

## MULTIDISCIPLINARY APPROACH IN A SURGICAL PRECISION NECK STABBING

Francesco La Corte <sup>1</sup>, Gennaro Baldino <sup>2</sup>, Filippo Bendetto <sup>1</sup>

1. Unit of Vascular Surgery, Department of Biomedical and Dental Sciences and Morphofunctional Imaging, Policlinico G. Martino, University of Messina

2. Section of Legal Medicine, Department of Health Promotion Sciences, Maternal and Infant Care, Internal Medicine and Medical Specialties (PROMISE), University of Palermo

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### ABSTRACT

Trauma involving the neck region are to always be considered as clinical/surgical emergencies because of the presence of vascular, nervous and lymphatic vessels, along with the pharyngo-esophageal and laryngo-tracheal structures. For this reason, therapeutic and diagnostic timing arouses great interest. The authors report the case of a conscious and hemodynamically stable man, presented to the emergency room for a neck penetrating trauma, caused by a knife passing through his neck (zone II) from right to left. A correct instrumental examination (CT angiography and selective right carotid axis angiography) and the multidisciplinary surgical approach proved to be fundamental for the safe extraction of the knife.

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### 1. Introduction

Traumas involving the neck region represent a clinical-surgical emergency due to the presence of vascular, nervous, lymphatic and aerodigestive structures. The neck region is anatomically divided in three zones: zone I, from the clavicle/sternum to the cricoid cartilage; zone II, from the cricoid cartilage to the mandible; zone III, corresponding to the superior angle of the mandible (Figure 1) [1]. Traumas more frequently involve zone II and almost always determine an emergency setting because of its anatomy. The diagnostic and therapeutic timing of neck penetrating trauma is still subject to differing opinions. In those cases of patients who are hemodynamically stable, it is mandatory to integrate both the imaging and the clinical signs. In non-stable patients, the first thing to do is to ensure the airway patency and to stabilize the clinical conditions so that imaging could be performed after. CT angiography is the gold standard for these pathologies, as its three-dimensional reconstructions allow a complete study of the vascular, nervous and aerodigestive structures involved. A post-operative CT scan should be performed in all cases in order to ensure that there is no persistence of foreign bodies. Here we report the case of a patient affected by a neck penetrating trauma in zone II due to a reported self-inflicted stab.

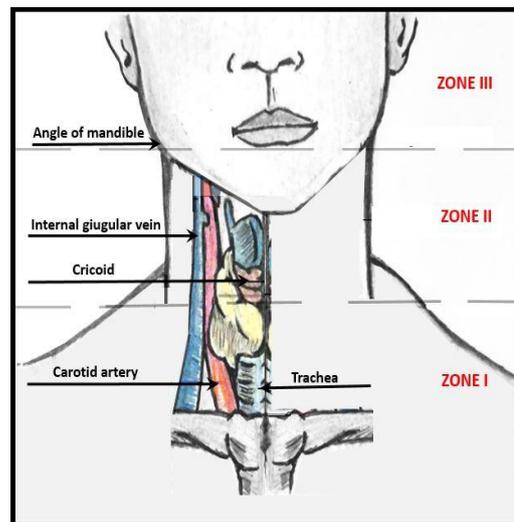


Figure 1. Anatomical representation of the neck zones (Inspired by a figure published by Julie Mayglothling on <https://aneskey.com/penetrating-neck-trauma-2/> in “Emergency Medicine”).

\* Corresponding author: Francesco La Corte, frlacorte@gmail.com

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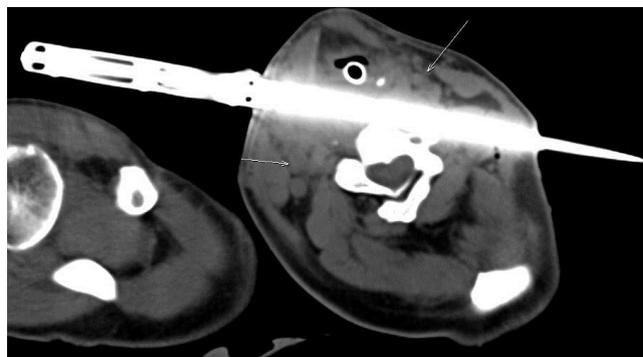
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## 2. Case report

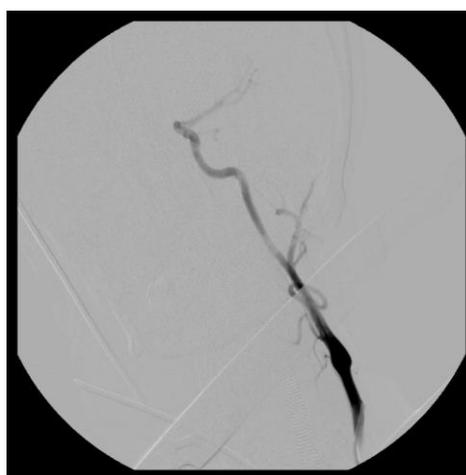
A 52-year-old man presented to the emergency room with a long-bladed knife passing through his neck (zone II) from right to left, (Figure 2) with cervical subcutaneous emphysema and in absence of external bleeding. The relatives reported that it was due to a self-stabbing in order to attempt suicide. The airways were studied via fibrobronchoscopy performed by the thoracic surgeon and the otorhinolaryngologist and rhino-tracheal intubation was performed. No macroscopic signs of lacerations of the airway walls were evident. As he was hemodynamically stable, a CT angiography was executed, showing a metal body passing on the plane of the anterior side of C3 soma and beyond the median structures by an entry from the right lateral side of the neck and an exit on its left side. Around it, in the right para-pharyngeal space, was a large swelling that could likely have originated from a lesion of the vascular-nervous structure (Figure 3). A selective right carotid axis angiography was necessary to exclude the latest, with particular attention on the lingual artery, and it was performed by a percutaneous left femoral access, showing absence of frank contrast medium leak, with normal presentation of the vascular structures (Figure 4). Actually, the knife was situated in a virtual space, passing between the right carotid artery and internal jugular vein, then between the C3 soma and the pharyngo-esophageal junction, then going posteriorly to the posterior border of the sternocleidomastoid, to exit from the left side of the neck. The patient was led to our operating room. After esophageal-gastric-duodenal endoscopic evaluation resulted negative for lesions, we proceeded with surgical preparation of jugular vein and carotid artery axis via a right pre-sternocleidomastoid surgical access. No evidence of active bleeding or injuries to lymphatic or nervous structures were found and the knife was removed. As the knife removal was completed, just a lesion in the medial side of the jugular vein was carried out, and it was immediately repaired by direct suture. We then positioned a drainage in aspiration before closing the surgical wound. An intra-operative doppler ultrasound check was performed, showing regular flow within the vascular structures. At the end, the patient was transferred to the intensive care unit, discharged after three days and, finally, entrusted to the care of the family doctor.



**Figure 2. Presentation at the observation in the emergency room: a long-bladed knife passes through the neck (zone II), from the right to the left.**



**Figure 3. CT angiography showing the passage of the knife through the anatomical planes, through the plane of the right vascular-nervous structures and beyond the median structures.**



**Figure 4. Selective right carotid axis arteriography showing absence of contrast medium leak from the studied vascular structures.**

## 3. Discussion

Self-inflicted stabs are not a common method of suicide [2-4] and the neck represents the region mainly involved together with the thorax and abdomen [5-6]. Generally, these stab wounds lead to death due to upper airway and/or vessel injuries [7-8], whilst when the subjects do survive, they should be considered as clinical-surgical emergencies. Neck penetrating traumas still cause debates about their diagnostic-therapeutic timing, among immediate surgical exploration and conservative management using auxiliary diagnostic tests to detect internal neck damage. In hemodynamically stable patients, surgical timing is generally determined by integrating both clinical signs and radiological findings [9-11]. If radiological imaging is not available, it is recommended to proceed with close and sequential physical examinations and continuous observation.

The first priority is to ensure airway stability and maintain circulation. If the airways are unstable, oral endotracheal intubation or a tracheostomy should be performed immediately. Once the clinical conditions are stable, diagnostic tests could be executed to assess the extent of the injury.

CTA is the recommended diagnostic test for these patients so as to make a precise evaluation of aerodigestive, skeletal and vascular injuries. CT and three-dimensional reconstructions are useful for this last aspect. Moreover, a postoperative CT should be performed to exclude persistent foreign bodies [12-13].

Among neck penetrating traumas, those involving zone I have the highest mortality rates and are difficult to treat because of both the surgical access, which is made hostile by the anatomy of the skeletal structures, and the possible involvement of the large supra-aortic vessels, central veins, phrenic nerve, trachea and esophagus. Also, surgery in zone III is difficult because of the skeletal structures and it can involve cranial nerves, internal carotid artery and vertebral artery in their distal segments. Trauma in zone II are more frequent but more anatomically and surgically approachable.

Penetrating injuries that breach the deep cervical fascia can lead to hard signs, with indication for an immediate surgical management, such as the presence of a pulsatile bleeding, an expanding hematoma, massive hemorrhage and refractory shock, airway compromise, significant air escape, subcutaneous emphysema, stridor or hoarseness. Symptoms concerning an involvement of the cervical spine are more frequent in gunshot wounds. The use of hard collars could cause a misdiagnosis and, therefore, it is usually not indicated.

Presence of the abovementioned respiratory symptoms and signs suggest a laryngo-tracheal compromise, while esophageal lesions are not common but, when present, can lead to a mediastinitis with mortality rates up to 26%. Vascular lesions are the most common and a traumatic aneurysm may occur and lead to a temporary bleeding interruption. If an active bleeding leads to a massive hemorrhage, a direct pressure on the site should be the first approach. Another way of tamponing the vessels could be obtained by inflating an 18 or 20 Fr Foley catheter balloon into the wound, if the tissues are exposed. While zone I and zone III are less easily explorable surgically and can therefore, at least in the early stages, benefit from an endovascular repair, bleeding from zone II impose immediate surgery [11].

In our case, we treated a patient affected by a penetrating trauma caused by a knife passing through the neck. After having ensured respiratory and hemodynamic stability and without macroscopic signs suggestive for an immediate emergency, a CT angiography was performed. Like in this case, when a penetrating foreign body passes very close to vascular structures, it could be very useful and advisable to assess its involvement by selective angiography in order to look more specifically for contrast medium leaks. After the removal of the foreign body, an intra-operative control, if available, would be advisable, while, if it is not, a post-operative CT scan is again the gold standard. Post-operative intensive care is recommended [13]. In the present case, the patient did not have any evidence of cervical spine injuries or other neurological signs before the intervention. After surgical exposure of the right carotid and internal jugular vessels, the knife was carefully extracted by direct control of it passing between the latest. This last aspect is of primary importance in order to look for vascular lesions that could have been tamponed by the foreign body itself. In this case, just a lesion on the internal jugular vein needed to be repaired by direct suture. No neurological complications were reported after the knife removal.

In conclusion, traumas of the neck region represent a clinical/surgical emergency. As a first step, it is mandatory to obtain the clinical and hemodynamic stabilization in order to avoid its worsening which could be rapid.

After completing the imaging study, which provides further and useful data for a correct evaluation, it is often important that a multidisciplinary team composed of thoracic and vascular surgeons, an otorhinolaryngologist and an anaesthesiologist, collaborate to minimize the relevant mortality risk, as multiple different structures can be involved depending on the zone that is hit.

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