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**Case Report** 

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# **Penetrating Carotid Artery Injuries: When is the Suitable Time to Repair? : A Case Report and Review of the Literature**

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#### ABSTRACT

Carotid artery injury (CAI) following head and neck trauma is rare but is associated with devastating complications. Decisions on carotid arterial repair are difficult especially when there is a neurological deficit. This case report is about a 38-year-old male who presented after penetrating common carotid artery injury. He was intubated; therefore, his neurological status could not be assessed. He was haemodynamically unstable. Therefore, a decision was taken to explore the neck immediately. On exploration, the common carotid artery was found to be contused. The contused segment was excised and repaired with a Polyester interposition graft. The patient had an uneventful recovery with no neurological deficits.

Keywords: Penetrating Carotid artery injuries, timing of repair, neurological deficits

# INTRODUCTION

Carotid artery injury (CAI) following head and neck trauma is rare. However, it is associated with devastating complications. Decision-making on carotid arterial repair following trauma may become difficult especially when there is a neurological deficit. This case report is about a patient who presented after penetrating neck trauma with a common carotid artery injury. He presented after 10 hours. He was intubated had continuous oozing from the wound and was haemodynamically unstable. Therefore, a decision was taken to explore the neck immediately. On exploration, the common carotid artery was found to be contused and thrombosed. The contused segment was excised and repaired with a Polyester interposition graft. The patient had an uneventful recovery with no neurological deficits.

#### **CASE REPORT**

A 38-year-old male was transferred from a peripheral hospital with a laceration to the left side of the neck following a road traffic accident (in zone 2) (Figure 1). There was a history of bleeding at the time of trauma. He had continuous bleeding from the neck wound despite attempts at haemostasis at the local hospital. Therefore, he was suspected to have a vascular injury. He was intubated and transferred to the National Hospital of Sri Lanka (NHSL) Colombo for further vascular surgical management.



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## Penetrating Carotid Artery Injuries



Figure 1: Image showing zone 2 neck injury

On arrival at the NHSL, the patient was haemodynamically unstable. He did not have clinical evidence of aero-digestive tract injuries in the neck. Pupils were reacting to the light. It was not possible to assess the rest of the neurological functions because he was paralyzed and ventilated.

Because of continuous bleeding from the neck wound and haemodynamic instability, he was immediately taken for neck exploration. On exploration, a contusion on the wall of the common carotid artery with thrombosis was noticed (Figure 2). The contused segment was excised and the artery was repaired with a Polyester interposition graft (Figure 3). The patient had an uneventful recovery. There were no neurological deficits noticed in the postoperative period.



Figure 2: Common carotid artery showing the contused area



Figure 3: Repair with Polyester interposition graft

# DISCUSSION

Carotid artery injury (CAI) occurs in 4.9% to 6% following penetrating neck injury and in 1% to 2.6% following blunt neck injury (1). Penetrating carotid injuries result in a mortality rate of 22% to 33% (2) (3). Penetrating CAI results in about 23% stroke rate (7). Neurological deficit due to cerebral ischemia or infarction is an important clinical feature following CAI.

In the neck, the common carotid artery (CCA) runs superiorly from the level of the sterno clavicular joint to its division into external and internal carotid arteries (ICA) at the level of the upper border of the thyroid cartilage. The ICA runs superiorly and ends by entering the carotid canal. The ICA is closely related to the last four cranial nerves.

For management purposes, the neck is divided into three zones. i.e. Zones 1, 2 and 3. Zone 1 extends from the suprasternal notch to the level of the cricoid cartilage. Zone 2 extends from the level of the cricoid cartilage to the angle of the mandible. Zone 3 is above the level of the angle of the mandible. The patient described above had a common carotid artery injury in zone 2 (Figure 1).

Opinion on preoperative imaging and angiography varies according to the zone of the injury and patient stability. Stable patients can undergo imaging whereas unstable patients should go to the operation theatre immediately (6).

The management following penetrating neck injury is still debated. During the early period, mandatory exploration was suggested in all patients in whom the platysma muscle was penetrated (8). Later the management was dependent on the haemodynamic stability and the neck zones injured (9).

At present the important considerations in penetrating neck injury are the haemodynamic stability and the presence of aero-digestive injuries. If the patients are haemodynamically unstable with evidence of major vascular injury, the surgical exploration is done immediately (10).

If there is no clinical evidence of aero-digestive tract injury or no hard signs of vascular injury, the patient can be managed conservatively (11).

Options for intervention include open and endovascular (12). The exploration of carotid vessels is done by an incision along the anterior border of the sternocleidomastoid muscle. If proximal carotid vessel control is needed (Zone 1), a sternotomy can be done. If distal control is needed (Zone 3), mandibulotomy can be done. The open surgical options include direct arterial repair (lateral arteriography), patch repair (venous and synthetic), end-to-end repair and interposition graft repair (venous graft or synthetic graft) (Figure 3).

Indications for ligation of an injured carotid artery include: persistent hypotension, severe soft tissue injury to the neck and signs of irreversible ischemic changes seen on the computed tomography of the brain (13) (14).

The ligation of the carotid artery is associated with a higher stroke rate (13). In addition, the ligation is associated with higher mortality (2). Therefore, repair should be done whenever possible.

Endovascular options can be offered for patients with false aneurysms, intimal flaps and luminal narrowing. These can be managed with stenting. Endovascular options can also be used to achieve proximal and distal control in case of zone 1 and zone 3 injuries.

Another concern regarding the repair of carotid injuries following trauma is the presence of neurological deficits. Previously it was believed that repairing carotid arteries in the presence of a neurological deficit will convert an ischaemic stroke into a haemorrhagic stroke and worsen the clinical situation. Therefore, in the presence of neurological deficits, ligation of the carotid artery was advised (15). But recent studies have found that the majority of the patients who died following carotid artery injury died due to cerebral edema rather than haemorrhagic transformation. And other studies have found that revascularization after prolonged neurological deficit and deficits due to established infarction improve after revascularization probably due to the resolution of cerebral oedema. Therefore, some authors have advised to revascularize even in the presence of established neurological deficits (14).

Opinion on intraoperative shunting also varies, it is recommended shunting in cases of prolonged repairs (e.g. interposition graft repair) and in hypotensive patients (16).

Therefore, in carotid artery injuries, resuscitation of the patient and repair as early as possible is advised if there is no evidence of massive infarction on imaging.

#### Author declaration

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#### Authors' contributions:

Conceptualization and Design: JMSK, JA; Literature Survey: JMSK, JA; Data Collection and Analysis: JMSK, JA; Manuscript Writing: JMSK, JA; Manuscript Review and Final Proofreading: JMSK, JA.

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The authors declare that there is no financial or non-financial conflict of interest.

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Written informed consent was obtained from the patient before they participated in the case, ensuring their understanding of the purpose, procedures, and potential implications involved.

#### Statement on data availability:

All data generated during this study are available upon request from the corresponding author.

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