# Successful Common Carotid Interposition Graft Using Proximal Saphenous Vein in a Patient with Cervical Gunshot Injuries: A Case Report

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#### Abstract

**Introduction:** Gunshot injuries to the head and neck usually result in severe trauma due to damage to major vessels and pose challenging surgical management. A penetrating neck injury places numerous organs at a significant risk.

**Presentation:** We present a 39-year-old female transferred to the level I trauma center due to multiple pellet injuries to the neck and jaw.

**Diagnosis:** Computed tomography (CT) angiography showed the presence of multiple metal densities, an intimal flap, and a local thrombus in the left common carotid artery.

Intervention: The patient underwent surgical exploration, which revealed neck hematoma and near-total transection of the left common carotid artery. She received a carotid interposition graft (CIP) using the greater saphenous vein to reconstruct the artery.

**Outcomes:** Following an uneventful recovery, the patient was discharged three days after the surgery without any neurological side effects or hematoma. A follow-up CT angiography six weeks after the discharge showed a successful graft.

**Conclusion:** This case presents a rare scenario of a penetrating neck injury with foreign objects in zone 2, necessitating a specialized surgical approach. Therefore, it contributes to the current literature and aids surgeons in managing similar patients.

Keywords: Carotid Artery Injury, Gunshot Wound, Saphenous Vein Graft, Vascular Reconstruction, Case Report.

## Introduction

Gunshot wounds to the head and neck often result in life-threatening and extensive damage to the soft tissue and are the second most prevalent cause of penetrating neck injuries after stab wounds. These types of injuries can result in severe conditions for the patient. The clinical course and the unpredictability of the wound track depend on the size of the foreign body and the severity of the injury. Additionally, gunshot wounds to the head and neck can cause damage to multiple organs, including the carotid artery  $^{1,2}$ .

Management of gunshot wounds to the head and neck has undergone significant evolution in recent years. Management should be individualized and multidisciplinary <sup>3</sup>.

This case study adheres to the SCARE 2020 criteria <sup>4</sup> and aims to illustrate a successful case of managing

penetrating injuries to the neck using a carotid interposition graft.

#### **Case presentation**

A 39-year-old female was admitted to the Emergency Department of a local hospital in Tehran with a penetrating injury to the neck due to a gunshot. At the same time, she was a pedestrian approximately two hours before admission. Upon entry to the hospital, the patient was conscious and presented with multiple minor wounds on the midline and left side of the neck and jaw. The patient complained of odynophagia, left upper limb pain, and slight numbness; however, the patient did not report dysphonia or dysphagia. Vital signs on admission were within normal, including blood pressure (BP) of 100/80, respiratory rate (RR) of 17, pulse rate (PR) of 83, and peripheral oxygen saturation (SPO2) of 98%. Her neck was edematous, and the active and passive movement of the neck was painful. The jugular vein was not elevated, and the trachea was in the midline. No carotid bruit was heard, and the heart, lungs, and abdomen were normal. All four limbs were warm to the distal, with symmetrical and strong pulses. Despite complaints of left upper limb pain and slight numbness, the patient's neurological exam was within normal limits. CT scan results showed multiple foreign bodies with metal density in the soft tissue of the neck, including medial to the left supraclavicular area, prevascular area of the thoracic inlet, left carotid sheath, right sternocleidomastoid, and cervical subcutaneous soft tissue of the anterior and lateral parts of the neck as shown in figure 1.



Figure 1: CT scan showing multiple foreign bodies in the neck and jaw

However, the report was suboptimal due to the severe streak artifact on the artery. A 25 mm  $\times$  35 mm hematoma was suggested by the heterodense areas peripheral to the middle part of the left CCA, with minor pressure to the adjacent trachea. The right CCA and internal carotid artery (ICA) were normal, as shown in Figure 2.



Figure 2: Carotid CT angiography.

The patient was referred to our hospital three days following the initial incident. At the admission, she was alert, awake, and able to answer the question, with BP: 130/80, PR:90, SPO2:98%, RR:18. A color Doppler sonography of carotid and vertebral arteries revealed a free-floating flap in the left common carotid artery (CCA) lumen, without extension to the carotid bifurcation.

Consequently, angiography was performed, which confirmed the presence of an intimal flap and a tubular intraluminal filling defect, suggesting a floating clot in CCA.

Following the angiography, the patient underwent a classic left-sided neck exploration with an anterior sternocleidomastoid muscle incision under general anesthesia, as shown in Figures 3 and 4. During the procedure, a weak pulse was observed in the CCA, and

severe inflammation, small foreign bodies, and hematoma were found. Further examination revealed the presence of a through-and-through CCA injury with a relatively small hematoma. The insertion of a small metal adjacent to the artery lumen resulted in local hemostasis. After the CCA was debrided, a 2 cm defect was observed, and a decision was made to perform saphenous vein interposition for carotid reconstruction, using the proximal left saphenous vein graft for an endto-end anastomosis with 6-0 polypropylene suture as shown in Figure 5.



Figure 3: DSA angiography of carotid artery.

A proper pulse distal anastomosis was established. The platysma and skin were then approximated.

The recovery of the patient was uneventful. Postoperatively, the patient did not experience any neurological deficit, radiating pain to the distal of the left upper limb, which she had complained about since the admission was resolved.

On the third day after the surgery, the patient was discharged

The patient was followed for six weeks after discharge, and the follow-up CT angiography of the patient six weeks after discharge showed successful reconstruction and graft, as shown in Figure 6.



Figure 4: Site of the injury in the left side of the neck and left common carotid artery interposition graft.



Figure 5: Interposed saphenous vein graft.



Figure 6: CT angiography of the cervical vessels six weeks after the surgery.

#### Discussion

Penetrating neck injuries are potentially dangerous and require emergent treatment due to the presence of important structures in this area, such as nerves and vessels. Comprehensive knowledge of the anatomy of the neck, clinical assessment, proper diagnostic techniques, and therapeutic interventions are crucial for appropriate management <sup>5</sup>.

Approximately 25% of penetrating neck injuries cause arterial injury; of these patients, the carotid artery is involved in 80%  $^{6}$ .

Patients with cervical blood vessels injury can present with active bleeding, expanding hematomas, and deranged vital signs, which are nonresponsive to resuscitation <sup>7</sup>. Even though our patient had such an injury in zone 2 of the neck, surprisingly, she did not suffer any of the mentioned consequences. Her vital

signs were all within normal range and remained stable during her stay in the hospital. She was alert and awake. In the neck exploration in the operation room, hematomas, but not expanding, were identified in our patient.

Although a study concluded that physical examination alone could safely and accurately evaluate patients with zone 2 wounds to the penetrating neck to confirm or exclude vascular injury, the limited population and type of wounds of such a study make the conclusion unreliable <sup>8</sup>. Established evidence showed that Patients with hard signs or hemodynamics must be immediately taken to the operating room <sup>9</sup>. In patients with hemodynamic stability and no obvious signs of arterial or venous injury, similar to our patient, CT angiography and duplex ultrasonography are needed <sup>9</sup>.

There are no international guidelines, and the optimum

assessment and treatment of penetrating neck injuries are debated <sup>2</sup>. However, when an injury to a common or internal carotid artery is identified during a neck exploration, it is suggested that repairing the artery provides better outcomes than ligation. There are different carotid repair methods, and choosing the most suitable one often depends on the size and location of the injury. The two most common techniques are transverse arteriography vein and or polytetrafluoroethylene (PTFE) patch angioplasty with interrupted and continuous 6-0 polypropylene sutures, respectively <sup>10</sup>. Also, resection of the damaged site and a primary end-to-end anastomosis are reported <sup>11</sup>. Carotid artery interposition graft using either vein or PFTE is a safe and effective way with excellent longterm outcomes for carotid reconstruction. Still, the risk of dangerous blood loss should be noted <sup>12</sup>.

#### Conclusion

We present a challenging but successful surgical strategy for a patient with a penetrating neck injury by carotid reconstruction using a carotid artery interposition graft with the saphenous vein.

### Abbreviations

advanced trauma life support (ATLS), common carotid artery (CCA), carotid interposition graft (CIP), blood pressure (BP), respiratory rate (RR), pulse rate (PR), Saturation of Peripheral Oxygen (SPO2), Computed tomography (CT), internal carotid artery (ICA), polytetrafluoroethylene (PTFE).

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## **Conflict of Interest Disclosures**

The authors declare no conflict of interest.

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None.

## **Authors' Contributions**

NT: Main idea, supervision, final correction, and approval; FJ: data collection, gathering of radiological images; SSh; HKh and MB: revising the manuscript, data collection.

#### **Ethical Statement**

The Consent form was taken from the patient.

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