MULTIDISCIPLINARY MANAGEMENT OF COMPLEX BALLISTIC CERVICAL TRAUMA. CASE REPORT

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MULTIDISCIPLINARY MANAGEMENT OF COMPLEX BALLISTIC CERVICAL TRAUMA. CASE REPORT (Abstract): Accidental explosion of a projectile in peacetime is very rare. Ballistic trauma can be fatal or cause long-term consequences. Cervical trauma is associated with comminuted bone fracture, dilacerations of muscle fibers, vascular and nerve compression with or without complex lesions of the upper aerodigestive and respiratory tract. It is a rare situation that a projectile fragment passes through the face and neck without damaging vital structures. Considering the multiple lesional aspects, especially at the level of the cervical area where there are many vital visceral structures, a concise clinical, laboratory and multidisciplinary assessment is required to ensure the therapeutic success. We present such a case from our experience managed with a multidisciplinary team approach. Keywords: BALLISTIC TRAUMA, FOREIGN BODY, MULTIDISCIPLINARY APPROACH.

Complex lesions of the head and neck of ballistic etiology are rarely described in the literature, generally in case reports from armed conflict zones. However, there are fewer reports of accidentally exploding shells dating from the World War II in areas outside the war zones (1). Most of the deaths occurring after ballistic cervical trauma are caused by vascular injuries in the aerodigestive and respiratory tracts, vertebral column or calvarium (2). The questions surrounding the optimal management of cervical trauma are related to exploratory surgery in emergency or to selective surgical approach after some investigations to decrease the rates of morbidity and mortality. In this paper we present the approach and the management of a patient who was admitted in the emergency department with complex craniofacial and cervical ballistic trauma.

CASE REPORT
In the present study we report the case of a 52-year-old, male patient which was brought into the Emergency Room of the
“Sf. Spiridon” County Clinical Emergency Hospital in March 2015, with complex injuries caused by an accidental explosion of a 76 millimeters projectile from World War II. At the first examination, the patient was in a serious condition, being intubated and mechanically ventilated. The clinical examination revealed right periorbital hematoma, asymmetric face, discontinuous bone contours, abnormal bone mobility of the right part of the face, right-side chin concussion wound in the 1/3 superior part, tenderness of the cutaneous and subcutaneous plans in upper posterior third of the neck, without any identified exit wound of the projectile fragment.

Initially we performed a neck X-ray (fig. 1) and a computed tomography which revealed comminuted fracture with displacement of the lateral and anterior wall of the right maxillary sinus (fig. 2), right zygomatic arch, lateral wall of right orbit, external process of the right pterygoid apophysis, and mandibular fracture of the right ascending ranch. It was also observed a metallic foreign body with a maximum diameter of 34 mm, positioned on the soft tissues from the right posterior cervical region at C1, C2, C3 level (fig. 3). The CT showed a fracture of the transverse process of the atlas and possible fracture of the right carotid channel with gas bubbles, fluid collection with maximum dimensions of 10.2/30.2 mm and a 55 mm cranio-caudal extension of the head on the right side, located between posterior cervical muscles, semi spinal, and splenius. One of the right posterior veins, accompanying the splenius muscle was dilated in its lower part, and its upper part was apparently intercepted by the metallic foreign body.

Fig. 1. X-ray-Foreign body located in the right posterior cervical region.

Fig. 2. CT-comminuted fracture with displacement of the lateral and anterior wall of the right maxillary sinus.

Fig. 3. CT-metallic foreign body located in the right posterior cervical region.
The patient was evaluated by a multidisciplinary surgeons' team: ENT, maxillofacial, ophthalmologist and neurosurgeon. The primary surgical approach consisted in an eschilectomy, reduction and immobilization of the orbital wall through the maxillary sinus approach and osteosynthesis of right ascending part of the mandible by the oromaxilofacial surgeon. Postoperatively, the patient showed confusional state, dysphonia and marked dysphagia. ENT evaluation and fibroscopy examination detected an adductor paralysis of the right vocal cord, salivary stasis in the right piriform sinus without swelling and hematoma of the oro- and hypopharynx. The upper gastrointestinal endoscopy performed during the gastroenterological exam excluded an intrinsic or extrinsic obstructive cause at this level. Computed tomographic reassessment highlighted besides the presence of the foreign body and cervical collection - the presence of an 42 mm wide edema in the upper portion of right para pharyngeal space with bulging of pharyngeal wall and obliteration of the fat layer at the level of right carotid space, without perivascular extravasated during injection, right jugular vein compression in the upper portion from the exit of the skull base, deficiency filling for a distance of 45 mm, including the jugular foramen.

The second surgical phase involved an intervention performed by a mixed surgical team of ENT and neurosurgeon. The collection was located intraoperatively in the right paravertebral space C1-C4 and after aspiration of secretions was identified the foreign body with a prismatic shape of 3.0/2.0/2.5 cm, metallic nature, ash-gray color. The foreign body was extracted, and the remnant cavity was explored internally – in intimate contact with the lateral portion of C1-C4, externally-the muscle plane, anterior-prior to about 8 cm continuing with paths that dissected away the right retrostilian part of para pharyngeal space. All plans showed necrotizing fasciitis and identified a bone splinter with sharp edges about 2.0/1.5 cm, which was extracted. The surgical team performed a surgical toilet of the plans, washing with diluted Betadine solution, hemostasis, debris removal; they placed a drain in the wound cavity and realized a partial suture. Subsequently, the patient received antibiotic, analgesic, steroid anti-inflammatory, and anticoagulant therapy, anti-tetanus vaccination, nutritional supplement and topical wound bandage. The evolution was favorable permitting drain suppression, secondary suture of the wound and hospital discharge after 30 days. The 3-month follow-up of the patient showed improvement of right vocal cords mobility.

**DISCUSSION**

The neck is divided into three zones, by imaginary horizontal lines traced through the collarbone, cricoid cartilage, mandible angle and base of skull. These are used in the evaluation and treatment of penetrating neck injuries (3, 4). The classification system of penetrating facial trauma involves two entry areas: the face and mandible (4, 5, 6). To understand the complexity of the injuries caused by exploded projectiles, some notions of ballistic physics are necessary: external lesion, the path and terminal lesion. Once the projectile fragment penetrates the skin it will destroy and crush the tissues, the complexity of the wound being directly proportional to the input speed and with the shock wave that radiates outwards resulting in stretching, shearing and then collapse them. A small gateway can hide
massive internal injuries that are not visible at first medical evaluation (1). Cervical region involves a vital risk because of the anatomical noble elements, both visceral and neurovascular, which lack the protection of a skeleton bone (7, 8, 9).

The appearance of gunshot entrance wounds on the body depends upon many factors including, the type of firearm, the type of ammunition, the location of the wound on the body, and the circumstances of how a wound was sustained (10). The capacity of the penetrating projectile to destroy and dislocate tissue is defined by its kinetic energy, but the real tissue injury is related to the manner of energy release during the contact between the projectile and the tissue and to the physical characteristics of tissues and organs involved (resistance to tension, physical sizes of an organ, and the existence or absence of surrounding anatomical limitations (2,11). Therefore, the ratio of energy transmission to the tissues along the wound trajectory is influenced by some projectile features, as profile, structure, and stability. At the level of tissue injury can be recognized two areas: a cavity created by the passage of the projectile and the contused tissue surrounding it, created principally by transitory cavitation which is an indicator of real high-energy assignment to tissue. Consequently, the wound assessment and the type of necessary treatment must be centered on the understanding of the mechanisms contributing to tissue impairment (12, 13). The surgeon can promptly evaluate the tissue injury in a patient if he knows the type of missiles and features related to wound profile as the penetration complexity, the ammunition distortion/fragmentation, diameter of the permanent and temporary wound cavity (13).

Primary evaluation, in emergency, involves stabilization of breathing and circulatory functions, as well as injuries that may be life threatening. In most cases, medical history, physical examination, laboratory investigation, and treatment are done simultaneously. They are performed by a multidisciplinary team consisting of surgeons (ENT, maxillofacial, neurosurgery, vascular, plastic) and intensive care specialists, who will determine lesion characteristics and treatment priorities. The ideal time and treatment choice remain a continuous discussion within this subject (14, 15). In our case, the surgical extraction of the projectile fragment was not a priority because it has not started to migrate, and it was not a danger for the vital structures of the neck. Subsequently, priority was given to the maxillary and mandibular fixation. Although, the belief that projectiles are sterilized by the heat is false, and the antibiotic administration is questionable (16), in this case we administered intravenous doses of vancomycin, meropenem and ceftriaxone.

**CONCLUSIONS**

Our study confirms that ballistic cervical trauma is associated with high risks, requiring emergency treatment and a multidisciplinary approach for collaboratively developing a treatment plan. Particularities of this case consist in defining the mechanism of cervical trauma, accidental explosion of a projectile outside armed conflict areas and surgical therapeutic approach with a mixed team to ensure a high survival rate, optimal healing with prevention of postoperative complications and sequels.
REFERENCES