

ROLE OF EXTERNAL CAROTID ARTERY LIGATION IN ERA OF SELECTIVE ARTERIAL EMBOLIZATION AMONG HEAD AND NECK PATIENTS- A CASE SERIES

Dr. Synan Abdullah. K. A¹, Dr. S.M. Azeem Mohiyuddin^{2*}, Dr. Usha. G³

¹MBBS MS ENT(postgraduate final year), ²*MS Ent, SEKHSARIA FELLOWSHIP IN HEAD AND NECK SURGERY
FICS, FACS, MNAMS, Professor and HOD, ³Associate Professor

^{1,2,3}Department of ENT & Head & Neck Surgery Sri Devaraj Urs Medical College, Tamaka, Kolar - 563103, Karnataka, India

ABSTRACT

Introduction: Severe hemorrhage in the head and neck region remains a life-threatening emergency, particularly in advanced malignancies, trauma, and postoperative complications. While selective arterial embolization is the modern standard of care, its availability is limited in resource-constrained settings. External carotid artery (ECA) ligation continues to serve as a rapid, effective, and accessible surgical option in such scenarios.

Objective: To evaluate the role, indications, and clinical outcomes of ECA ligation in controlling severe hemorrhage among head and neck patients in the era of selective arterial embolization.

Methods: A retrospective case series was conducted at a tertiary rural hospital from January 2021 to August 2025. Medical records of 14 patients who underwent ECA ligation for uncontrolled hemorrhage due to malignancy, postoperative bleeding, trauma, or vascular emergencies were reviewed. Patient demographics, etiology of bleeding, intraoperative findings, and postoperative outcomes were analyzed descriptively.

Results: Of the 14 patients (mean age 52.7 years; 57.1% male), the majority (57.1%) presented with postoperative hemorrhage following oral cancer surgery. Other indications included post-radiotherapy bleeding (14.3%), post-tonsillectomy hemorrhage (14.3%), trauma (7.1%), and prophylactic ligation in a carotid body tumor (7.1%). Hemostasis was achieved in all cases, enabling continuation of planned oncologic treatment in postoperative cancer patients. No major neurological complications were observed.

Conclusion: External carotid artery ligation remains a safe, effective, and life-saving procedure for uncontrolled head and neck hemorrhage, particularly in resource-limited settings where selective arterial embolization is unavailable. Beyond immediate hemorrhage control, ECA ligation facilitates stabilization and continuation of definitive oncologic therapy, underscoring its continued relevance in modern surgical practice.

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INTRODUCTION

Most of the blood supply of head and neck except for cranial cavity comes through the external carotid artery and its branches. In the present era a severe haemorrhage can be stopped by selective embolization of that vessel. However, even today unexpected vessel blowout or severe tumour bleed may require external carotid artery ligation. We are presenting a series of external carotid artery ligations for similar emergency cases in a tertiary rural hospital.¹

Selective artery embolization is a modern, minimally invasive alternative that targets specific bleeding vessels. However, it carries risks of re-bleeding and complications related to embolization agents, and repeated interventions may be required. Despite advances in selective artery embolization, external carotid artery (ECA) ligation remains widely practiced, particularly in hospitals with limited access to advanced interventional radiology. This study aims to provide evidence from a case series that evaluates the continued relevance and role of ECA ligation in the modern era, helping to guide clinical decisions, improve patient safety, and optimize surgical management in tertiary rural hospital.^{1,2}

Severe hemorrhage in the head and neck region can occur not only in advanced malignancies but also following trauma, maxillofacial injuries, and surgical complications. Rapid control of bleeding in such situations is critical to prevent airway compromise, hemodynamic instability, and mortality. External carotid artery (ECA) ligation has been described as an effective surgical method

for controlling intractable hemorrhage arising from branches of the ECA when conservative measures and local hemostatic techniques fail. However, there is limited literature evaluating its overall indications, safety, and outcomes across both oncological and traumatic conditions. This is a retrospective study of external carotid artery ligation in cases of arterial blowouts, severe tumour bleeds particularly in off duty hours. This study highlights relevance, feasibility, ease and safety in such emergency situations. Therefore, the present study was undertaken to assess the role, indications, and clinical outcomes of external carotid artery ligation in the management of uncontrolled hemorrhage in various head and neck conditions, including malignancy and trauma.^{3,4,5}

Surgical Anatomy¹¹

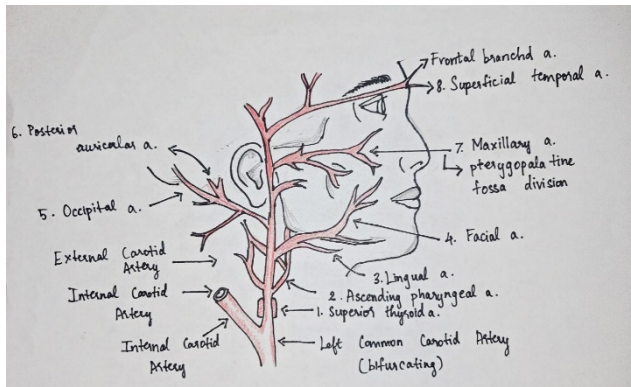
The external carotid artery arises from the bifurcation of the common carotid artery at the level of the third cervical vertebra (C3). It courses superiorly and slightly anteriorly to reach a point posterior to the neck of the mandible, approximately 1.5 cm below the zygomatic arch, where it terminates by dividing into the maxillary and superficial temporal arteries. The artery gives off several branches in the neck, with the superior thyroid, lingual, and facial arteries arising from its anterior aspect, and the ascending pharyngeal, occipital, and posterior auricular arteries arising posteriorly. Owing to its superficial course and multiple branches supplying the head and neck region, the external carotid

*Author for Correspondence: Dr. S.M. Azeem Mohiyuddin

artery is readily accessible and serves as an important target for surgical ligation in the control of severe hemorrhage.

Figure 1 shows the course and branches of external carotid artery

Figure.1 EXTERNAL CAROTID ARTERIES WITH ITS BRANCHES



Aim of the Study

To evaluate the role and clinical effectiveness of external carotid artery ligation in controlling severe hemorrhage in head and neck patients in the era of selective arterial embolization.

Objectives

To document the variety of clinical scenarios where ECA ligation is performed.

To highlight the indications and outcome of external carotid artery ligation in selective embolization era

Methodology

This study was approved by central ethics committee number

Ref: SDUAHER/R&D/CEC/SDUMC-PG/248/NF/-2025-26

This case series was conducted by obtaining medical records of patients treated for severe hemorrhage due to arterial blowout / severe tumor bleed / uncontrollable bleed from operated site in Department of Otorhinolaryngology & Head and Neck Surgery at a tertiary care rural hospital.

Inclusion Criteria:

All the patients with severe hemorrhage due to arterial blowout / severe tumour bleed / uncontrollable bleed in our tertiary care rural hospital from January 2021 to August 2025 was be documented.

Exclusion Criteria:

Patients who are fit for selective embolization of external carotid artery.

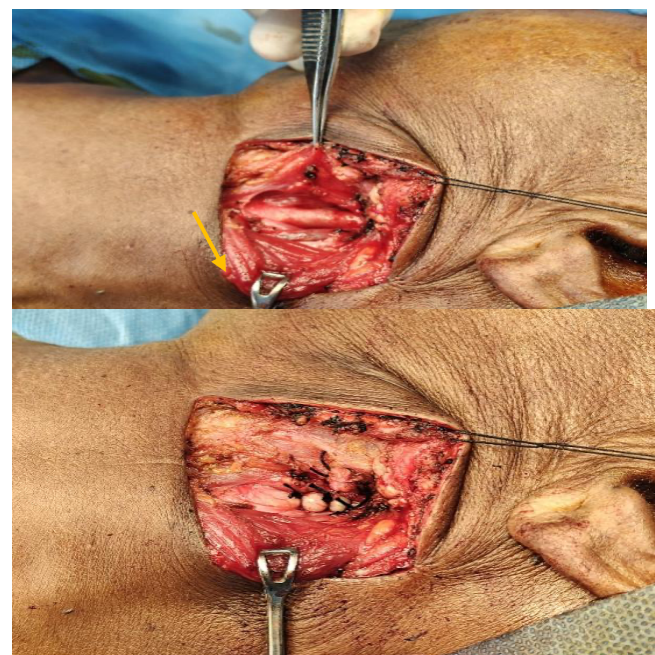
Patients with uncorrected coagulopathies or bleeding disorders that may confound outcomes.

The medical case records of 14 adults external carotid artery ligation was done in our hospital were obtained. Medical records of patients who underwent external carotid artery ligation for the management of uncontrolled head and neck hemorrhage were reviewed. Patients who required external carotid artery ligation due to various causes such as head and neck malignancies, postoperative bleeding, trauma, or other vascular emergencies were included in the study. Relevant clinical data including patient demographics, underlying etiology of bleeding, intraoperative

findings, and postoperative outcomes were collected from hospital records. The effectiveness of the procedure in achieving hemorrhage control, as well as any associated complications, were analyzed. Re-bleeding and complications if any were documented. The images were revisited and documented according to medical case records to document the source of bleeding

Statistical analyses included descriptive summaries for baseline characteristics. All data were collected and analyzed using SPSS statistical software. Descriptive statistics were used to summarize the data. Continuous variables such as age were expressed as mean $\pm$ standard deviation (SD) or median with range, while categorical variables such as gender, indication for external carotid artery ligation, and etiology of bleeding were presented as frequencies and percentages. The outcomes of the procedure, including successful control of hemorrhage and occurrence of complications, were also analyzed descriptively. The results were presented in the form of tables and charts where appropriate to facilitate interpretation. All 14 patients presented with uncontrolled head and neck hemorrhage were taken up for emergency surgical intervention. Under general anesthesia, the patient was placed in a supine position with the neck extended and turned to the contralateral side. A transverse cervical incision was made on the neck crease extending from mastoid tip to upper border of thyroid cartilage ; in postoperative cases, the previous neck dissection incision was reopened. Subplatysmal flaps were elevated, and the sternocleidomastoid muscle was identified and retracted laterally to expose the carotid sheath. The sheath was carefully opened, and the internal jugular vein was retracted laterally. The common carotid artery bifurcation was identified at the level of the upper border of the thyroid cartilage. The external carotid artery, typically located medial to the internal carotid artery, was isolated and ligated distal to the origin of its first branch, the superior thyroid artery, using 2-0 silk sutures. Hemostasis was secured, and the wound was closed in layers. Figure:2 shows the intraoperative pictures of external carotid artery ligation.

FIGURE 2: INTRAOPERATIVE PICTURE OF ECA LIGATION (arrow indicating the external carotid artery).



Results

A total of **14 patients** who underwent external carotid artery ligation for control of severe head and neck hemorrhage were included in the study. Among them, **8 (57.1%) were males and 6 (42.9%) were females**. The **age of the patients ranged from 15 to 73 years**, with a **mean age of 52.7 ± 18.3 years**. Table 1 shows the demographic characteristics of patients.

Table 1: Demographic Characteristics of Patients (n = 14)

Variable	Value
Total patients	14
Gender	
Male	8 (57.1%)
Female	6 (42.9%)
Age (years)	
Mean $\pm$ SD	52.7 ± 18.3
Range	15–73

Out of the 14 patients included in the study, the majority of hemorrhagic events were observed in the postoperative period of head and neck malignancies. **Eight patients (57.1%)** developed bleeding following surgery for oral cavity cancers. **Two patients (14.3%)** presented with hemorrhage in the post-radiotherapy period, likely related to tissue necrosis and vascular fragility. **Two patients (14.3%)** developed secondary hemorrhage post-tonsillectomy, while **one patient (7.1%)** had trauma to face following a road traffic accident and one patient had Shamblin type II carotid body tumor, prophylactic right side ECA ligation was done followed by excision of the tumour. These findings indicate that postoperative oncologic cases constitute the most common risk group for severe hemorrhage requiring external carotid artery ligation, followed by radiation-induced and post-tonsillectomy bleeding. Table 2 shows the indication for external carotid artery ligation

Table 2: Etiology/Indication for External Carotid Artery Ligation (n = 14)

Indication	Number of Patients (n)	Percentage (%)	Side of ECA ligated
Postoperative oral cancer secondary hemorrhage following orocutaneous fistula	8	57.1	Left-5 Right-3
Post-radiotherapy hemorrhage	2	14.3	Left-1 Right-1
Post-tonsillectomy secondary hemorrhage	2	14.3	Left-2
Trauma (RTA)	1	7.1	Right-1
Right Carotid body tumor – Shamblin type II (prophylactic)	1	7.1	Right-1

Total	14	100	14
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Among the 8 patients who developed postoperative hemorrhage following oral cancer surgery, bleeding occurred **prior to the initiation of adjuvant therapy**. Following successful control of hemorrhage with external carotid artery ligation, all patients were subsequently able to complete their planned adjuvant treatment. Of these, **two patients (25%)**—one post-op carcinoma left lateral border of tongue and one post-op carcinoma buccal mucosa—received concurrent chemotherapy and radiotherapy, while the remaining **six patients (75%)** underwent adjuvant radiotherapy alone. This highlights the role of external carotid artery ligation not only as a life-saving procedure but also as a means to stabilize patients and enable continuation of definitive oncologic management. Table 3 shows the adjuvant therapy in postoperative oral cancer patients following eca ligation.

Table:3 Adjuvant Therapy in Postoperative Oral Cancer Patients Following ECA Ligation (n = 8)

Variable	Number of Patients (n)	Percentage (%)
Bleeding before adjuvant therapy	8	100
Completed planned treatment	8	100
Type of adjuvant therapy		
Radiotherapy alone (post-op buccal mucosa carcinomas)	6	75
Concurrent chemoradiotherapy (1 post-op buccal mucosa carcinoma and 1 postop tongue carcinoma)	2	25
Total	8	100

Both patients with post-tonsillectomy hemorrhage initially presented with active bleeding from the right tonsillar fossae. Primary control measures, including cauterization, were attempted but failed to achieve hemostasis. Subsequently, right-sided external carotid artery ligation was performed and hemostasis was achieved.

These patients developed hemorrhage after working hours when an interventional radiologist or cardiac catheterization lab was not available hence ECA ligation was done.

Discussion

In the Indian setting, a substantial proportion of patients with oral cavity malignancies present at an advanced stage, with nearly two-thirds exhibiting locally advanced (T4) disease. This delayed presentation is often attributed to self-neglect and low socioeconomic status. Hemorrhage is a serious and potentially life-threatening complication in such cases, which, if not promptly managed, may result in mortality due to airway compromise or hemorrhagic shock. Therefore, timely airway protection and effective control of bleeding are critical. In the present study, emergency tracheostomy was performed to secure the airway, followed by external carotid artery ligation to control active bleeding in patients with locally advanced oral cancers. The rationale for ECA ligation lies in the fact that the internal carotid artery does not give off branches in the neck, and the majority of the blood supply to the head and neck region is derived from

branches of the external carotid artery.¹

Gosh et al also concluded that emergency external carotid artery (ECA) ligation combined with tracheostomy proved to be a safe and effective intervention for controlling life-threatening hemorrhage in patients with advanced oral cancer. In their series, this approach provided immediate stabilization without postoperative neurological complications, highlighting its value in resource-limited settings where patients often present late with advanced disease. Prior radiation therapy was associated with increased operative difficulty due to fibrosis and altered anatomy, emphasizing the importance of careful dissection in such cases. Compared to ligation of the common or internal carotid arteries, which carries a higher risk of stroke and morbidity, selective ECA ligation after the superior thyroid artery offered a practical balance between efficacy and safety. These findings support the role of ECA ligation as a life-saving measure that enables patients to proceed to definitive or palliative oncological care they concluded.⁶

Gary et al attributed that major hemorrhage during maxillofacial surgery is an uncommon but potentially life-threatening problem. The surgical procedures most readily associated with acute hemorrhage typically involve orthognathic surgery oncology, pathology, and the temporomandibular joint. Although ligation of the offending artery, vein, or vascular malformation is clearly the treatment of choice, identifying the offending vessel and gaining adequate access to it are often difficult or impossible to perform. In these situations, although temporary arrest of the bleeding is usually possible with packing and pressure, definitive control of the bleeding has historically been achieved with either ligation of the external carotid artery (ECA) or selective embolization. The choice is often determined more by the availability of a skilled interventional radiologist proficient in angiography and embolization and the ability of the surgeon to perform ligation of the ECA. Considerable controversy still exists as to which modality is the most efficacious and least morbid.¹²

Study Strengths and Limitations

Strengths of the Study:

Inclusion of a **heterogeneous group of patients** (malignancy, postoperative bleeding, trauma), reflecting real-world clinical scenarios.

Demonstrates the role of **external carotid artery ligation as a life-saving emergency procedure** in uncontrolled head and neck hemorrhage.

Highlights its **utility in resource-limited settings** where selective arterial embolization may not be readily available.

Shows that ECA ligation can act as a **bridge to definitive treatment**, enabling completion of adjuvant therapy in postoperative oncologic patients.

Provides **practical surgical insights**, including challenges in previously irradiated patients and need for bilateral ligation in select cases.

Limitations of the Study:

Small sample size (n = 14), limiting generalizability of results.

Retrospective study design, with potential for selection and information bias.

Lack of a control or comparison group (e.g., embolization), preventing direct outcome comparison.

Limited statistical analysis due to small sample size.

Short-term outcome assessment, with limited data on long-term complications and survival.

Conclusion

External carotid artery ligation remains a safe, effective, and life-saving procedure in the management of severe head and neck hemorrhage, particularly in patients with advanced malignancies, postoperative bleeding, and trauma. Despite the increasing use of selective arterial embolization, ECA ligation continues to hold significant value in emergency settings due to its rapid execution, wide availability, and cost-effectiveness. In addition to achieving prompt hemostasis, it facilitates stabilization of patients and enables continuation of definitive oncologic treatment. Therefore, ECA ligation should be considered an important surgical option in the management of life-threatening hemorrhage in head and neck patients, especially in resource-limited settings.

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