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# Bilateral external carotid artery ligation: A life saving procedure in severe maxillofacial trauma



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## ABSTRACT

**INTRODUCTION:** Bilateral external carotid arteries ligation is a rare practice in cases of extensive maxillofacial injuries. Defining indication criteria in the management of such cases is highly demanded in emergency surgery.

**CASE PRESENTATION:** Reported case presents a male patient 67 years old man with a gunshot to the face. The whole face was macerated. Patient was operated surgically performing bilateral external carotid artery ligation, tracheostomy, pharyngostomy, gastrostomy and pressure dressing to face and head.

**CONCLUSION:** The procedure of bilateral external carotid artery ligation has no defined role in the management of maxillofacial trauma. The current status of such procedure in maxillofacial trauma needs revision.

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## 1. Introduction

Life threatening hemorrhage due to maxillofacial trauma is extremely uncommon. This type of trauma is rarely seen out of war injuries. Unavailability of specialized maxillofacial surgeons mandates an immediate life-saving procedure by the general surgeon. External carotid artery ligation (BECAL) is usually practiced in neck zone III or maxillofacial trauma cases. Interventional radiology has reduced the number of open procedures. BECAL is reported in post-operative bleeding control and onco-surgery, but not in maxillofacial trauma. Publication of such case aims at opening the field to highlight the current clinical situation.

## 2. Case presentation

67 years old man with history of depressive maniac disease presented to emergency room with suicidal gunshot to the face. Shortly after patient's arrival, he suffered cardiac arrest. Cardiopulmonary resuscitation was successful, including endotracheal intubation, bilateral central venous catheters were inserted into the subclavian veins, and urinary catheter was kept in place. His Glasgow coma scale scored 3. Vital signs showed systolic blood pressure 40–60 mm Hg and his pulse rate was 145/min. His oxygen saturation (PO<sub>2</sub>) was 87–82% on full drive ventilation. He was bleeding profusely from the macerated face tissues in spite of tight

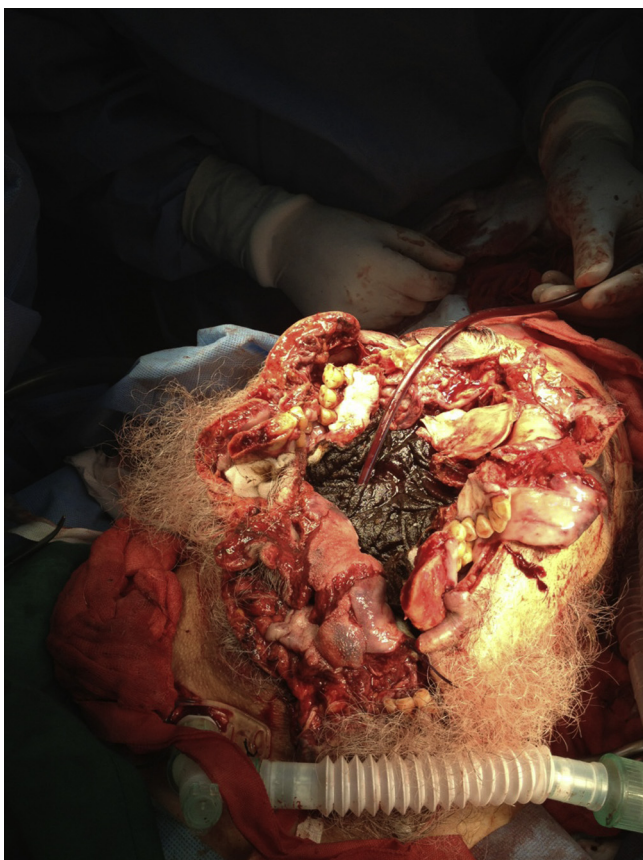
packing. Initial blood investigations revealed hemoglobin level 3.9 g/dl, platelet count  $28 \times 10^3$  cells/ $\mu$ l and clotting profile (prothrombin time 25 s, activated partial thromboplastin time 47 s, international normalized ratio 2.1 (with transfusion of 4 units whole blood, 11 units fresh frozen plasma and 9 units platelet concentrates within the initial 40 min). Blood serum electrolytes and hepato-renal functions tests were extremely deranged.

Synchronous neurogenic and hemorrhagic shocks were the most prominent danger to patient's life. The critical question was how to control such a morbid case?

Patient was shifted to operative theater and X-ray shots were taken while preparing for the procedure. X-ray views showed bilateral tempro-mandibular, maxillo-facial and orbital comminuted fractures. There was neither skull base fracture nor a trace of the bullet itself. Other X-ray views taken on the body skeleton showed intact neck, chest, abdomen and extremities. Soft tissue exploration showed bilateral ruptured eye globes, macerated facial muscles, soft palate, floor of mouth and tongue with laryngeal edema. The situation was critical and prognosis was guarded.

Due to the multiple source bleeding and the critical general condition of the patient the decision was made to go for BECAL. Anterior approach for BECAL is the technical approach of choice being easier, faster and suitable for ligation bilaterally. Once vascular ligation was achieved; remarkable control of bleeding was confirmed by gradual slow rise in blood pressure and reduction of tachycardia. Thorough wound wash with antiseptic and removal of bone fragments and dead tissues were carried out. Pharyngostomy tube was placed and connected to low suction pressure container. The trans-oral endotracheal tube was substituted by a cuffed tube

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**Fig. 1.** Documents the extensive maxillo facial injury.



**Fig. 2.** External carotid artery taped before ligation on the left side.

tracheostomy. Packing of the whole maxillofacial row surfaces with surgical, gauze and orthoband pressure dressing was completed. No drain was inserted, to maintain tamponade effect of the pressure dressing. Finally, abdominal tube gastrostomy was inserted for feeding [Figs. 1 and 2](#).

Following the end of surgery patient's vital signs were steadily improving over 50 min. The patient was shifted to the intensive care unit. Patient's data showed improvement of the biochemical parameters. In the following 24 h, the patient showed blood pressure ranging between 68–83/41–56 mm Hg, pulse rate of 79–103, pulse oximetry of 91–95% and urine output of 0.8–1.1 ml/kg/Hr on dopamine venous infusion 5–10 µg/kg/min.

Serial biochemical data showed near normal values with Hb 10–11 and INR values of 1.2–1.1 without blood transfusion. Recurrent attacks of bradycardia counted 5 times with a pulse rate of 37–45 every 3–4 h and patient finally had asystole from which he could not be resuscitated. Patient declared dead after 27 h from time of admission.

### 3. Discussion

In this case the mechanism of injury might be that patient was sitting leaning with upper half trunk to the front, the rifle base on the ground and the shaft is against the floor of mouth, the shot passed in tangential pathway from below upwards and from posterior to anterior: passing through the floor of mouth, palate, maxilla and then emerged out. The near distance of shooting made the explosive effect of the shot extensive and devastating to tissues. Death in bradycardia could be due to hidden brain stem tissue injury that has no clinical proof.

Uncontrollable maxillofacial bleeding is a major problem that might be fatal in some occasions. The procedure of BECAL is physi-

ologically tolerable by patient as proved experimentally. In clinical medicine BECAL has been tried unilaterally or bilaterally on two sessions to avoid cerebral edema but never reported bilaterally on the same session. Some of the complications after the BECAL are: lingual atrophy, masseter muscle claudication with mastication, maxillofacial or pre-tracheal hematoma. After BECAL, blood flow into ischemic and non-ischemic areas is greatly enhanced. In addition, the flow in the hyperemic areas is reduced significantly, presumably since collateral circulation functions with a favorable redistribution to the ischemic zone. Reconstruction of the ligated BECAL is possible and technically easy [\[1–5\]](#).

Some reports on experimental BECAL mentioned that cerebral circulation is temporarily reduced and the return to normal levels depends on the hemodynamic situation and the efficiency of the cerebral circulatory anastomosis. The uncorrected brain stem hypoxia could be a cause to bradycardia. Others reported that no effect on maxillofacial circulation up to documenting new bone formation in later stages [\[6–8\]](#).

In case of trauma to the neck or maxillofacial areas, interventional radiology control needs clinically stable patient and the existence of a senior surgeon beside the radiologist and could be impossible from the beginning. The option of the procedure of BECAL remains remote and very uncommon choice to the surgeon [\[9\]](#).

Decision of surgical intervention in such a case could be described as heroic but optimized according to the concept of maximal surgical effort in cases of extensive lethal trauma regardless case prognosis. Choosing the surgical anterior approach implied by the need to ligate the artery on both side and tracheostomy as well.

The general surgeon has to be trained on various techniques and more over on immediate decision making with no hesitation. The global training in the field of emergency medicine has to exceed

the alphabetical training given in trauma management courses to the extreme surgical practice.

Review of literature for similar cases describing BECAL in maxillofacial trauma as a life-saving procedure did not reveal any report up to author best knowledge. This negative literature record has encouraged to present the current case report.

#### 4. Conclusion

Bilateral external carotid artery ligation BECAL is an extremely rare procedure in the field of trauma. Usually BECAL is described in maxillofacial surgery and onco-surgery. The current status of such procedure in maxillofacial trauma needs to be reviewed.

#### Conflicts of interest

There is no conflicts of interests.

#### Sources of funding

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#### Ethical approval

Case publication approved from the Central Office For Research Ethics Committees, Ministry of Health.

#### Consent

Written informed consent was obtained from the patient's next kin for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal. In addition case publication is approved

from the Central Office For Research Ethics Committees, Ministry Of Health.

#### Author contribution

Single author publication.

#### Guarantor

The author.

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