Are Regional Flaps Still an Adequate Reconstruction Strategy for Head and Neck Tumors in the Era of the Boom for Free Flap? Evaluation of 269 Cases in a 4-Level Center

Retalhos regionais ainda são uma estratégia de reconstrução adequada para tumores de cabeça e pescoço na era do boom dos retalhos livres? Avaliação de 269 casos em um centro de nível 4

Andres I. Chala[1] Yessica A. Trujillo[1]

[1] Oncologos del Occidente, Manizales, Caldas, Colombia

Rev Bras Cir Plást 2025;40:s00451811180.

Address for correspondence Andres I Chala, Oncologos del occidente, Calle 92 29-75 Manizales, Caldas, Colombia (e-mail: andreschalag@hotmail.com; andres.chala@ucaldas.edu.co).

Abstract

Introduction There is a current trend towards microsurgical flaps, compared with the pedicled ones in reconstruction of large locoregional defects after surgery. We reviewed the use of both techniques in head and neck reconstruction to establish the role of the non-microvascular flaps.

Materials and Methods A retrospective cross-sectional study was conducted. Statistical analysis included means and standard deviations (SD), absolute and relative frequencies, bivariate analysis correlation, and a binary logistic regression. Statistical significance was defined with $p < 0.05$, and 95% confidence interval (CI).

Results A total of 269 patients were reviewed, with 105 women and 164 men, and a mean age of 62.5 years. The majority had squamous cell carcinoma located in oral cavity and oropharynx, stage IV (77%). Regional flaps were used in 70.6% and microvascular in 29.4% of the cases. Overall morbidity was 16%, mortality 6.7% (all stage IV, $>$ 70 years old). Bivariate analysis exhibited intermediate correlation between older age and greater morbidity, low correlation between advanced stages and more frequent use of microsurgical flaps, no correlation between morbidity and type of flap or clinical stage, and high correlation between over 70 years old and postoperative mortality. Logistic regression showed that microsurgical flaps had 2.8 times higher chance of morbidity and males had 2.7 times higher risk of mortality, which increased to 18.5 times in cases with postoperative morbidity.

Conclusion Currently, even with the preference towards free flaps, pedicled ones should not be dismissed, as they can offer similar results, including lower morbidity, surgical time, and health care costs.

Keywords
- free-tissue flaps
- head and neck neoplasms
- mandibular reconstruction
- microsurgery
- surgical flaps

received
April 6, 2025
accepted
May 20, 2025

DOI https://doi.org/10.1055/s-0045-1811180.
ISSN 2177-1235.

Thieme Revinter Publicações Ltda., Rua Rego Freitas, 175, loja 1, República, São Paulo, SP, CEP 01220-010, Brazil

Resumo

Introdução Há uma tendência atual em favor de retalhos microcirúrgicos em comparação aos pediculados para reconstrução de grandes defeitos loco-regionais após cirurgia. Revisamos o uso de ambas as técnicas na reconstrução de cabeça e pescoço para estabelecer o papel dos retalhos não microvasculares.

Materiais e Métodos Estudo transversal retrospectivo. A análise estatística incluiu médias e desvios padrão (DP), frequências absolutas e relativas, correlação por análise bivariada e regressão logística binária. A significância estatística foi definida como $p < 0,05$, com intervalo de confiança (IC) de 95%.

Resultados Revisamos 269 pacientes, sendo 105 mulheres e 164 homens, com idade média de 62,5. A maioria apresentava carcinoma espinocelular localizado na cavidade oral e orofaringe, em estágio IV (77%). Retalhos regionais foram usados em 70,6% e microvasculares em 29,4% dos casos. A morbidade geral foi de 16% e a mortalidade foi de 6,7% dos casos, todos em indivíduos com doença em estágio IV e mais de 70 anos. A análise bivariada revelou uma correlação intermediária entre idade avançada e maior morbidade, baixa correlação entre estágios avançados e uso de microcirurgia, além de alta correlação entre a idade superior a 70 anos e mortalidade pós-operatória. A regressão logística mostrou que o retalho microcirúrgico tinha 2,8 vezes maior probabilidade de morbidade, enquanto homens apresentavam 2,7 vezes mais risco de mortalidade, aumentando para 18,5 vezes em casos com morbidade pós-operatória.

Conclusão Apesar da atual preferência por retalhos livres, os pediculados não devem descartados, pois podem oferecer resultados semelhantes, inclusive menor morbidade, tempo cirúrgico e custos de saúde.

Palavras-chave

- microcirurgia
- neoplasias de cabeça e pescoço
- reconstrução mandibular
- retalhos cirúrgicos
- retalhos de tecido biológico

Introduction

The reconstruction of the large loco-regional defects resulting from the oncological margins in head and neck resections is of utmost importance. This procedure minimizes morbidity, preserves organ function (such as phonation and swallowing), protects vital structures, gives an adequate aesthetic appearance, and improves quality of life.

The use of the pectoralis major flap was first described by Ariyana in 1979 for head and neck reconstruction. Since then, there have been great advances in reconstruction. Although the first microvascular flap was performed in 1959 by Steinberg, it was only in 1970 that the technique became popular and, from the 90's it was rapidly and progressively developed, including new proposals for microsurgical flaps that add three dimensional (3D) preoperative designs and improve aesthetic and functional results. Over those years, different and versatile pedicled and nonpedicled flaps were also developed; good examples are the submandibular and supraclavicular flaps, which efficiently achieve similar results.

In contrast to this trend of microsurgical reconstruction as an almost obligatory alternative, individualized indication in cases where the other flaps can't achieve similar results, aiming to reduce surgical time, morbidity, and health care costs.

Different studies show similar or better benefits with pedicled or nonpedicled regional flaps in terms of functional and aesthetic results, with similar rehabilitation possibilities and a shorter surgical time, less requirement for intensive care units (ICUs), and lower health care costs. This means that regional flaps still have an important role in the era of free flaps, and should be considered when defining a reconstruction.

Materials and Methods

A retrospective, cross-sectional review study was conducted in patients who underwent reconstruction with regional and microsurgical flaps after oncological head and neck surgery to correct a surgical defect from resection. Cases from January 1st, 2019, to December 31, 2023, were included to evaluate the results of reconstruction with both techniques.

The inclusion criteria were patients over 18-years-old who underwent regional and microsurgical flaps for reconstruction for and oncological surgery, for a benign condition or trauma. Those with incomplete information were excluded. For the purposes of this work, the microsurgical propeller and regional pedicled flaps were grouped, considering that no microvascular anastomosis was performed in them. Clinical data were recorded regarding the patient and the primary tumor, its location, clinical stage, type of surgery, pathological anatomy, type of reconstruction, morbidity, and mortality. There wasn't direct intervention to patients and the study followed the guidelines of the Declaration of Helsinki. Institutional approval was obtained and patient data were obtained from the institutional medical records, preserving their privacy.

Data were collected in a Microsoft Excel (Microsoft Corp.) spreadsheet. The IBM SPSS Statistics for Windows (IBM Corp.) software, version 22.0, was used for statistical analysis. The Shapiro-Wilk test was applied to assess the normality of quantitative variables. The quantitative variables were expressed as means and standard deviations (SD). The qualitative variables were expressed with absolute and relative frequencies. The bivariate analysis of correlation of the dependent variables was performed using Pearson's correlation. To evaluate their association with the other variables, binary logistic regression was performed. Statistical significance was defined as $p < 0.05$, and 95% confidence interval (CI).

Results

A total of 269 patients were included, of whom 105 were women and 164 men. The mean age was 62.5 years; 60.2% were over 61-years-old, and most were between 51 and 79-years-old. Oncological resection for cancer (96.3%) was the main indication for flap, followed by benign and traumatic indications. Squamous cell carcinoma was the most frequent etiology, with 187 cases, followed by papillary thyroid carcinoma (6.3%), and others like sarcoma (3.7%), melanoma (3%), and cystic adenoid salivary glands (3.7%). The main locations were oral cavity and oropharynx (28.6%), followed by paranasal sinuses and orbit (20.1%), larynx (12.3%), and parotid gland (14.9%). Most patients were in the clinical stage IV (77%), the rest were III. No patients were diagnosed in early stages, and few cases were benign or trauma (►**Table 1**).

Surgical treatment was used an initial therapy in 167 patients, and as a secondary in 102, after previous nonsurgical oncological management.

The most frequent surgery was partial or total maxillectomy (14.5%), followed by pharyngeal monobloc resection, laryngectomy, glossectomy, orbital exenteration, comprehensive neck dissection, and tracheal resection. Regarding oral cavity surgeries, 20.5% required mandibular resection and 12.8% an approaching mandibulotomy.

The most frequent flaps used were the regional flaps in 70.6% of cases. Among microsurgical flaps, 48 were musculocutaneous and 12 osteocutaneous. Regarding the type of free flaps, the radial was the most used (10.4%), followed by the anterolateral thigh (ALT), scapula, and fibula flaps. A total of 168 pedicle regional flaps were performed; the most common was the Ariyana (27.1%), followed by the supraclavicular and the submandibular ones (►**Table 2**). Regarding the location, defects in the oral cavity were resolved with a submandibular flap in 38.9% of cases, with musculocutaneous microsurgical in 31.9% and osteocutaneous in 15.3% of patients. Oropharyngeal defects were covered with regional flaps in 88.2% of patients. Most of orbital and SPN defects required a microsurgical flap but 31.1% could be resolved with a propeller one.

Overall morbidity was 16% but only 6.8% was associated with the reconstruction with a free or pedicle flap. With respect to microsurgical flaps, their morbidity was 22.5% and 13.2% for the regional flaps. Altogether, causes of morbidity were compromised of flap vascularization, surgical site infection, hematoma, and dehiscence. Postoperative pneumonia also occurred in 2 patients (0.7%). Regarding morbidity by type of flap, arterial thrombosis was found in 3.8% in the free flaps group; dehiscence in 1.3% free flaps and 2.6% regional ones; the appearance of fistula in 2.5% free flaps and 3.7% regional flaps; as well as hematoma in 5% of the free flaps and 1.6% of regional ones. When vascular compromise of the flap was detected, 46.2% could be rescued during the revision surgery with a new arterial or venous anastomosis depending on the situation. Those that couldn't be rescued successfully underwent regional flaps, with one exception who underwent a second free flap with no success.

Mortality occurred in 18 patients (6.7%), all were in stage IV, 10 patients were over 70-years-old (55.6%), half had cancer of the aerodigestive tract. The most frequent causes were postoperative fistula and vascular complications, and the rest were nonsurgical medical causes (►**Table 3**).

Bivariate analysis was performed using Pearson correlation. There was evidence of an intermediate correlation

Table 1 Characteristics of patients

N = 269		%
Mean age	65 years	
Sex		
Female	105	39
Male	164	61
Histological diagnosis		
Squamous cell	187	69.5
Papillary thyroid cancer	17	6.3
Cystic adenoid	10	3.7
Melanoma	8	3
Basal cell	6	2.2
Sarcoma	10	3.7
Trauma/fistula	16	5.9
Other	15	5.7
Localization		
Oral cavity	72	26.8
Larynx	33	12.3
Sinuses/Orbit	45	16.7
Increased salivation	40	14.9
Oropharynx	17	6.3
Skin	21	7.6
Thyroid	19	7.1
Trachea/Esophagus/Hypopharynx	17	6.3
Other	5	1.9
Clinical stage		
III	44	16.4
IV	207	77
Benign/Trauma	18	6.6

Table 2 Type of flap

	n = 269	%
Flap		
Microsurgical	79	29.4
Regional	190	70.6
Regional/Pedicle		
Ariyana	73	38.4
Bakamjiam	19	10.0
Submandibular	38	20.0
Supraclavicular	44	23.1
Trapezius	4	2.1
Other	12	6.3
Microsurgical		
ALT	18	22.8
Scapula	6	7.6
Fibula	6	7.6
Radial	28	35.4
TRAM	2	2.5
Propeller	19	24.0

Abbreviations: ALT, anterolateral thigh; TRAM, transverse rectus abdominis muscle.

Table 3 Characterization and causes of morbidity and mortality in patients

Morbidity	**n = 269**	%
None	226	84
Vascular complications	13	4.8
Locoregional infection	2	0.7
Hematoma	7	2.6
Dehiscence/fistula	15	5.6
Pneumonia	2	0.7
Others	4	1.5
Mortality	**n = 18**	%
Stage IV	18	100
> 70-years	10	56
Aerodigestive pathology	9	50
Causes of mortality		
Post-surgical fistula	5	28
Vascular complications	2	11
Nonsurgical medical causes	11	61

between older patients and greater morbidity, and a low correlation between advanced clinical stages and the more frequent need for microsurgical flaps. Also, there was no correlation between the type of flap or the clinical stage with greater morbidity (►**Table 4**).

Similarly, there is a high correlation between ages over 70-years and higher postoperative mortality, and a significant correlation between the type of flaps and higher mortality. Additionally, logistic regression analyses were performed to evaluate whether morbidity was associated with type of flap, age, sex, clinical stage, tumor location, and mandibular approach. The results found that microsurgical flap was 2.8 times more likely to present morbidity ($p = 0.010$). When considering the same variables to explain mortality, male patients had a 2.7 times higher risk ($p = 0.052$). Furthermore, there was an 18.5-fold increased risk of mortality in postoperative morbidity cases ($p = 0.001$) When analyzing the type of morbidity, patients with postoperative involvement of flap vascularization had a 0.27 times higher risk of mortality ($p = 0.001$), as can be seen in ►**Table 4**.

Discussion

Flap reconstruction in head and neck surgery is an important tool to minimize the sequelae of large resections with oncological margins, aiming to achieve coverage, function, and color match, among others, to restore normalcy of the tissues. There has been a great technical evolution in the performance of head and neck flaps for reconstruction, with a higher current preference for free ones. However, reconstruction with pedicled regional flaps has been a tool of great value for the multiple head and neck subsites.

Free flaps are more time-consuming and require more training. Sometimes they must be performed in conjunction with reconstructive surgeons, who are not always accessible in all institutions. Hence, in this scenery, the importance of head and neck surgeons also being protagonists when reconstructing is highlighted.

Day et al. conducted an online cross-sectional survey of all surgeons in the American Society for Head and Neck Surgery to determine the experience characteristics of surgeons performing regional flaps; 197 replies (25%) were obtained. Surgeons performing both regional and free flaps took less time to practice, but the number of regional flaps per year was higher; 28 and 23% of surgeons performed supraclavicular and submental flaps, respectively, at least 4 to 10 times per year. The most frequent were regional flaps for reconstruction.[1]

In our study, the postoperative morbidity rate was 6.1%, of which 22.5% were microsurgical and 13.2% regional flaps. These rates are a little higher compared to the study from the San Paolo Hospital (Italy) who collected 45 patients reporting the percentage of complications of 4.4% for their regional flaps, from 2009 to 2014. These, included muscle and myocutaneous flaps of the pectoralis major, trapezius, supraclavicular, latissimus dorsi, and fasciocutaneous temporalis. No flap failure was observed. One case presented complete loss of skin but retained the muscular part of the flap. One case had partial loss of the skin, and one with active bleeding.[2]

Similar to our work, Gabryz-Forget et al. evaluated the complications categorized according to the type of flap performed, regional or microvascular. Their systematic review showed that free flaps were associated with a higher

Table 4 Logistic regression morbidity/mortality analysis

Correlation ODD	Pearson's R		Bilateral significance	
Morbidity				
Age groups	0.45		0.047	
Flap type	-0.116		0.049	
Clinical stage				
Microvascular flap use	-0.122		0.045	
Morbidity	-0.21		0.73	
Mortality				
Age groups	0.89		0.015	
Flap type	0.77		0.21	
Morbidity	**Significance**	**OR**	**95% CI**	
			Inferior	**Superior**
Location	0.076	1.138	0.987	1.313
Stage	0.863	0.95	0.53	1.703
Mandibular surg	0.595	0.866	0.51	1.47
Gender (masculine)	0.364	1.366	0.696	2.679
Age	0.912	0.999	0.974	1.024
Microvascular flap	0.01	2.793	1.281	6.09
Mortality				
Age	0.141	1.035	0.989	1.084
Gender (masculine)	0.045	2.694	0.871	8.336
Localization	0.402	1.099	0.881	1.37
Stage	0.211	2.275	0.628	8.244
Mandibular surg	0.682	1.214	0.48	3.07
Microvascular flap	0.167	0.344	0.075	1.564
Morbidity	0.01	18.505	5.823	58.811
Causes of mortality				
Vascular flap	0.001	0.027	0.003	0.227
Infection	0.085	0.083	0.005	1.411
Hematoma	0.999	0	0	
Dehiscence/Fistula	0.224	0.167	0.009	2.984
Pneumonia	0.72	0.667	0.073	6.111

Abbreviations: CI, confidence interval; OR, odds ratio.

incidence of complications compared to regional ones, 68 versus 36% respectively. Microsurgical flaps also had greater rates of arterial thrombosis and hematoma, while regional ones had greater dehiscence and appearance of fistula.[3] Our cases showed similar findings but in a much lower percentage, with no cases of arterial thrombosis in the pedicled patients and minimal fistula difference between the two groups (2.5% microsurgical vs. 3.7% regional). Surgical times are longer for patients with a free flap reconstruction, with longer ICU and hospital stays. Although our study did not consider quality of life, Gabryz-Forget et al. reported similar scores in terms of swallowing and phonation with both reconstruction techniques, similar oral opening, and similar results of dependence on the feeding tube.[3]

On the other hand, unlike our study, Goyal et al.[4] showed a higher rate of infection 9.1% with no difference in flap type, associated with prolonged hospital stay. The presence of fistula was also higher compared to ours, 8.2 versus 3.7%, respectively, with no significant differences between free and pedicle flaps. The pedicled ones presented with fistula in the elderly population, as well as in patients who previously underwent surgery or radiotherapy.

In the patients with morbidity related to vascular involvement due to ischemia or thrombosis, 46.2% had successful revision of the flap. This rate is a little lower compared to other rescue publications regarding rescue techniques of free flaps. Kucur et al.[5] presented loss of the free flaps in 3.5% of their patients; 12% of their flaps needed a revision surgery,

with a successful rescue in 57%. Ross et al.,[6] in their series of 1,473 patients, required rescue in 2.8% of cases with a second free flap, with a success rate of 73%. In our work, only one patient required a second rescue flap, which wasn't successful.

Bozikov and Arnez[7] obtained a success rate of 85% in 162 patients, observing that the failure of free flaps was 5 times higher in the presence of diabetes and 4.6 times higher after salvage surgery, especially if an interposition venous graft was used.

The systematic review by Mooney et al.[8] compared the submental and free flaps, and included 7 studies, most of which were retrospective. Although the groups evaluated had moderate heterogeneity, the regional flap reduced the surgical time by an average of 193 minutes, as well as the length of hospital stay by 2.1 days compared to the free flaps. Total flap loss, hematoma, surgical site infection, dehiscence, and venous congestion rates were similar in both groups, with no statistically significant differences. Tumor recurrence was under 10% in both groups. On the other hand, Vitkos et al.[9] also compared the supraclavicular and free flaps. They found 8 studies with no significant difference in terms of flap loss, necrosis, fistula, and dehiscence, proposing these flaps are alternatives of similar utility to the microvascular one.

The multivariate analysis found a high correlation between older patients and higher morbidity, as well as between those over 70-years-old and higher postoperative mortality. There are several authors who have reported that age should not be considered an independent risk factor for performing a free flap. Ferrari et al.[10] had a success rate of 96.5% in 54 flaps performed in patients over 75-years-old with a complication rate of 30.9%, similar to that of younger patients, noting an association with the American Society of Anesthesiologists (ASA) classification's physical status rather than age. Similarly, Tarsitano et al.[11] reported that the complication rate was similar in patients older (11%) and younger (9%) than 75 years, with a high ASA score being related to a higher probability of complication.

Our results could not be compared with the systematic review by Fancy et al. since their cut-off point of greatest risk of perioperative morbidity and mortality was 80-years, finding serious complications at 30 days in up to 51% of cases, and mortality of 8% at 90 days, especially associated with greater frailty, low body mass index (BMI), long duration of surgery and subsites such as oral cavity, oropharynx and maxilla. Similar to our study, in the presence of morbidity, mortality was even higher in patients under 80-years-old. The type of flap, free or pedicled, was not associated with morbidity and mortality, and it did not contrast with the surgical time, which is obviously longer in microsurgical patients.[12]

With respect to sex-related mortality, which in our study was higher in men, the Global Burden Cancer[13] data shows similar findings, where the mortality is higher in men 241,585 (95% uncertainty interval [UI]: 207,546–279,188) compared to women with 148,189 (95% UI: 124,242–175,146). The higher incidence for men was 2:1 in that study, and in ours 1.5:1. Mortality was also higher in the group between 70 and 79-years-old.

Finally, the postreconstruction mortality observed in our study was 6.8%, similar to Ali et al.,[14] who showed a 30-day mortality for free flaps of up to 6.3%, especially related to anemia, age over 80 years, malnutrition, and poor functional status.

Conclusion

The reconstruction of large and complex surgical defects after oncological resection of advanced head and neck tumors requires good clinical judgment of the pedicled, microsurgical, or regional flap techniques. Currently, there is a preference for free flaps, based on the application of novel techniques that improve aesthetic and functional results. However, regional and pedicled flaps should not be dismissed, since they are similarly useful in terms of coverage, function, and even aesthetics. With the exception of the bone component in reconstruction, they should be considered relevant surgical tools, since they offer similar results, lower morbidity, and reduced surgical time, which also reduces health care costs. The age of 70 years seems to be the cut-off point in which morbidity and mortality increase in those undergoing microsurgical flaps for reconstruction in head and neck surgery. These rates are even higher for men, and a less demanding type of reconstruction should always be considered as an alternative in these cases.

Financial Source
The authors declare that they did not receive financial support from agencies in the public, private, or non-profit sectors to conduct the present study.

Conflict of Interests
The authors have no conflict of interests to declare.

References

1 Day AT, Yang AM, Tang L, Gordin EA, Emerick KS, Richmon JD. Regional flap practice patterns: A survey of 197 head and neck surgeons. Auris Nasus Larynx 2020;47(06):1088–1090. Doi: 10.1016/j.anl.2019.11.004
2 Colletti G, Tewfik K, Bardazzi A, Allevi F, Chiapasco M, Mandalà M, Rabbiosi D. Regional flaps in head and neck reconstruction: a reappraisal. J Oral Maxillofac Surg 2015;73(03):571.e1–571.e10. Doi: 10.1016/j.joms.2014.10.021
3 Gabrysz-Forget F, Tabet P, Rahal A, Bissada E, Christopoulos A, Ayad T. Free versus pedicled flaps for reconstruction of head and neck cancer defects: a systematic review. J Otolaryngol Head Neck Surg 2019;48(01):13. Doi: 10.1186/s40463-019-0334-y
4 Goyal N, Yarlagadda BB, Deschler DG, Emerick KS, Lin DT, Rich DL, et al. Surgical Site Infections in Major Head and Neck Surgeries Involving Pedicled Flap Reconstruction. Ann Otol Rhinol Laryngol 2017;126(01):20–28. Doi: 10.1177/0003489416672871
5 Kucur C, Durmus K, Uysal IO, Old M, Agrawal A, Arshad H, et al. Management of complications and compromised free flaps following major head and neck surgery. Eur Arch Otorhinolaryngol 2016;273(01):209–213. Doi: 10.1007/s00405-014-3489-1
6 Ross G, Yla-Kotola TM, Goldstein D, Zhong T, Gilbert R, Irish J, et al. Second free flaps in head and neck reconstruction. J Plast Reconstr

Aesthet Surg 2012;65(09):1165–1168. Doi: 10.1016/j.bjps.2012.03.035
7 Bozikov K, Arnez ZM. Factors predicting free flap complications in head and neck reconstruction. J Plast Reconstr Aesthet Surg 2006;59(07):737–742. Doi: 10.1016/j.bjps.2005.11.013
8 Mooney SM, Sukato DC, Azoulay O, Rosenfeld RM. Systematic review of submental artery island flap versus free flap in head and neck reconstruction. Am J Otolaryngol 2021;42(06):103142. Doi: 10.1016/j.amjoto.2021.103142
9 Vitkos EN, Galani Manolakou MM, Kounatidou NE, Dimasis P, Kyrgidis A. Is Supraclavicular Artery Island flap (SAI) a viable alternative to Free Tissue Transfer (FTT) in head and neck reconstruction? A systematic review and meta-analysis. J Stomatol Oral Maxillofac Surg 2023;124(03):101391. Doi: 10.1016/j.jormas.2023.101391
10 Ferrari S, Copelli C, Bianchi B, Ferri A, Poli T, Ferri T, Sesenna E. Free flaps in elderly patients: outcomes and complications in head and neck reconstruction after oncological resection. J Craniomaxillofac Surg 2013;41(02):167–171. Doi: 10.1016/j.jcms.2012.07.005
11 Tarsitano A, Pizzigallo A, Sgarzani R, Oranges CM, Cipriani R, Marchetti C. Head and neck cancer in elderly patients: is microsurgical free-tissue transfer a safe procedure? Acta Otorhinolaryngol Ital 2012;32(06):371–375
12 Fancy T, Huang AT, Kass JI, Lamarre ED, Tassone P, Mantravadi AV, et al. Complications, Mortality, and Functional Decline in Patients 80 Years or Older Undergoing Major Head and Neck Ablation and Reconstruction. JAMA Otolaryngol Head Neck Surg 2019;145(12):1150–1157. Doi: 10.1001/jamaoto.2019.2768
13 Zhou T, Huang W, Wang X, Zhang Y, Zhou E, Tu Y, et al. Global burden of head and neck cancers from 1990 to 2019. iScience 2024;27(03):109282. Doi: 10.1016/j.isci.2024.109282
14 Ali B, Choi EE, Barlas V, Petersen TR, Menon NG, Morrell NT. Risk Factors for 30-Day Mortality After Head and Neck Microsurgical Reconstruction for Cancer: NSQIP Analysis. OTO Open 2021;5(03):2473974X211037257. Doi: 10.1177/2473974X211037257

