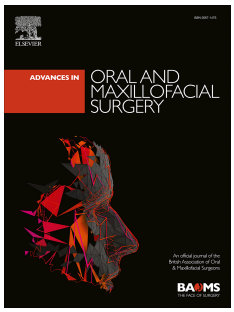

Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

# Journal Pre-proof




The revival of the supraclavicular artery island flap (SCAIF) during the COVID-19 pandemic

Ciro Emiliano Boschetti, Annalisa Pollice, Romolo Fragola, David Guida, Samuel Staglianò, Rita Vitagliano, Mario Santagata, Salvatore D'Amato, Giuseppe Colella, Gianpaolo Tartaro

PII: S2667-1476(22)00108-X

DOI: https://doi.org/10.1016/j.adoms.2022.100358

Reference: ADOMS 100358

To appear in: *Advances in Oral and Maxillofacial Surgery*

Received Date: 23 September 2022

Accepted Date: 10 October 2022

Please cite this article as: Boschetti CE, Pollice A, Fragola R, Guida D, Staglianò S, Vitagliano R, Santagata M, D'Amato S, Colella G, Tartaro G, The revival of the supraclavicular artery island flap (SCAIF) during the COVID-19 pandemic, *Advances in Oral and Maxillofacial Surgery* (2022), doi: https://doi.org/10.1016/j.adoms.2022.100358.

# The revival of the supraclavicular artery island flap (SCAIF) during the COVID-19 pandemic

Ciro Emiliano Boschetti, Annalisa Pollice, Romolo Fragola, David Guida, Samuel Staglianò, Rita Vitagliano, Mario Santagata, Salvatore D'Amato, Giuseppe Colella, Gianpaolo Tartaro

Multidisciplinary Department of Medical and Dental Specialties. Oral and Maxillofacial Surgery Unit. AOU – University of Campania "Luigi Vanvitelli", Naples, Italy

Correspondence: Annalisa Pollice

Multidisciplinary Department of Medical-Surgical and Dental Specialties. Oral and Maxillofacial Surgery Unit. AOU – University of Campania "Luigi Vanvitelli" via del Sole - 80138 -Naples, Italy

e-mail: annalisa.pollice@unicampania.it

Disclosures: None

Funding: None

**Keywords**: SCAIF, Free Flap, Oral Cancer, Parotid Cancer, COVID-19, Head and Neck Surgery

**The revival of the supraclavicular artery island flap (SCAIF) during the COVID-19 pandemic**

**Introduction**

The outbreak of the COVID-19 pandemic has dramatically affected the health-care system organization. The hospital resources were reallocated in order to face the big Coronavirus disease challenge. According to the pandemic related guidelines, the surgical and anesthesiologic staff, the operating rooms and the ICU availability were drastically minimized [1]. Of course, the Head and Neck cancer lanes were inevitably impacted by the pandemic's healthcare priority. When dealing with head and neck cancer, the surgery usually represents the first treatment choice. Most of the patients require complex reconstructive surgery to avoid comorbidities resulting from the ablative process. During the last years, the use of free flaps has represented the gold standard in HNC reconstruction. However, free flaps require a large hospital resources commitment, such as the personnel, ward and ICU beds and even diagnostics services use. During the COVID era, the locoregional flaps have taken over as reconstructive techniques as they are less demanding in terms of the deployment of human, financial and facilities resources [2]. In particular, the supraclavicular artery island flap (SCAIF) is slowly becoming a mainstream flap in head and neck reconstruction. It is a fasciocutaneous pedunculated flap based on the supraclavicular artery, a branch of the transverse cervical artery and it is characterized by a rotation angle of up to 180 °[3], that makes it quite easy to manipulate. It is quick and easy to set up and thanks to its versatility it can be used in most of the head and neck areas.

The aim of this paper is to investigate if the SCAIF can be considered as a valid alternative technique to free flaps when dealing with a resource restricted setting.

**Materials and Methods**

From April 2021 to January 2022, a series of 11 patients (47-84 years old, 7 males and 4 females) underwent head and neck reconstruction with SCAIF after tumor resection in the Italian Maxillo-facial Unit of the Azienda Ospedaliera Universitaria Luigi Vanvitelli of Naples.

All the patients were affected by locally advanced head and neck malignancies, recurrent cancers or experienced the failure of the previous reconstruction. All patients underwent an extensive resection of the lesions with at least 1.0-cm safe margins of soft tissue. All the patients who underwent head and neck reconstruction by SCAIF were included in the study, despite age, sex, race and tumor size. The patients with more than one comorbidity were included in the study (*Table 1*).

**Preoperative Planning**

SCAI flaps were designed with an axis drawn from the center of a triangle formed by the posterior edge of the sternocleidomastoid muscle, the external jugular vein, and the medial part of the clavicle, toward the acromioclavicular joint and the ventral surface of the deltoid muscle. The supraclavicular artery arises from the transverse cervical artery, a branch of the subclavian artery that may arise from the thyrocervical trunk or, in a minority of cases, from the subclavian artery directly.

It is mandatory to demonstrate the presence of the artery and to locate it preoperatively.

If the patient previously underwent a neck dissection, an angio-CT scan was preferred to demonstrate the artery, otherwise the artery was located and marked with a pencil Doppler probe.

The pedicle of the flap is drawn according to the distance of the site of reconstruction and the size of the flap according to the extension of the defect.

**Surgical technique**

Flap rising was conducted from distal to proximal, dissecting it in a subfascial plane.

The flap is dissected until its most proximal portion, where the supraclavicular artery arises from the transverse cervical artery.

Since the pedicle is surrounded by the fascia and the connective tissues in this region, it can be dissected without the need to expose the supraclavicular artery. No particular effort was made to locate and preserve the nervous pedicle of the flap.

After harvesting was completed, the flap was rotated to reach the site of reconstruction and, in most cases, the proximal portion of the flap was de-epithelialised and the flap was tunnelled under the cervical skin to reach mouth defects.

For facial and cervical skin reconstruction, the flap can be simply rotated to cover the defect (*Table 2*) (*Figure 1, 2*).

**Results**

A total of 11 patients were included in this study, 4 (36,37 %) females and 7 (63,64%) males. Mean age of all the patients was 62.45 ± 11.46 (51 to 84) years. 6 (54,54%) patients were affected by oral cavity tumors, such as tongue, floor of the mouth and buccal mucosa tumors, while 4 (36,37%) patients had a diagnosis of parotid or salivary duct tumors. Tumor size ranged from pT2 to pT4a, only 3 (27,27%) patients presented with lymph node involvement (stage N1-N2). None of the patients had distant metastases at the time of presentation. All the patients were affected by comorbidities. Two of them suffered of type II diabetes (18,18%) and one of them of COPD (9,09%), while most of the patients had a diagnosis of cardiovascular diseases, such as atrial fibrillation, myocardial infarction, peripheral arterial disease (*Table 1*). The mean hospitalization time was 5.09 ± 2.77 days (3 to 13 days) and only 5 (45,45%) patients required an ICU stay that lasted 19 h 30 min ± 4.38 on average (14 h to 26 h). The total time required for the reconstruction, that comprises flap harvesting and inset, was overall 1 h and 16 min ± 10 min (1 h 5 min to 1 h to 25 min). Five patients (45,45%) underwent lymphadenectomy. Only 1 patient (9,09%) needed a tracheostomy, all the other patients received a nasotracheal intubation. The mean flap size was 53.8964 ± 17.96 cm3 (23.36 to 77 cm3). Flap tunneling was required in all the patients who received SCAIF for the reconstruction of oral cavity tumor resection (54,54%). In every patient, the donor site closure was direct and it did not require a reconstruction. Regarding post-operative complications, 2 patients (9,09%) developed seromas, 1 patient (9,09%) a hypertrophic scar and 1 patient (9,09%) a small incision dehiscence. With regard to the recipient site morbidity, only 3 patients (27,27%) had complications: 1 patient experienced

partial flap necrosis, 1 patient a distal 1,5 cm tip necrosis and 1 patient suffered of partial skin loss. All these patients were affected by oral cavity tumors (Table 2).

**Discussion**

The SCAIF has been known since the early 19th century and it was quickly abandoned probably due to the high number of complications [4]. In the 1990s, Pallua et al., recovered this flap for the reconstructions after burns or cervical scar contractures [5] and in 2009 Chiu et al. has been the first to propose SCAIF for reconstruction of oncological defects after the head and neck surgery. The SCAIF is becoming more and more prevalent as head and neck reconstructive technique. Its similarity in color and texture to facial and neck skin structure makes it suitable for the reconstruction of these areas. As a matter of fact, it has been shown to be suitable for defects of the buccal mucosa, tongue, oral floor, palate, oropharynx, lower gum parotid, and neck [6].

During the COVID-19 pandemics, the SCAIF has become a potential alternative to the free flaps, thanks to several characteristics that makes it a valid option when surgical resources are limited. Preoperative imaging is cheap and easy: although Adams et al. demonstrated that CT angiography allowed accurate identification of the vascular pedicle [7], the use of the Doppler is usually sufficient for the identification of the supraclavicular artery [8], thereby preserving diagnostics services. The SCAIF can be set up by a single surgeon, thereby minimizing the use of the medical and nursing staff in the operating room [9]. When a free flap reconstruction is performed, two concurrent teams are required. In all the patient a nasotracheal intubation was performed, only one patient required a tracheostomy. The total time required for reconstruction, including flap harvesting and inset, that accounts to 1 h and 16 min on average, is dramatically reduced if compared to microvascular free tissue transfer. The concern of high dependency is significantly reduced [10]. The hospital stay was decreased if compared to free flaps (5 days on average) and most of the patients did not require ICU stay. Compared to free flaps, the donor site closure was direct and did not require a reconstruction, which represents one of the most common complication in the radial free forearm flap (RFFF) [11],

that is the one of the most used free flap in this area. Regarding post-operative complications, the most common were minor complications that were easily managed as outpatient procedure, such as seromas, hypertrophic scars or dehiscence. Three patients experienced partial flap necrosis, that was again treated as outpatient by surgical debridement. To avoid this kind of problem, many authors suggested to prevent scaling of the tip, the distal extension should not exceed 5 cm. Di Benedetto et al. in the 2005 recommended to leave a fascial lining around the vascular pedicle and to skeletonize the pedicle only in case to increase the length or the arc of rotation of the flap [9].

Furthermore, this flap can also be considered in patients undergoing previous radiotherapy treatments of the head and neck and in patients affected by more than one comorbidity [12], [13].

Overall, the SCAIF can be considered a valid alternative to the free flaps in terms of health-care resources saving. Functional and aesthetic outcomes were also satisfactory[14],[15] (*Figure 3*) thereby the supraclavicular flap can be considered superimposable to the free flap when required.

## Conclusion

The supraclavicular artery island flap (SCAIF) is a reliable alternative to the free tissue flaps. Its characteristics make it a good choice when hospital resources are limited or strained, such as during the COVID-19 pandemics. The SCAIF allows for immediate soft tissue reconstruction, with reduced surgical time, staff components, hospital and ICU stay.

**Acknowledgments**. None.

**Consent for publication**. The consent to participate and the consent for publication were obtained.

[1] F. C. Hojaij, L. A. Chinelatto, G. H. P. Boog, J. A. Kasmirski, J. V. Z. Lopes, and V. M. B. Medeiros, "Head and Neck Practice in the COVID-19 Pandemics Today: A Rapid Systematic Review," *International Archives of Otorhinolaryngology*, vol. 24, no. 4. Georg Thieme Verlag, pp. 518–526, Oct. 01, 2020. doi: 10.1055/s-0040-1715506.

[2] D. Butler *et al.*, "Head and neck oncological ablation and reconstruction in the COVID-19 era – our experience to date," *British Journal of Oral and Maxillofacial Surgery*, vol. 58, no. 8, pp. 1008–1013, Oct. 2020, doi: 10.1016/j.bjoms.2020.06.011.

[3] L. Giordano *et al.*, "The supraclavicular artery island flap (SCAIF) in heaand neck reconstruction: An Italian multi-institutional experience," *Acta Otorhinolaryngologica Italica*, vol. 38, no. 6, pp. 497–503, Dec. 2018, doi: 10.14639/0392-100X-1794.

[4] L. Giordano *et al.*, "The supraclavicular artery island flap (SCAIF) in heaand neck reconstruction: An Italian multi-institutional experience," *Acta Otorhinolaryngologica Italica*, vol. 38, no. 6, pp. 497–503, Dec. 2018, doi: 10.14639/0392-100X-1794.

[5] N. Pallua, H. G. Machens, O. Rennekampff, M. Becker, and A. Berger, "The fasciocutaneous supraclavicular artery island flap for releasing postburn mentosternal contractures.," *Plast Reconstr Surg*, vol. 99, no. 7, pp. 1878–84; discussion 1885-6, Jun. 1997, doi: 10.1097/00006534-199706000-00011.

[6] F. Martins De Carvalho, B. Correia, A. Silva, and J. Costa, "Versatility of the Supraclavicular Flap in Head and Neck Reconstruction," 2020.

[7] A. S. Adams *et al.*, "The use of multislice CT angiography preoperative study for supraclavicular artery island flap harvesting.," *Ann Plast Surg*, vol. 69, no. 3, pp. 312–5, Sep. 2012, doi: 10.1097/SAP.0b013e31822afaba.

[8] J. W. Granzow, A. Suliman, J. Roostaeian, A. Perry, and J. B. Boyd, "The supraclavicular artery island flap (SCAIF) for head and neck reconstruction: surgical technique and refinements.," *Otolaryngol Head Neck Surg*, vol. 148, no. 6, pp. 933–40, Jun. 2013, doi: 10.1177/0194599813484288.

[9] G. di Benedetto, A. Aquinati, M. Pierangeli, A. Scalise, and A. Bertani, "From the 'charretera' to the supraclavicular fascial island flap: revisitation and further evolution of a controversial flap.," *Plast Reconstr Surg*, vol. 115, no. 1, pp. 70–6, Jan. 2005.

[10] S. Zhang, W. Chen, G. Cao, and Z. Dong, "Pedicled Supraclavicular Artery Island Flap Versus Free Radial Forearm Flap for Tongue Reconstruction Following Hemiglossectomy," *Journal of Craniofacial Surgery*, vol. 26, no. 6, pp. e527–e530, Sep. 2015, doi: 10.1097/SCS.0000000000002031.

[11] M. J. Timmons, F. E. M. Missotten, M. D. Poole, and D. M. Davies, "Complications of radial forearm flap donor sites," *British Journal of Plastic Surgery*, vol. 39, no. 2, pp. 176–178, Apr. 1986, doi: 10.1016/0007-1226(86)90078-0.

[12] W. L. Chen *et al.*, "Extended supraclavicular fasciocutaneous Island flap based on the transverse cervical artery for head and neck reconstruction after cancer ablation," *Journal of Oral and Maxillofacial Surgery*, vol. 68, no. 10, pp. 2422–2430, Oct. 2010, doi: 10.1016/j.joms.2010.01.015.

[13] G. Colella *et al.*, "Clinical management of squamous cell carcinoma of the tongue: patients not eligible for free flaps, a systematic review of the literature.," *Expert Rev Anticancer Ther*, vol. 21, no. 1, pp. 9–22, 2021, doi: 10.1080/14737140.2021.1840359.

[14] C. E. Boschetti *et al.*, "Kabat Rehabilitation in Facial Nerve Palsy after Parotid Gland Tumor Surgery: A Case-Control Study," *Diagnostics*, vol. 12, no. 3, p. 565, Feb. 2022, doi: 10.3390/diagnostics12030565.

[15] D. de Cicco *et al.*, "Health-Related Quality of Life in Oral Cancer Patients: Scoping Review and Critical Appraisal of Investigated Determinants.," *Cancers (Basel)*, vol. 13, no. 17, Aug. 2021, doi: 10.3390/cancers13174398.

**Figure 1**. SCAIF inset after tongue cancer ablation.

**Figure 2**. SCAIF inset after total parotidectomy without skin sparing.

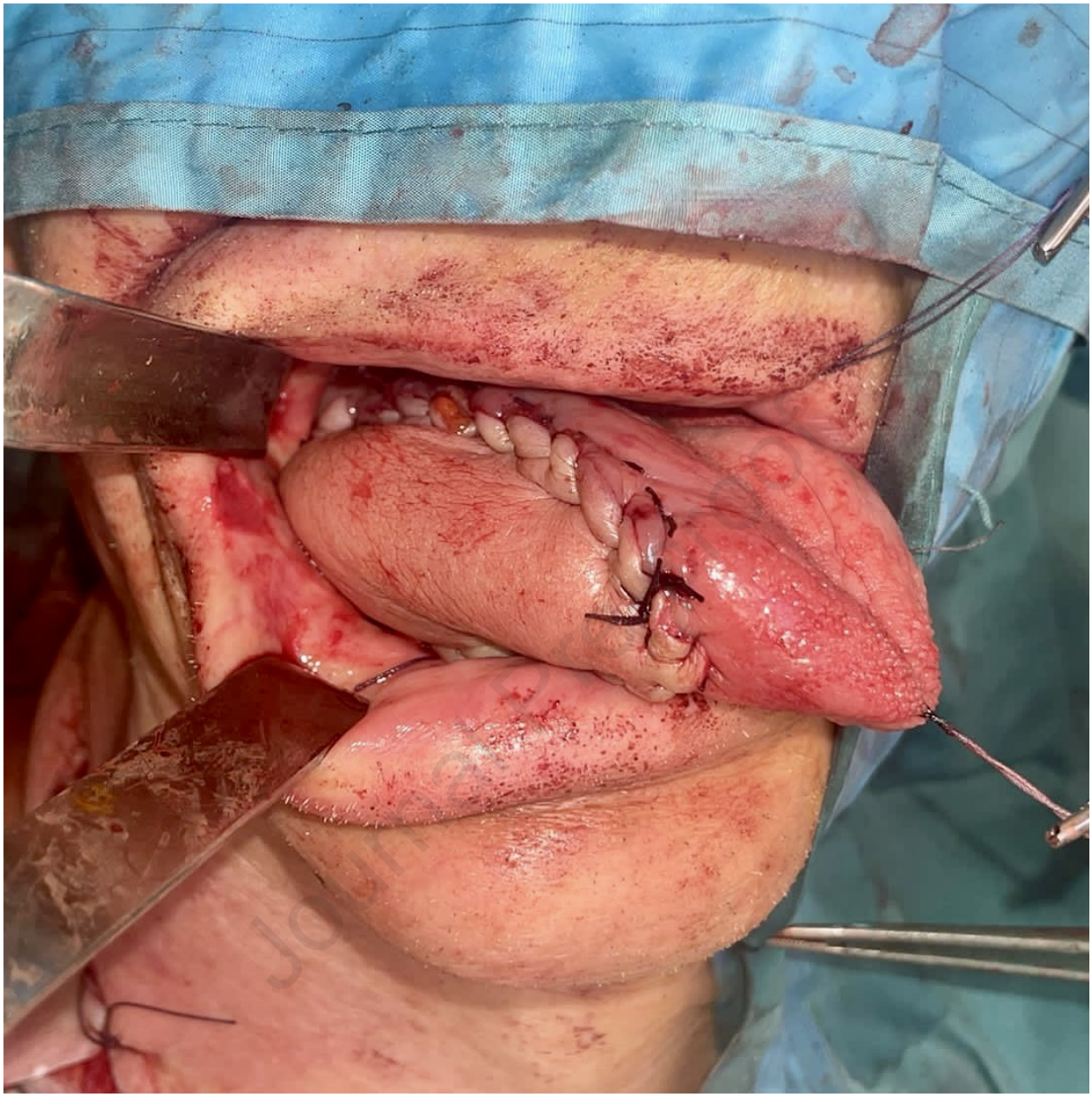
**Figure 3**. Patient follow-up: 6 months after surgery.

**Table 1**. Patients characteristics.

**Table 2**. Surgery details.

| N° | Patient | Hospitalization time (days) | Length of reconstruction (hh:mm) | Lymphadenectomy | ICU (hours) | Tracheostomy | NGT | Flap size (cm) | Tunneling | Donor site closure | Donor site morbidity | Recipient site morbidity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | BF | 4 | 1h 5min | Yes | No | No | No | 5 x 8,5 | No | Direct | None | None |
| 2 | GV | 13 | 1h 35min | Yes | 18h | No | Yes | 5,5 x 8 | Yes | Direct | None | Partial Flap Necrosis |
| 3 | IF | 3 | 1h 20min | No | 26h | No | Yes | 4,2 x 5,8 | Yes | Direct | None | None |
| 4 | MG | 4 | 1h 10min | No | No | No | Yes | 6 x 12 | No | Direct | Seroma | None |
| 5 | FA | 4 | 1h 10min | Yes | No | No | No | 7 x 11 | No | Direct | Seroma | None |
| 6 | LE | 5 | 1h 25min | No | 21h | Yes | Yes | 7 x 10 | Yes | Direct | None | 1,5cm Distal tip |
| 7 | PR | 5 | 1h 30min | No | 14h | No | Yes | 4 x 8,5 | Yes | Direct | None | None |
| 8 | SC | 4 | 1h 10min | Yes | No | No | Yes | 6,5 x 10 | No | Direct | Hypertrophic scar | None |
| 9 | TG | 3 | 1h 5min | No | No | No | No | 6 x 9 | No | Direct | None | None |
| 10 | MM | 5 | 1h 10min | No | No | No | No | 5 x 8 | Yes | Direct | None | None |
| 11 | PG | 6 | 1h 25min | Yes | 20h | No | Yes | 7 x 10 | Yes | Direct | Small incision dehiscence | Partial Skin Loss |

| N° | Patient | Age | Sex (M/F) | Tumor site | Staging | Comorbidities |
|---|---|---|---|---|---|---|
| 1 | BF | 51 | M | Parotid | pT4 N1 M0 | HBP, T2DM |
| 2 | GV | 47 | F | Buccal mucosa | pT3 N1 M0 | O, HBD, T2DM |
| 3 | IF | 56 | M | Mouth floor | pT4a N0 M0 | AF |
| 4 | MG | 84 | M | Salivary Duct | pT3 N0 M0 | MI |
| 5 | FA | 67 | M | Parotid | pT4 N2 M0 | TIA |
| 6 | LE | 61 | F | Tongue | pT3 N0 M0 | CAD, O |
| 7 | PR | 77 | F | Buccal mucosa | pT4a N0 M0 | PAD |
| 8 | SC | 58 | M | Salivary Duct | pT4 N0 M0 | CHF, T2DM |
| 9 | TG | 63 | M | Parotid | pT3 N0 M0 | HBD |
| 10 | MM | 52 | M | Hard Palate | pT4 N0 M0 | CH, O |
| 11 | PG | 71 | F | Tongue | pT2 N2 M0 | COPD |



**Declaration of interests**

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☐The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: