



# Lingual Artery as the Recipient Vessel of Choice in Patients Requiring a Second or Third Free Flap in Recurrent Oral Cancers and Vessel-Depleted Neck: A 5-Year Experience in a Single Institute

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## Abstract

**Introduction** Reconstruction with free flaps becomes a challenge in recurrent cases having previously treated necks, in patients who have received prior radiation therapy or chemotherapy or both, and where the patient has already undergone free flap reconstruction in a prior surgery. Depleted cervical recipient vessels can increase the complexity of reconstruction in achieving successful free flap perfusion and thereby increasing flap thrombosis and eventually failure.

**Materials and Methods** Over a period of 5 years from January 2018 to February 2023, we encountered a total of 22 cases of recurrent or second primary oral cancer with bilateral necks operated, postadjuvant chemo-radiotherapy, and requiring a second or third free flap reconstruction. In most of the cases we resorted to the lingual artery as the recipient artery of choice.

**Results** No flap loss was reported. No cases were reexplored either for hematoma or for congestion. All patients recovered uneventfully.

**Conclusion** To the best of our knowledge, there has been no paper yet that focuses on the lingual artery to be the recipient vessel of choice in recurrent oral cancers. We find the lingual artery to be a reliable and safe option and advocate its usage as recipient vessel of choice in recurrent oral cancers requiring more than one free flap reconstruction.

## Keywords

- ▶ lingual artery
- ▶ recipient vessels
- ▶ free flap
- ▶ recurrent oral cancer
- ▶ vessel depleted neck

## Introduction

Microvascular free flap reconstruction is considered to be the gold standard in oral cavity malignancies. Microvascular

surgery is undergoing continuous evolution since the past century and has shown promising results with a success rate of more than 99%.<sup>1</sup> However, an important determinant in the success of free tissue transfer in oral cavity malignancies

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is the availability and quality of recipient vessels in the neck that are used for microvascular anastomosis. Reconstruction with free flaps becomes a challenge in recurrent cases having previously treated necks, in patients who have received prior radiation therapy, or where the patient has already undergone free flap reconstruction in a prior surgery. Patients who have undergone these kinds of prior interventions have poor cervical anatomy with distorted tissue architecture, inflammation, and with scarred and fibrosed vessels leaving the patient's neck devoid of suitable recipient vessels, referred to as "frozen" neck or "vessel-depleted" neck. Depleted cervical recipient vessels can increase the complexity of reconstruction in achieving successful free flap perfusion and thereby increasing flap thrombosis and eventually failure.<sup>2</sup>

In such cases, the reconstructive surgeon faces the challenge of finding an appropriate and reliable vessel for anastomosis. The criteria for a suitable vessel are as follows:<sup>3</sup>

1. Reliable anatomical architecture with minimum or no atherosclerotic changes, absence of intimal damage, and dynamic and pulsatile blood flow.
2. Adequate vessel length to reach the donor vessel for anastomosis after flap inset.
3. Adequate caliber and size match with donor vessels.
4. Ease and safety of dissection of the vessel providing sufficient space to perform anastomosis.
5. Position in a preferably nonirradiated part of the neck.

In our institution, in treatment of naive necks, usually the recipient artery is chosen to be the superior thyroid artery in most cases followed by the facial artery, and the veins to be the internal jugular vein followed by the external jugular vein. However, in redo flap cases, since these vessels are already used up, the only resort is to look for other safe alternatives in the same side, use opposite neck vessels if the donor pedicle length is long, or employment of vessel transplants from undamaged areas. In our institution, over a period of 4 years, out of total 1,852 free flap reconstructions, we had 22 recurrent and second or third primary cases of oral cancer, with bilateral necks operated and irradiated requiring a second or third free flap reconstruction.

In our experience, we found the lingual artery to be a safe recipient artery in redo and salvage surgeries requiring free flap reconstruction because of its position in a relatively less irradiated zone of the neck, adequate vascular length after dissection, and reliable flow.

## Materials and Methods

Over a period of 5 years, from January 2018 to February 2023, out of a total number of 1,852 cases that required a free flap reconstruction, we encountered 22 cases of recurrent or second primary oral cancer cases with bilateral necks operated, postadjuvant chemo-radiotherapy, and requiring a second or third free flap reconstruction. All reconstructions were done by a single plastic surgeon. In 20 cases we resorted to the lingual artery as the recipient vessel (–Figs. 1, 2A–C), in 1 case the transverse cervical artery was chosen, and in 1 the donor pedicle was anastomosed directly to the external



**Fig. 1** Dissection of lingual artery in previously operated and radiated neck.

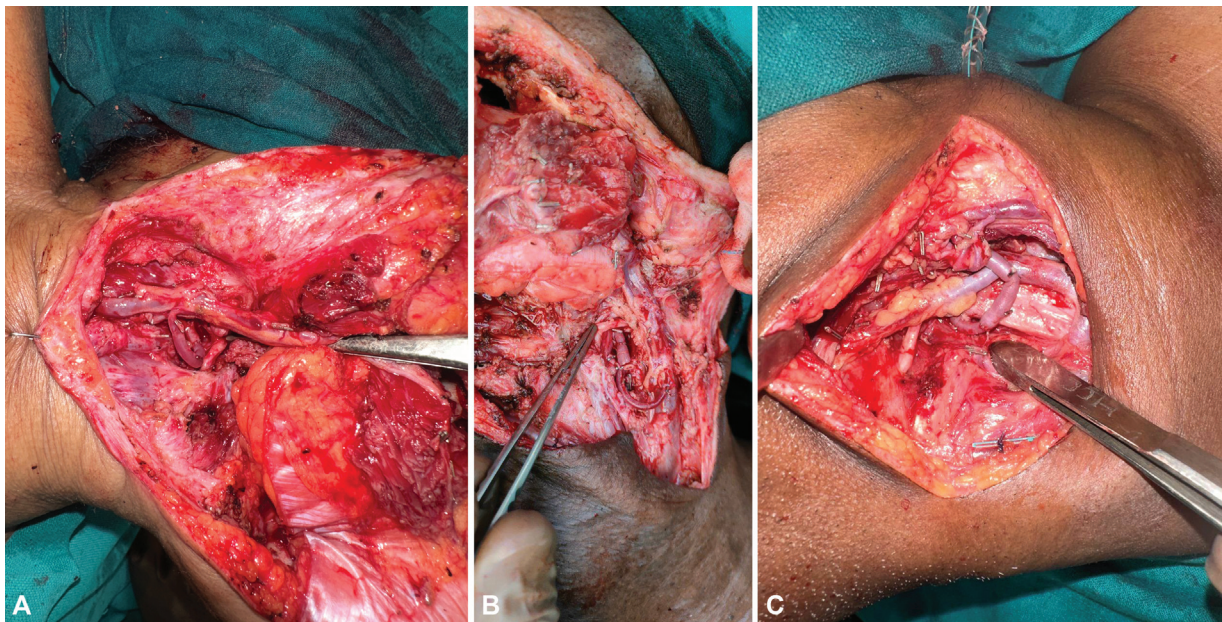
carotid artery (end to side). For venous anastomosis, internal jugular vein was used in 17 cases, an intact external jugular vein in 3 cases, and flipped cephalic vein in 2 cases (–Table 1).

## Results (–Tables 2–5)

There was one incidence of postoperative hematoma on postoperative day 1 at the primary site from maxillary artery, which was timely intervened without any compromise to the airway or the flap. No flaps required reexplorations for venous congestion or arterial insufficiency. As the contralateral lingual artery was preserved in most cases, we have not encountered any tongue or floor of mouth necrosis. Also, due to dissection of ipsilateral lingual artery used for anastomosis, since we did not dissect inside the floor of the mouth, we avoided devascularization of the same. There was no incidence of hypoglossal nerve injury in any of our cases.

## Discussion

The use of microvascular reconstruction after head and neck extirpative procedures has been well delineated in the literature. Free flaps nowadays are the preferred method of reconstruction and is placed at the highest order in the reconstructive ladder. Frequently, oral cancer patients require a second or third reconstruction due to development of recurrence or a second primary tumor. There is a 3 to 7% annual risk of developing a second primary tumor, irrespective of the stage of the primary tumor, probably due to the concept of field cancerization in oral cancer.<sup>4</sup> Pedicled flaps like pectoralis major flap can be used in these situations but free flaps have proved to be reliable and safe as long as suitable recipient arteries and veins are found. Most of these defects are complex and not suitable for reconstruction by



**Fig. 2 (A, B,C)** Post anastomosis pictures of lingual artery as the recipient artery for free flaps.

**Table 1** Patient Characteristics

Patient status	Total no.
Previously irradiated neck	22
Previously done bilateral neck dissection	22
First time recurrence	07
Second primary lesion	05
Second time recurrence	04
Third primary lesion	03
Third time recurrence	03

**Table 2** Defect Characteristics

Defect site	Total no.
Buccal mucosa with skin involvement	10
Buccal mucosa with mandibular involvement	07
Tongue	02
Maxilla	03
Total	22

**Table 3** Type of Free Flap used

Flap used	Total no.
FALT—free anterolateral thigh flap	15
FRAFF—free radial artery forearm flap	06
FFOCF—free fibula osteocutaneous flap	01
Total	22

**Table 4** Type of Recipient Artery used

Recipient artery used	Total no.
Lingual artery (end to end)	20
Others	02
Total	22

**Table 5** Type of Recipient Vein used

Recipient vein used	Total no.
Internal jugular vein (end to side)	17
External jugular vein (end to end)	03
Cephalic vein (flipped)	02

local or locoregional flaps. These reconstructive procedures are more challenging than previous surgeries because of the presence of scarring from prior surgeries, fibrosis caused by radiation, and other structural changes occurring over a period. Consequently, complication rates are also expected to be considerably high.<sup>5</sup> A crucial approach in such patients is determining the recipient vessels that are to be used for microvascular anastomosis since in these cases the neck becomes somewhat “vessel depleted.” In our study, selection of vein was not a problem as internal jugular vein was used in 17 cases, an intact external jugular vein in 3 cases, and flipped cephalic vein in 2 cases. Selection of recipient artery was pivotal in our series because of the following reasons:

1. Facial artery was not available because of previous bilaterally operated necks.
2. Ipsilateral superior thyroid artery was used up in all cases in the previous free flap reconstruction(s).

3. Contralateral superior thyroid was used up in eight cases (second recurrence or third primary cases).
4. Many times, due to limitation of pedicle length, same side anastomosis is preferred over vein grafts.

Hence an alternative artery with suitable length, diameter, and caliber had to be selected for viable arterial anastomosis. We found the lingual artery to be a reliable and safe alternative to be used as a recipient artery in cases where the common arteries like superior thyroid artery and facial artery are unavailable for anastomosis. Since lingual artery is not ligated in previous neck dissection surgeries, it was available in all the cases except in two tongue primary cases where lingual artery had been ligated in neck in previous surgeries.

The lingual artery is an anteromedial branch of the external carotid artery (►Fig. 3) that arises adjacent to the greater cornu of the hyoid bone between the superior thyroid artery and facial artery. It arises either as a solitary branch or from a common trunk with either one or both of these vessels<sup>6</sup> (►Fig. 4A-C). It runs parallel and deep to the hypoglossal nerve. It is divided into three parts by the hyoglossus muscle. Our area of interest is the second part where the artery lies deep to the hyoglossus muscle, tendons of digastric muscle, and the stylohyoid muscle. Since it is deep to these muscular structures, it is well protected from the

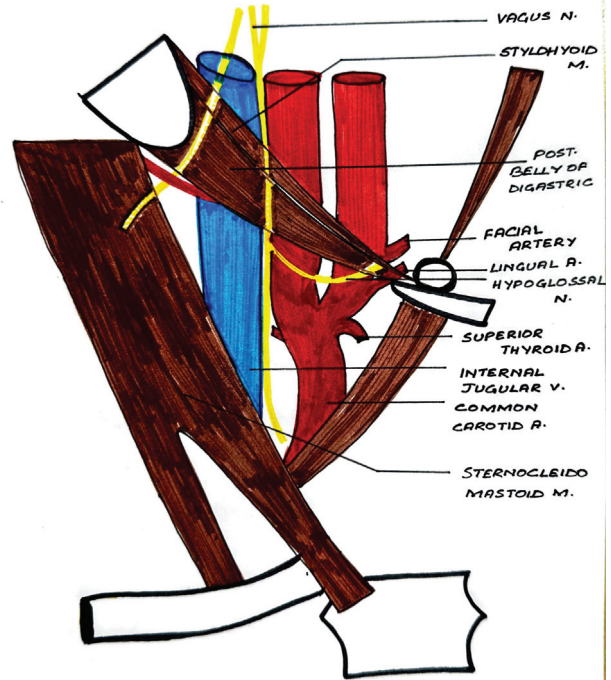


Fig. 3 Anatomy of lingual artery.

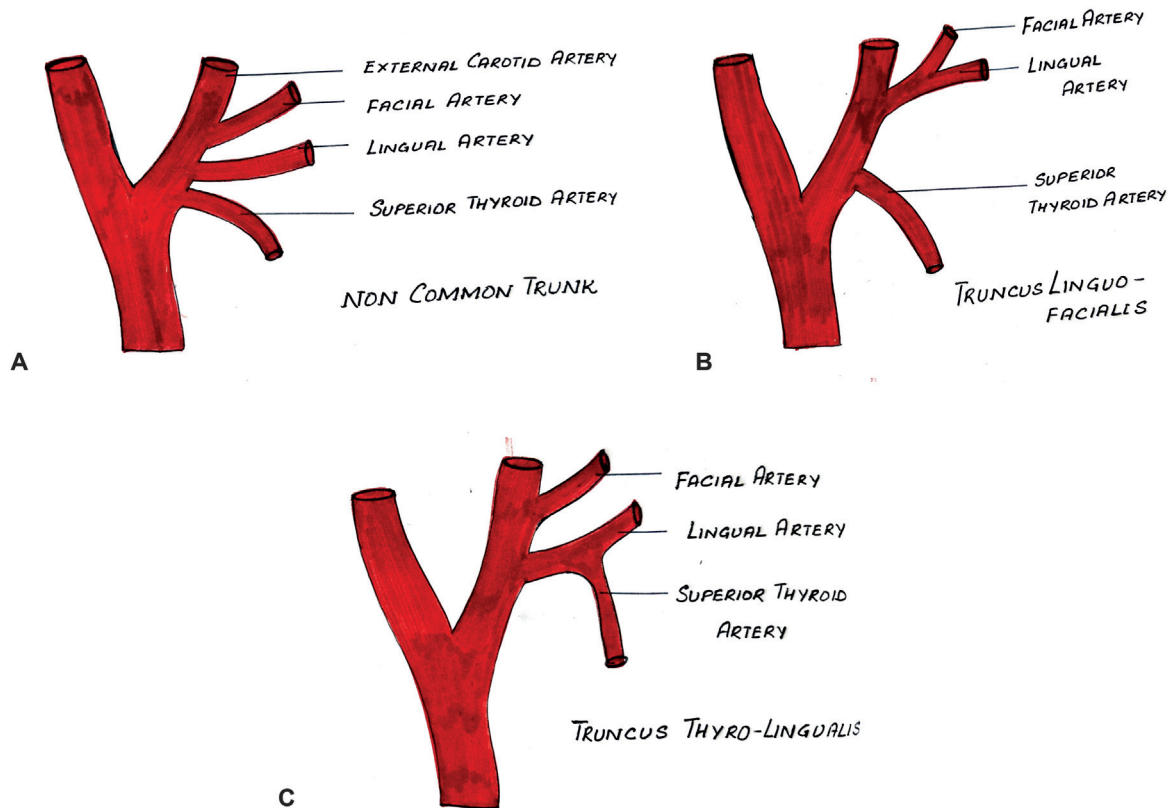


Fig. 4 (A) Non common trunk of lingual artery (60–70%); (B) Linguo-facial trunk (20–25%); (C) Thyro-lingual trunk (2–3%).

ill-effects of previous radiation therapy and untouched in previous neck surgeries. In addition to this factor, we believe that its proximity to the defect site, reliable flow (because of its proximity to the external carotid artery), ease of dissection, long pedicle length, and adequate caliber make it an excellent choice for recipient artery. The ease of dissection of this artery can considerably shorten the surgical time without compromising the anastomotic safety. In vessel-depleted necks, the other options of recipient artery include the transverse cervical artery, internal mammary artery, end-to-side anastomosis with external carotid artery, or opposite neck vessels in cases with sufficient pedicle length. In a paper by Chung et al,<sup>7</sup> lingual artery had been used in three patients (8.82%) as a recipient vessel in recurrent head and neck cancer. Some investigators have reported favorable results when using transverse cervical vessels<sup>8</sup> and superficial temporal vessels<sup>9</sup> in the ipsilateral side of the neck as recipient vessels in previously operated necks. There are several reports of using recipient vessels outside of the reconstruction zone. The dorsal scapular artery,<sup>10</sup> internal mammary vessels,<sup>11</sup> internal mammary artery perforators,<sup>12</sup> and lateral thoracic artery<sup>13</sup> are far from the damaged zone and are available in reconstruction. However, dissection of these vessels may be extremely time-consuming, prolonging the duration of surgery. Finding corresponding recipient veins may be difficult, and many times vein grafts are required to lengthen the vessels.

## Conclusion

The exploration of suitable-quality recipient vessels, especially arteries, in regions with severe scarring and fibrosis in the neck due to previous neck dissection and postradiation changes may be painstaking, sometimes leading to unfavorable results. Though several options exist, an appropriate choice can make the entire procedure simple. To the best of our knowledge, there has been no detailed experience published yet that focuses on the lingual artery to be the recipient vessel of choice in recurrent oral cancers. We find the lingual artery to be a reliable and safe option and advocate its usage as recipient vessel of choice in recurrent oral cancers requiring more than one free flap reconstruction.

### Ethical Approval

The paper has been prepared in compliance with the ethical standards of our institution and has been approved

by the ethical committee. Informed consent was taken from the patients for participation in the study.

### Conflict of Interest

None declared.

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