongue	5
IHMF	10	IHMF	3
PMMC	1	PMMC	2
floor of mouth	18	base of tongue	1
IHMF	13	buccinator flap	1
submental island flap	2	oropharynx (lateral wall)	1
platysmal flap	2	supraclavicular flap	1
buccinator flap	1	hypopharyngeal / PCF reconstruction	6
hypopharyngeal suture reinforce	1	PMMC	4
PMMF	1	SCM flap	2
extensive parotid region defect	1	anterior neck after salvage LE	2
PMMC	1	PMMC	2
		lateral neck after salvage resection	5
		PMMC	7
		parotid and temporal defects	4
		trapezius muscle flap	4
		hypopharyngeal suture reinforce after salvage LE	4
		PMMF	4
		peritracheostomal defects	1
		IMAP	1
		midface defects	2
		forehead paramedian flap	1
		nasolabial flap	1
		orbital exenteration	1
		temporal flap*	1
<b>Total</b>	<b>31</b>	<b>Total</b>	<b>32</b>

\* combination with skin graft, IHMF – infrahyoid myocutaneous flap, IMAP – internal mammary artery perforator propeller flap, LE – laryngectomy, PCF – pharyngocutaneous fistula, PMMC – pectoralis major myocutaneous flap, PMMF – pectoralis major myofascial flap, SCM – sternocleidomastoid flap

older polymorbid patients because of the extensive operation time and also after salvage surgery, where vessel-depleted neck is strongly predicted [4,5].

All these aspects can favor the utilization of pedicled flaps. In their patient cohort comparing free and pedicled flaps, Mahieu et al. stressed out that pedicled flaps were not significantly in-

ferior in terms of functionality, complications or prognosis [6]. Gabrysz-Forget et al. [7] presented a systematic review focused on the comparison of free and pedicled flaps. They concluded that free flaps are superior to some pedicled flaps (PMMC) in some aspects. On the contrary, supraclavicular and submental artery island pedicled flaps are compa-

rable to free flaps, but at a lower cost, which favors them in some specific indications. Sittitrai et al. [1] presented comparable complications and functional outcomes, while decreasing the costs of oral cavity reconstruction with pedicled flaps. Though in extensive defects (> 70 cm<sup>2</sup>), they preferred free flaps for better preservation of swallowing function. In our study, the most frequent primarily reconstructed region was oral cavity with the base of the mouth and mobile tongue. For medium-sized defects in this area, regional flaps like infrahyoid or submental flaps, and less frequently platysmal flaps, used to be raised. The infrahyoid flap has been selected preferably due to its sufficient distance from the primary defect, thus not colliding with the primary resection site. The functional results are comparable to those with free flap reconstructions. Moreover, the skin paddle is designed as a part of the skin incision for neck dissection, thus no other donor site wound is necessary and primary closure of the donor site is very easy. Care must be taken into account in previous neck surgery, either thyroid surgery or neck dissection. Worse healing after previous neck irradiation may be observed, with radiotherapy considered a relative contraindication [8,9]. On the contrary, the utilization of the submental flap in case of a bulky nodal disease in level I could be a challenge for the pedicle dissection without violating it as well as perfect clearance of this area. Thus, in case of a clinical or radiographic evidence of level I cervical lymph node disease, it should not be performed [10]. The advantage of both flaps is their thickness and pliability. Although there was even a major healing complication, like near total flap necrosis, no second reconstruction procedure was necessary and the defect has recovered with good anatomical and functional results. Myomucosal local defects are more suitable for minor defects after resection of the early stage disease, or for defect coverage

**Tab. 4. Our preference of selection of the pedicled flap according to the region of reconstruction.**

oral cavity	IHMF
	submental island flap
	PMMC/PMMF
	buccinator/ facial artery myomucosal flap
	supraclavicular flap
oropharynx	platysmal flap
	supraclavicular flap
hypopharynx	PMMC/PMMF
	supraclavicular flap
	IMAP
parotid and temporal region*	PMMC
	supraclavicular flap
	trapezius muscle flap
midface**	nasolabial flap
	forehead paramedian flap
outer neck	PMMC
	supraclavicular flap
	IMAP/deltopectoral flap

\* cervico(thoraco)facial rotational advanced flap is the first choice of reconstruction, \*\* local translation or rotation flap is preferred as the first option, IHMF – infrahyoid myocutaneous flap, IMAP – internal mammary artery perforator propeller flap, PMMC – pectoralis major myocutaneous flap, PMMF – pectoralis major myofascial flap

after salvage surgery with no need for dissection of previously irradiated neck.

The PMMC remains a workhorse for reconstruction of neck defects, after either primary or salvage surgery. Moreover, it is also suitable for oral and oropharyngeal reconstruction, namely near-total to total glossectomy [11]. As an U-shaped or only myofascial variant (PMMF), the PMMC can be adjusted for hypopharyngeal reconstruction. In our patients, the PMMC was utilized almost exclusively after salvage surgery. It is considered the first choice in salvage surgery, in cases of complication or free flap failure or in the recurrence of the primary disease [12]. The PMMC is our favorable flap with a very good survival and no complications detected in

this cohort. On the contrary, in the literature, the PMMC has very low rate of total necrosis (0.2–4%), but the overall complication rate was recorded up to 63% in some papers [13,14]. Despite this high rate, no reoperation was required to resolve complications. Skin loss is a minor complication, which may occur if the skin island is designed rather beyond the pectoralis muscle boundaries, or it is too small to include a sufficient number of perforators. For each successful reconstruction, only satisfactorily supplied muscle is an essential condition, which enables to utilize the PMMF only. The PMMF is thinner and more pliable, thus more suitable for the hypopharyngeal reconstruction and also prevention of the pharyngocutaneous fistula forma-

tion or wound dehiscence particularly in patients after radiotherapy [15,16]. The protective and trophic effect of the pectoralis muscle on neck vessels and tissues is an advantage in all cases after radiotherapy and neck dissection, even if the reconstructed defect is in the pharynx, oral cavity, or other head and neck sites [17]. Both variants of the pectoralis muscle flaps are also used in combination with free tissue transfer for the coverage and protection of microanastomosis [13,18]. Due to its worse pliability, we have begun using more appropriate flaps, e.g. the supraclavicular flap for the oropharyngeal reconstruction. It has been reserved only for salvage surgery, because in our institutions the advanced oropharyngeal cancer is primarily treated by radiotherapy or chemoradiation. Therefore, only few cases have been reconstructed until now, most of them by free flaps, not pedicled flaps; thus, they could not be all included in this cohort. The supraclavicular artery island flap is recently a favored choice for simple and quick reconstruction with the minor donor site morbidity and strongly considered even in difficult and vessel-depleted necks [19]. The only condition for successful reconstruction is preservation of the transverse cervical artery during neck dissection of level V [20,21].

The preferred option of reconstruction in our institutions in parotid and buccal regions is the local random pattern flap, namely the advanced cervico (thoraco) facial flap, with very good reach to the lateral to midface region, and thus having a very good cosmetic result. The pedicled flaps, as the trapezius flap or the PMMC, are reserved for deeper lesions due to their thickness and worse conditions during harvesting. Particularly the request for positioning when the trapezius flap is raised can increase a risk of wound infection. In our institutions, no primary facial surgery is performed and that is why only a few patients were reconstructed due to the primary surgery performed elsewhere or

when an oncologic treatment had failed. As the first choice option, the local rotation and transposition still remains, followed by some pedicled flaps, as nasolabial or forehead flaps, determined mainly for the midface and external nose reconstruction. The main disadvantage of the forehead flap is a procedure with at least two stages, which is completed within 3–6 weeks after the initial phase. Despite this, the forehead flap represents the ideal reconstructive choice, which can be safely and reliably performed not only in an inpatient but also in an outpatient setting in many institutions [22]. A complete flap failure is rare but revision surgery is sometimes indicated for significant nasal obstruction after external nose defect reconstruction [23]. The nasolabial flap is another versatile option for reconstruction of the midface and nose defects as well as defects of the oral cavity [24,25]. The temporalis muscle flap was utilized in the salvage orbital exenteration, indicated in a patient with recurrent basal cell carcinoma of the eyelids, spreading into the medial canthus and the conjunctiva. In this indication, either local skin transfer or split skin graft covering the temporal muscle flap is needed for completion of the reconstruction. Frontal branch of the facial nerve can be injured during raising the flap, although its injury rate is very low [26]. The muscle mobilization usually causes the temporal fossa concavity, which must be filled most frequently with a fat graft or hydroxyapatite, thus increasing the patient's morbidity. However, the flap has other broad clinical applications, such as reconstructions of the defects of oral cavity, oropharynx, nasopharynx, maxilla or skull base [27,28].

### Conclusion

Reconstructive surgeons in the centers should be experienced in harvesting a broad range of flaps. It enables them to provide ease and freedom in resection of the primary lesion with sufficient sur-

gical margins and thus ensuring R0 resection, which is an important prognostic factor and the only under surgeon's control. Various flaps are favored according to institutions, however, the alternative flaps should be considered, if necessary. Pedicled flaps are still valuable options in the most of minor reconstructive centers even in developed countries and should be reserved for the reconstruction in major centers utilizing primarily free flaps, for indicated patients who are not suitable for microsurgical reconstruction.

### Roles of authors

M. Almaši – data assessment, study design, manuscript preparation; M. Sučaň – data assessment, study design, critical manuscript revision; L. Kaliarik – data assessment, study design, critical manuscript revision.

### Disclosure

The authors have no conflicts of interest to disclose. The authors declare that this study has received no financial support. All procedures performed in this study involving human participants were in accordance with ethical standards of the institutional and/or national research committee and with the Helsinki declaration and its later amendments or comparable ethical standards.

### References

1. Sittitjai P, Ruenmarkkaew D, Klibngern H. Pedicled flaps versus free flaps for oral cavity cancer reconstruction: a comparison of complications, hospital costs, and functional outcomes. *Int Arch Otorhinolaryngol.* 2023, 27(1): e32–e42.
2. Katna R, Girkar F, Tarafdar D, et al. Pedicled flap vs. free flap reconstruction in head and neck cancers: clinical outcome analysis from a single surgical team. *Indian J Surg Oncol.* 2021, 12(3): 472–476.
3. Baliarsing AS., Thorat TS., Gupta A., et al. Flap selection in head and neck cancer reconstruction. *Int J Otorhinolaryngol Clin.* 2013, 5(2): 63–76.
4. Chang BA., Asarkar AA., Horwich PM., et al. Regional pedicled flap salvage options for large head and neck defects: the old, the new, and forgotten. *Laryngoscope Investig Otolaryngol.* 2023, 8(1): 63–75.
5. Correia C., Wang W., Vincent AG., et al. Regional salvage options in head and neck reconstruction. *Semin Plast Surg.* 2020, 34(4): 293–298.
6. Mahieu R., Colleti G., Bonomo P., et al. Head and neck reconstruction with pedicled flaps in the free flap era. *Acta Otorrhinolaryngol Ital.* 2016, 36(6): 459–468.

7. Gabrysz-Forget F., Tabet P., Rahal A., et al. Free versus pedicled flaps for reconstruction of head and neck cancer defects: a systematic review. *J Otolaryngol Head Neck Surgery*. 2019, 48(1): 13.
8. Dolivet G., Gangloff P., Sarini J., et al. Modification of the infra hyoid musculo-cutaneous flap. *Eur J Surg Oncol*. 2005, 31(3): 294–298.
9. Deganello A., Mancio V., Dolivet G., et al. Infrahyoid fascio-myocutaneous flap as an alternative to free radial forearm flap in head and neck reconstruction. *Head Neck*. 2007, 29(3): 285–291.
10. Howard BE., Nagel TH., Donald CB., et al. Oncologic safety of the submental flap for reconstruction in oral cavity malignancies. *Otolaryngol Head Neck Surg*. 2014, 150(4): 558–562.
11. Dvořák Z., Rink R., Pink R., et al. Pedicled pectoralis major flap in head and neck reconstruction-technique and overview. *Acta Chir Plast*. 2018, 60(1): 14–21.
12. Dvořák Z., Pink R., Michl P., et al. Pedicled pectoralis major flap in head and neck reconstruction – our experience. *Acta Chir Plast*. 2019, 60(1): 26–29.
13. Kroll SS., Goepfert H., Jones M., et al. Analysis of complications in 168 pectoralis major myocutaneous flaps used for head and neck reconstruction. *Ann Plast Surg*. 1990, 25(2): 93–97.
14. Shah JP., Haribakhti V., Loree TR., et al. Complications of the pectoralis major myocutaneous flap in head and neck reconstruction. *Am J Surg*. 1990, 160(4): 352–355.
15. Gilbert MR., Sturm JJ., Gooding WE., et al. Pectoralis major myofascial onlay and myocutaneous flaps and pharyngocutaneous fistula in salvage laryngectomy. *Laryngoscope*. 2014, 124(12): 2680–2686.
16. Righini C., Lequeux T., Cuisnier O., et al. The pectoralis myofascial flap in pharyngolaryngeal surgery after radiotherapy. *Eur Arch Otorhinolaryngol*. 2005, 262(5): 357–361.
17. Bussu F., Gallus R., Navach V., et al. Contemporary role of pectoralis major regional flaps in head and neck surgery. *Acta Otorhinolaryngol Ital*. 2014, 34(5): 327–341.
18. Talesnik A., Markowitz B., Calcaterra T., et al. Cost and outcome of osteocutaneous free-tissue transfer versus pedicled soft-tissue reconstruction for composite mandibular defects. *Plast Reconstr Surg*. 1996, 97(6): 1167–1178.
19. Sahin B., Ulasan M., Basaran B., et al. Supraclavicular artery island flap for head and neck reconstruction. *Acta Chir Plast*. 2021, 63(2): 52–56.
20. Nthumba PM. The supraclavicular artery flap: a versatile flap for neck and orofacial reconstruction. *J Oral Maxillofac Surg*. 2012, 70(8): 1997–2004.
21. Su T., Pargousis P., Fernandes R. Versatility of supraclavicular artery island flap in head and neck reconstruction of vessel depleted or difficult necks. *J Oral Maxillofac Surg*. 2013, 71(3): 622–627.
22. Correa BJ., Weathers WM., Wolfswinkel EM., et al. The forehead flap: the gold standard of nasal soft tissue reconstruction. *Semin Plast Surg*. 2013, 27(2): 96–103.
23. Schmidt C., Nightingale J., Ioannou C., et al. Forehead flap nasal reconstruction: oncologic and functional outcomes in a regional centre. *Aust J Otolaryngol*. 2021, 4: 30.
24. Weathers WM., Wolfswinkel EM., Nguyen H., et al. Expanded uses for the nasolabial flap. *Semin Plast Surg*. 2013, 27(2): 104–109.
25. Singh S., Singh RK., Pandey M. Nasolabial flap reconstruction in oral cancer. *World J Surg Oncol*. 2012, 10: 227.
26. Ein L., Daniyan O., Nicolli E. Temporalis muscle flap. *Oper Tech Otolaryngol Head Neck Surg*. 2019, 30(2): 120–126.
27. Smith J., Ducic Y., Adelson R. The utility of the temporalis muscle flap for oropharyngeal, base of tongue, and nasopharyngeal reconstruction. *Otolaryngol Head Neck Surg*. 2005, 132(3): 373–380.
28. Shanmugam S., Govindasamy G., Hussain SA., et al. Temporalis muscle flap in head and neck reconstructions is that forgotten or forbidden? Our case series and review of literature. *Indian J Surg Oncol*. 2017, 8(3): 321–325.

Milan Almaši, MD

ENT Department, East Slovak Oncology

Institute

Rastislavova 43

040 01 Košice

Slovak Republic

almasimilan@yahoo.com