

## Medical Approach in Penetrant Cervical Trauma: An Educational View

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### Abstract

Doubts about procedures are common within the medical field, especially within the area of surgical clinic or medical surgery. In view of this explanation, the present was limited to carrying out a literary review on the subject of penetrating cervical trauma. To this end, research was carried out in databases linked to health and medicine, with specific descriptors for the subject, and articles from the years 2000 to 2020 were selected to clarify the subject. Penetrating cervical traumas are injuries to the neck that go beyond the platysma muscle. There is currently a great debate about the conduct to be adopted in such injuries. Penetrating cervical trauma comprises 5% to 10% of traumatic injuries in adults. In the last decade, mortality from penetrating cervical trauma was approximately 5%. The initial approach in the emergency room should be systematized in order to quickly identify possible signs of severity that usually require the immediate transfer of the patient to the operating room. Clinical examinations should be performed in order to elucidate and direct the surgeon to the best treatment for the patient. Finally, it is possible to conclude that cervical injuries are better treated with selective management.

**Keywords:** penetrating wounds; cervical injuries; medical education; continuing education; surgical clinic; general surgery.

### 1 Introduction

The number of medical procedures within the area of general surgery in public and private hospitals is notable, due to several epidemiological factors. High criminology rates, increase the need for specialized labor, especially within general surgery, also leading to an increase in offers of residency in this area (Tonatto Filho et al., 2020).

Among the main demands, it is possible to mention penetrating cervical traumas (PCT's). These refer to neck injuries resulting from injuries by firearms, stabbing or penetrating fragments, such as glass or shrapnel, which go beyond the platysma muscle. PCT's can cause damage to the respiratory, digestive and neurovascular systems (Chapman et al., 2020). Mandatory surgical exploration of PCT's remained widely accepted until the 1990s, when it was realized that, despite the best results, mandatory surgery had unacceptably high negative rates of exploration - approximately 58% of the patients approached did not have serious injuries (Nasr et al., 2015).

Educationally, the present work was developed with the intention of updating doctors, residents and specialization (general and clinical surgery) and medical students to guide and update from the literature review and pre-defined protocols on the decision process to be taken in patients with PCT's.

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## 2 Methodology

To this end, a bibliographic, documentary survey with exploratory characteristics was carried out to assess initial evolution and handling in the emergency room, based on the databases of the Medical Literature Analysis and Retrieval System Online - MEDLINE, Latin American and Caribbean Literature in Life Sciences. Health - LILACS and UpToDate. The keywords were used: “trauma”, “penetrating” and “cervical” and their English counterparts. As inclusion criteria, the work should be available in full, in Portuguese, English or Spanish, corresponding to the years 2000 to 2020 relevant to the area of medical and surgical clinic. Exclusion, articles not available in full, in languages other than those mentioned in the inclusion, dated prior to the corresponding years and which are not part of the aforementioned subject.

## 3 Development

The neck can be anatomically divided into zones (I, II and III) and trigones (anterior and posterior). Zone I is between the clavicles and the cricoid cartilage; zone II between the cricoid cartilage and the angle of the mandible and zone III, extends from this angle to the mastoid. The anterior trigone is limited by the lower edge of the mandible, the sternocleidomastoid muscle and the anterior midline of the neck. In relation to the posterior trigone, the limits are: the upper face of the clavicle, the trapezius muscle and the sternocleidomastoid muscle (Freitas et al., 2020; Silva, 2020).

### 3.1 Epidemiology

PCT's comprise 5% to 10% of traumatic injuries in adults and are mainly caused by bullets, knives and other objects. Injuries caused by low-speed weapons or shrapnel tend to cause less aerodigestive and vascular injuries. High-speed injuries lead to a greater likelihood of serious injury and death (Wang et al., 2019).

Mortality rates for PCT's injured in Zone I are more common due to the proximity of the mediastinal structures, the severity of the vascular injuries suffered and the surgical challenges (Kesser et al., 2009; Wang et al., 2019). Massive hemorrhage is the most common cause of immediate death and the carotid artery is the most frequently involved structure, with the incidence of carotid artery injury being 6% to 17% of PCT (Balogh et al., 2020).

Zone II is the most affected and represents approximately 60% of PCT's, followed by zones I (5% to 31%) and III (1% to 30%). As for the organs with the highest incidence of injuries, there is a disagreement among some authors, with the organs of the respiratory and digestive tracts, followed by injuries to large vessels and nerve injuries, in addition to vascular injuries followed by neurological and aerodigestive tracts (Koruga et al., 2018; Nason et al., 2001; Nwawolo & Asoegwu, 2017) and mortality from penetrating laryngotracheal trauma is reported to be 20%, mortality from pharyngoesophageal injuries reaches 22% (Plott et al., 2007). Unstable cervical spine injuries are rare (Demetriades et al., 1996; Wu et al., 2007).

### 3.2 Anatomical Characteristics Of Injury

When evaluating a patient with PCT, it is imperative to look for signs of severity that usually require the immediate transfer of the patient to the operating room. These signs may include severe or uncontrolled bleeding, rapidly expanding or pulsating bruises, murmurs, hypotension unresponsive to fluid resuscitation, absent or diminished radial pulse, neurological deficits compatible with cerebral ischemia, air bubbling of the wound - which may indicate injury to the tract aerodigestive, massive hemoptysis and respiratory distress. Subcutaneous emphysema, regardless of its size or volume, should not be considered a sign of severity (Azuaje et al., 2003; Sekharan et al., 2000).

Generally, less severe PCT signs include mild hemorrhage, mild hypotension that responds to fluid resuscitation, hemoptysis or small hematemeses, non-expandable hematoma, dysphonia and dysphagia. As for the lesions, they are presented as laryngotracheal, vascular, pharyngoesophageal and those of the nervous system (Azuaje et al., 2003).

Vascular lesions can involve the carotid artery (common, internal and external), the subclavian and vertebral arteries, thyroid vessels and vertebral, brachiocephalic and jugular veins (internal and external). Vascular lesions are not always so evident and, if they go unnoticed, can lead to late complications, such as pseudoaneurysms, rupture and arteriovenous fistula (Sekharan et al., 2000).

In the initial physical examination, obvious and subtle signs of vascular injury should be considered. Obvious signs include shock, severe bleeding, diminished or absent peripheral pulses, deficits, expanding hematoma and murmurs. Subtle signs include non-expanding bruises, mild bleeding, and transient hypotension that responds to fluid resuscitation. Full, symmetrical pulses do not exclude the possibility of vascular injury.

It is practically unlikely that an asymptomatic patient with a normal physical examination will have suffered a vascular injury that requires surgical repair (Azuaje et al., 2003; Prichayudh et al., 2015).

Pharyngoesophageal lesions are uncommon, but are associated with high morbidity and mortality. They can be difficult to detect clinically and are often the leading cause of late PCT death. The search for pharyngoesophageal lesions must be meticulous in patients with any signs suggestive of injury, using appropriate auxiliary studies. There are no pathognomonic signs of esophageal injury, but dysphagia, blood in the saliva, hematemesis and subcutaneous emphysema suggest the diagnosis (Asensio et al., 2001; Makhani et al., 2014).

PCT's can also involve the central nervous system (spinal cord) or the peripheral nervous system. Spinal cord injury is uncommon, especially in low-kinetic injuries. High spinal cord injury can result in neurogenic shock with hypotension and bradycardia. Partial spinal cord injuries create varying combinations of motor and sensory deficits, depending on the location. A quick scan that can be done at the bedside without the need for any additional technology evaluates the most frequently injured cranial nerves (Azuaje et al., 2003; Hussain Zaidi & Ahmad, 2011).

### 3.3 Initial Evaluation in the Emergenc

Unstable patients, including those with an injured airway that requires immediate intervention, hemodynamic instability, or other serious injury, should be hemodynamically stabilized and transferred quickly to the operating room. The emphasis on initial care should be on rapid stabilization of the airways, breathing and circulation, following the ATLS protocol (Advanced Trauma Life Support) (Azuaje et al., 2003).

One should always be on the lookout for late presentations of airway compromise, worsening bleeding or other hidden injuries. Although there is no consensus, most specialists recommend immediate intubation in patients with evidence of significant injury or breathing difficulty (e.g., subcutaneous emphysema, airway involvement, significant bleeding or hematoma, voice alteration and stridor). Signs that strongly suggest the need to protect the airways immediately in patients with significant facial or cervical trauma include: significant bleeding or hematoma in the neck hemoptysis; subcutaneous cervical emphysema; distorted neck anatomy; stridor, difficulty or pain when swallowing secretions; and abnormal voice, especially hoarseness ("hot potato voice") (Azuaje et al., 2003; Kesser et al., 2009; Sekharan et al., 2000).

Once a definitive airway is obtained, it is followed by auscultation of the chest, bearing in mind that PCT's, particularly those in the lower neck (zone I), can damage intrathoracic structures such as the lung and large vessels. Unilaterally diminished breath sounds or palpable subcutaneous emphysema suggest pneumothorax (Van Waes et al., 2012).

Then, pulse and vital signs should be evaluated. In case of wounds with active bleeding, local compression should be performed in order to reduce bleeding. In almost all cases, the wound should not be explored in the emergency room. For life-threatening bleeding that does not stop with direct pressure, the doctor can insert a Foley catheter into the wound and fill the balloon with 10 to 15 mL of saline or even feel resistance, aiming to temporarily stop the bleeding until treatment definitive is available (Madsen et al., 2016; Van Waes et al., 2012).

Cardiorespiratory arrest after PCT is an indication for emergency thoracotomy. Potential causes of arrest include hemorrhagic shock, hypertensive pneumothorax, airway involvement, cardiac tamponade and gas embolism. Those with hemodynamically stable findings suggestive of vascular injury can be taken directly to the angiography room for possible embolization or definitive diagnosis (Isaacs et al., 2015; Young et al., 2020).

### 3.4 Diagnostic Exams And Their Uses In Specific Injuries

Many trauma specialists advocate the use of multidetector helical computed tomography - angiography (MDCT-A) for the initial assessment of stable patients with PCT who exhibit any sign of internal injury. However, there is no consensus on the best diagnostic approach, and the practice varies based on institutional resources and protocols, the most likely injuries and local surgical practice (Bodanapally et al., 2014, 2015).

In places with limited resources without MDCT-A or standard angiography or required surgical knowledge, the best approach is to stabilize the patient in the best possible way and then transport him to the nearest unit with the necessary equipment and personnel for an evaluation of the PCT. In the completely asymptomatic patient, with no signs of severity, it may be reasonable to observe the patient in a monitored environment for 24 hours and transfer him to an appropriate trauma center if any signs of injury develop (Bodanapally et al., 2015).

In laryngotracheal lesions, helical computed tomography (CT) is the imaging modality of choice when looking for laryngotracheal lesions in stable patients with PCT. Helical CT provides anatomical details on laryngeal integrity and is useful when immobilization of the cervical spine is necessary. Studies describing the characteristics of the helical CT test to detect PCT laryngotracheal lesions are limited, but sensitivity and specificity are considered high (Robinson et al., 2009). Other possibilities with nasopharyngoscopy, which is flexible and laryngoscopy provide additional methods for assessing laryngotracheal trauma. Endoscopy allows a complete assessment when the dispersion artifact of metallic objects obscures helical CT images. Flexible nasopharyngoscopy allows visualization of the hypopharynx and supralaryngeal structures in an awake or sedated patient, while flexible laryngoscopy allows the assessment of the larynx. Rigid endoscopy allows the assessment of the distal airway, but requires general anesthesia (Bodanapally et al., 2014, 2015; Demetriades et al., 1996; Robinson et al., 2009).

In vascular lesions in patients with PCT, options include MDCT-A, standard angiography, doppler ultrasound (USD) and, possibly, magnetic resonance angiography (MRA). MDCT-A demonstrates sensitivity and specificity approaching 100% in the detection of vascular lesions and is widely considered the study of first-line images in stable patients with less severe lesions. Conventional angiography may be necessary if metal fragments interfere with anatomical details on helical CT. The USD, despite being operator-dependent, has demonstrated high sensitivity and specificity in experienced hands to identify vascular lesions (Bodanapally et al., 2015).

When evaluating pharyngoesophageal lesions, relatively uncommon in clinical practice, penetrating esophageal lesions are notoriously insidious, and delays in diagnosis lead to mortality rates of approximately 20% (Bagheri et al., 2008).

If pharyngoesophageal trauma is suspected, MDCT alone is inadequate to definitively rule out any injury, although it often identifies any signs of injury. In some studies, the sensitivity of MDCT to pharyngoesophageal injury is reported to be approximately 53%, although a neck or chest radiograph showing retropharyngeal or pneumomediastinum air suggests esophageal injury, but none of these signs are specific (Bodanapally et al., 2015; Gonzalez et al., 2003).

There is currently a great debate around the conduct to be adopted in such injuries and operative management has been replaced by a more conservative approach. Using this approach, patients are classified as unstable or stable, and not according to the area of the injury in the cervical region, with unstable patients transferred quickly to the operating room. Those who are stable, but symptomatic, may be subjected to angiography by computed tomography, the results of which, in combination with the findings of the physical examination, help to determine whether other additional examinations will be performed or whether a surgical approach is necessary.

#### 4 Conclusion

The injuries that affect the cervical region, due to their complexity and morbidity, certainly deserve attention from the emergency services that provide services to the population. Analyzing the data obtained through this literature review, it was possible to observe that there are controversies among the authors regarding the operative or conservative treatment of PCT's. Finally, it is possible to conclude that cervical injuries are better treated with selective management. The mandatory surgical procedure "in principle" should be replaced by immediate operation only when the clinical conditions of the patient so require.

#### Acknowledgment

This work was carried out with the support of the Coordination for the Improvement of Higher Education Personnel - Brazil (CAPES) - Financing Code 001, and has financial support from the National Council for Scientific and Technological Development (CNPq).

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