

## Original Article

# External Carotid Artery Ligation: An Oncological Emergency Procedure for Bleeding Locally Advanced Oral Cancers in a Tertiary Care Hospital in Central India

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## ABSTRACT

**Introduction:** Oral cancer is a major public health problem in the Indian subcontinent. Bleeding is a frequent life-threatening problem for patients with advanced oral cancer. We in this study discuss our experience with bleeding locally advanced oral cavity cancers presenting to us in the emergency whereby we have performed surgical management in the form of external carotid artery (ECA) ligation.

**Methodology:** We performed a retrospective observational study of Emergency ECA ligation at our institute from October 2019 to October 2021. All patients were diagnosed case of oral squamous cell carcinoma (SCC) presented with severe life-threatening oral bleeding in the emergency department. Initially patients were resuscitated with IV fluids and blood products and oral cavity were packed with pressure dressings and patients immediately shifted to emergency operating room where we performed tracheostomy followed by external carotid artery ligation.

**Results:** A total of 14 patients underwent emergency ECA ligation. Out of which 12 were male patients and average age was 46 years. 12 out of 14 patients had locally advanced carcinoma (Ca) tongue and 2 patients had locally advanced Ca buccal mucosa. Following ECA ligation of all 14 patients, bleeding had stopped in the immediate post-operative day. Patients were discharged without any postoperative morbidity or mortality. No patient had any neurologic deficits postoperatively.

**Conclusion:** We conclude that ECA ligation in conjunction with tracheostomy is a very simple and life-saving procedure for locally advanced oral cancer patients presenting in the emergency department with severe life-threatening bleeding.

**Key words:** Oncological emergency procedure, Bleeding Oral Cancer, External Carotid artery ligation, Head and Neck cancer, tracheostomy, life-saving surgery

## INTRODUCTION

Oral cancer is a major public health problem in the Indian subcontinent, where it ranks among the top three types of cancer in the country. According to the GLOBOCAN 2018, there were 119,992 new cases of oral cancer in the country, with 72,616 deaths due to the same in 2018.<sup>1</sup> Although screening for oral cancer is relatively simple, in India the prevalence of oral cancer is high, especially among the low-income groups. This is probably due to a wide exposure to risk factors such as tobacco chewing, premalignant lesions, lack of awareness regarding cancer resulting in a delay in diagnosis and management of oral cancer.

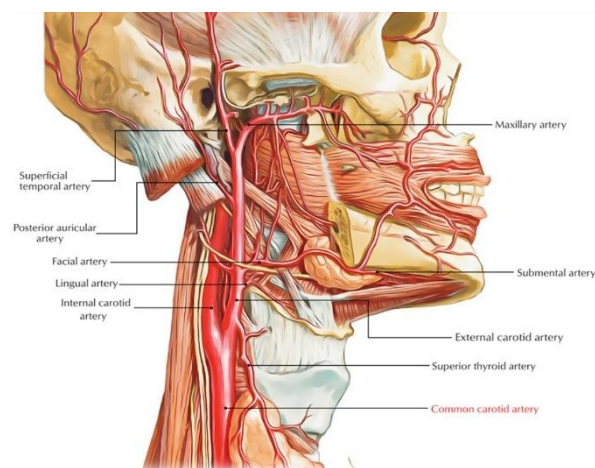
Bleeding is a frequent problem for patients with advanced oral cancer. Bleeding is the third most common cause of death in patients with metastatic cancer after organ failure from tumour invasion and infection. Bleeding can be caused by the cancer itself, as with local tumour invasion, abnormal tumour vasculature, or tumour regression. Non-invasive local treatment options include applied pressure, dressings, packing, and radiation therapy. We in this study discuss our experience with bleeding locally advanced oral cavity cancers presenting to us in the emergency whereby

we have performed surgical management in the form of external carotid artery (ECA) ligation.

### Surgical Anatomy of Carotid Artery:<sup>2</sup>

The right common carotid arises from the bifurcation of the brachiocephalic trunk and the left common carotid from the aortic arch. The common carotid artery can be divided arbitrarily into three parts: inferior, middle and superior. The inferior part is behind the sternoclavicular joint on the right, and is intrathoracic on the left. The middle section is located in the neck. The superior part bifurcates to the internal and external carotid arteries.

Topographically, the origin of the right common carotid is located behind the right sternoclavicular joint. The origin of the left common carotid is intrathoracic; as it enters the root of the neck, it passes posterior to the left sternoclavicular joint. At that level the two common carotid arteries are 2½ - 3½ cm apart, separated by the trachea. From that point, both carotid arteries have a length of 8-12 cm, terminating at the level of the 4th cervical vertebra and at the superior level of the thyroid cartilage. There they bifurcate to the external and internal carotid arteries. The larynx separates them from one another at 5½ - 6½ cm.

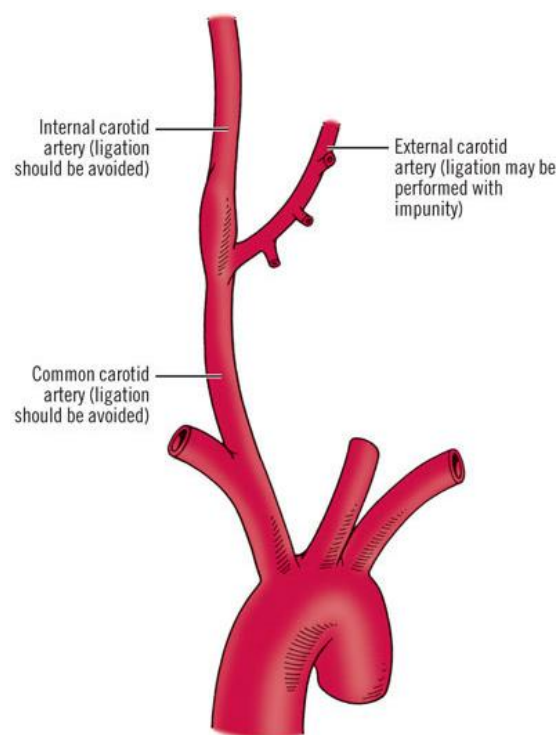


**Fig 1: Anatomy of Carotid arteries in the neck**

The internal carotid artery is located within the carotid triangle, under and deep to the stylohyoid muscle and the posterior belly of the digastric muscle. The internal carotid does not give origin to any branches in the neck, since its supply is limited to intracranial structures.

The external carotid artery begins at the bifurcation of the common carotid artery at C4. It continues upward to a point posterior to the neck of the mandible (approximately 1.5 cm below the zygomatic arch) where it bifurcates to form the maxillary and superficial temporal arteries. The superior thyroid, lingual, and facial arteries arise from the ventral aspect near the origin of the external carotid; the ascending pharyngeal, occipital and posterior auricular branches arise from the dorsal side of the external carotid.

**Ligation of the external carotid artery** can be done with impunity if the internal carotid artery is not injured (Fig. 2). The ligation can be done above or below the origin of the



**Fig 2: Ligation Guidelines**

superior thyroid artery if necessary. George Bushe was the first surgeon who tied the external carotid artery in a young patient for severe haemorrhage following the removal of a pulsating nevus from the temporal region.<sup>3</sup>

Ligation of the **common carotid artery** and **internal carotid artery** should be absolutely avoided (Fig.2). Ligation of the common carotid artery has been said to reduce the blood flow of the internal carotid artery and, therefore, the supply to the brain by approximately 50%. Hence neurological complications increase. According to Dandy<sup>4</sup>, there was a death rate of 4% following ligation of the internal carotid for intracranial aneurysms.

## METHOD

We performed a retrospective observational study of Emergency ECA ligation at our institute from October 2019 to October 2021. All patients were diagnosed case of oral squamous cell carcinoma (SCC) presented with severe life-threatening oral bleeding in the emergency department. Initially patients were resuscitated with IV fluids and blood products and oral cavity were packed with pressure dressings and patients immediately shifted to emergency operating room.

**Procedure:** At the outset Emergency Tracheostomy was performed in all patients to secure the airway. Patient was then put under general anaesthesia and painting and draping done. Patient was positioned in supine position with neck extended and turned to opposite side of oral ulcer. A transverse neck incision was made approximately at the upper level of thyroid cartilage and subplatysmal flap raised. Sternocleidomastoid muscle was then delineated and retracted laterally exposing the carotid sheath which was opened and IJV retracted laterally. Common carotid artery bifurcation identified at the upper border of thyroid cartilage. External carotid artery is usually located medially and internal carotid artery laterally. External carotid artery was hooked and ligated after its first branch i.e., superior thyroid artery with 2-0 silk ligatures. Wound is closed in 2 layers (platysma & skin).

## RESULTS

A total of 14 patients underwent emergency ECA ligation. Out of which 12 were male patients and average age was 46 years. 12 out of 14 patients had locally advanced carcinoma tongue.

Out of the **12** patients of **Ca Tongue** two were borderline resectable as the disease was involving vallecula at the outset and was given 2#TPF(Docetaxel/Cisplatin/5-FU) following which the disease had progressed and they presented to us in emergency with bleeding for which ECA ligation and tracheostomy was done and deemed inoperable and sent to Radiation Oncology for chemo-radiation (CTRT).

**Table 1: Subsites of oral squamous cell carcinoma (SCC)**

Subsites	Cases
Anterior 2/3 <sup>rd</sup> Tongue + Posterior 1/3 <sup>rd</sup> Tongue	12
Buccal Mucosa + RMT + Mandibular erosion	2

Two patients underwent emergency ECA ligation and Tracheostomy had cT4N1M0 disease for which definite surgery in the form of Total Glossectomy with bilateral modified radical neck dissection with PMMC (pectoralis major myocutaneous) pedicled flap reconstruction was done. Subsequently, patient underwent adjuvant radiation therapy.

Four patients after undergoing ECA ligation and tracheostomy had inoperable disease involving hyoid bone, tonsillar fossa along with vallecula and was sent for chemo-radiation Therapy.

Four patients had residual lesion post chemo-radiation (CTRT) therapy, underwent emergency ECA ligation and

tracheostomy following which 2 had undergone salvage Total Glossectomy with bilateral modified radical neck dissection with PMMC reconstruction and 2 had lung metastasis and was subjected for palliative chemo-therapy.

Two patients had locally advanced **Ca buccal mucosa** involving RMT and mandible. Following control of bleeding with ECA ligation and tracheostomy, they were sent for CTRT in view of inoperable disease involving high ITF (Infratemporal Fossa) and skull base involvement. (Chemo-radiation (CTRT)- Radiation Therapy of 60 Gy (Gray) / 30 # (Fractions) for 6 weeks along with 30 mg/m<sup>2</sup> of weekly Cisplatin.)

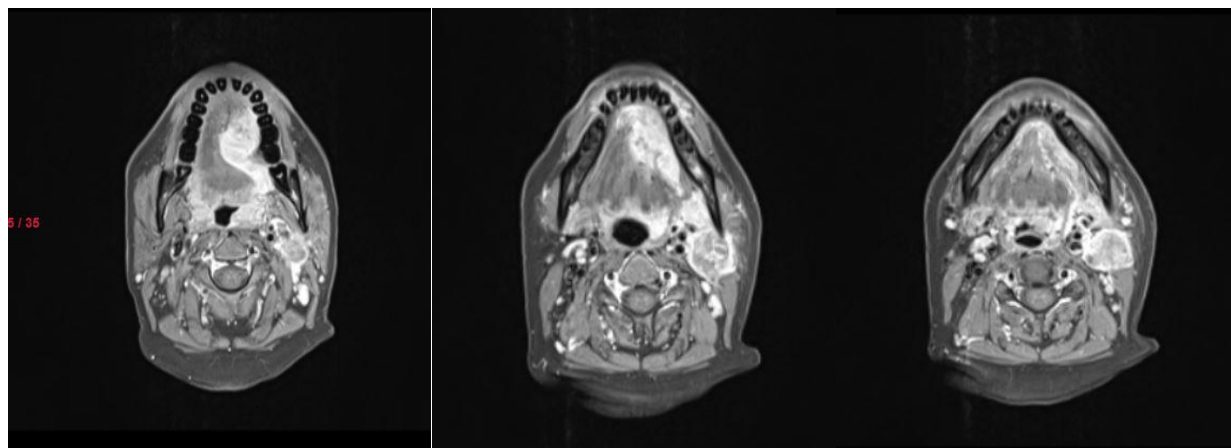


Fig 3/4/5: Show MRI images of a patient with bleeding Ca Tongue. Heterogeneously enhancing lesion involving left side of tongue crossing midline and almost reaching Vallecula on left side. Also seen is bulky left Level II Cervical Lymph node.

**Table 2: Duration of Surgery:**

Type of cases	Duration of Surgery
Untreated Neck patients (10)	<30 mins
Post CTRT (4)	>30 mins

**Duration of Surgery:** Also, in all patients undergoing ECA ligation with Tracheostomy, duration of surgeries was noted. It was found that in all bleeding Tongue/Buccal Mucosa cases without any prior radiation therapy (untreated neck) i.e., 10 patients, duration of surgery was found to be < 30 mins with an average time of 25 mins whereas in 4 post-irradiated Ca tongue patients with post radiation changes duration of surgery was longer > 30 mins (average time was around 45 mins). This increase in operating time in post CTRT patients is attributed to dense fibrosis in the neck following radiation therapy which distorts the anatomy and makes it far more difficult to identify external carotid artery.

Following ECA ligation of all 14 patients, bleeding had stopped in the immediate post-operative day. Patients were discharged without any postoperative morbidity or mortality. No patient had any neurologic deficits postoperatively.

## DISCUSSION

In the Indian Scenario, it is observed that patient usually present late with locally advanced T4 oral cancers in about 64.4% of the time<sup>5</sup> as a result of self-neglect and low socio-

economic status. One of the complications of locally advanced oral cancer is bleeding which can be life threatening, if not properly controlled at the right time may lead to death. The causes of death being immediate airway compromise and haemorrhagic shock. Thus, it is of utmost importance to secure the airway and control bleeding. Hence in the present study, we performed emergency tracheostomy for securing airway and ECA ligation for control of bleeding for bleeding locally advanced oral carcinomas. The rationale for ECA ligation is based on the fact that the internal carotid artery does not have any branch in the neck and complete blood supply is from the external carotid artery.

There are few case reports for ECA Ligation in extensive haemangioma of the tongue and lip<sup>6</sup> leading to decrease of swelling. However, in the English Literature, there is very limited data regarding ECA ligation for locally advanced oral malignancies. Kumar et al.<sup>7</sup> in their study of 11 patients with ECA ligation had also performed emergency tracheostomy in all their patients like in the present study. However, ECA was ligated flush to the common carotid artery whereas in our study we had ligated ECA after the take-off of superior thyroid artery.

Also, in our study it was observed that in patients who were previously irradiated, meticulous and careful dissection of external and internal carotid artery at the bifurcation had to be done as there were extensive fibrosis of neck structures and distorted anatomy thereby leading to increased operating time as compared to non-irradiated patients. Hence extreme caution should be exercised in post-radiation patients

with bleeding oral cancer so as to delineate external carotid artery from internal carotid artery in order to avoid unnecessary ligation of internal carotid artery leading to complications.

## CONCLUSION

Thus, we conclude that ECA ligation in conjugation with tracheostomy is a very simple and life-saving procedure for locally advanced oral cancer patients presenting in the emergency department with severe life-threatening bleeding.

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