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COMPLEX FACIAL TRAUMA CAUSED BY SELF-SHOOTING: A CASE REPORT

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Abstract: Trauma caused by firearms is complex, often fatal, especially when addressing certain anatomical regions such as the face and neck. The causes range from attempted murder to attempted suicide or accident. Their differentiation is important both legally and due to the fact that they can trans-late certain psychiatric sufferings of the patient that will have to be considered in the subsequent management. This kind of trauma is often characterized by significant loss of soft tissue and bone, which, for the survivors, will mean numerous reconstructive interventions in a multidisciplinary approach, lasting recovery and difficult social reintegration. The severity of these wounds is mainly related to the type of weapon used, the firing distance and the mass and velocity of the bullet. We will present the successful management regarding the treatment and rehabilitation of a patient with complex trauma caused by auto-shooting at the face level.

Key words: facial trauma, reconstructive interventions.

INTRODUCTION

Gunshot wounds to the head and neck cause significant damage with loss of bone structure and soft tissue [1]. In the case of the survivors, the treatment requires a multidisciplinary approach, numerous reconstructive interventions, lasting recovery and difficult social reintegration, the specialty literature being in favour of immediate reconstructive interventions compared to the delayed ones [1-3]. These types of injuries can come from attacks, accidents or can be self-inflicted, as a method of suicide, or accidentally [4].

Both from the point of view of the forensic interpretation and the understanding of the complexity of the injuries, most of which may be hidden at an initial examination, the type of weapon used and the estimation of the distance from which it was activated is of real help. Ballistic injuries can be divided into low, intermediate or high velocity injuries. The kinetic energy transmitted by a projectile on the tissues is directly proportional to the severity of the lesions. Mass and velocity of the bullet are the two determinants of kinetic energy, as described by the equation: kinetic energy = ½ mass × velocity2. The properties of the penetrated tissues greatly influence the appearance of the lesions. Different elasticity and density, anatomical relationships between tissues are responsible for the different response to a certain amount of kinetic energy [3, 5, 6]. Bone structures tend to fragment and may take up kinetic energy, thus becoming secondary projectiles, causing further injury. This is particularly important in facial lesions, where fragments of the mandible, maxilla or teeth can dislocate, penetrating the adjacent soft tissues [7-9].

The management of facial gunshot wounds has evolved significantly over time, from conservative interventions with delayed reconstruction, to immediate reconstruction and any subsequent refinements [10]. At present it is considered that low-velocity injuries, as in the case of penetrating and perforating wounds, can be treated in the same manner as blunt trauma, with minimal debridement and primary closure. In the case of high velocity lesions, there are still many controversies, because the tissues often present an evolutionary necrosis, so that the attempt of primary reconstruction could be compromised [11-12].

CASE PRESENTATION

A 40-year-old patient was brought to the Clinical Emergency Hospital Bucharest being conscious, cooperative, after accidentally unloading a gun to his face. The facial wounds involved composite defects

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at the level of the right buccal commissure, multiple fractures at the level of facial bony structure, severe wound in the right half of the tongue and buccal floor (Fig 1). The complexity of the case made it imperative to form a complex, multidisciplinary team, made up of doctors from the specialties of buco-maxylo-facial surgery, plastic surgery, ENT, anaesthesiology and neurosurgery.

The biological status at admission showed leukocytosis (13,000/μL), mild anaemia (haemoglobin 11g/dL) and a slight modification of the coagulation tests. The examination of the patient was completed by a computed tomography with reconstruction of the facial bones, which showed a comminutive fracture at the level of the horizontal left mandibular branch with dis-placement, 33-43 alveolar process fracture with muco-gingival disinsertion and 35 dental avulsion, LeFort I type fracture of the palato-alveolar plateau and alveolar process 16-17 with disinsertion and avulsion, fracture of the right maxilla (11-15 alveolar process and anterolateral wall of the right maxillary sinus), fracture of the anterior portion of the left maxillary sinus. Numerous bone fragments were projected at the level of the soft palate and the lingual region.

Figure 1. The patient's appearance at the hospital admission. One can notice the complexity of the facial wound with composite defects at this level, involving all the thickness of the right buccal commissure, with extension at the level of the upper lip.

Due to the necessity of performing an emergency surgery, a tracheostomy was required, by means of this approach endotracheal intubation was performed. In this case, the complexity of the lesions requires a well-established preoperative plan as well as a multidisciplinary approach, the most important aspect being to ensure the airway permeability, stabilization of the bone structure with the preservation of all viable elements and covering them with soft tissues. During first surgical intervention, rigorous evaluation of the lesions was realized, with the removal of devitalized bone fragments and the non-recoverable dental remains, suture of the tongue, reduction and immobilization of the alveolar process fracture 16-17, immobilization of the LeFort I type fracture with metallic splint and dental wire ligatures, reduction and immobilization of the mandible fracture by externally metallic wire osteosynthesis, monomaxillary reduction / immobilization of the alveolar process fracture 33-43 and 35 with metallic splint with buttons and dental wire ligatures, suture of vestibule and buccal mucosa, hard palate and facial wounds.

The next 14 days postoperatively, the patient is maintained in the intensive care unit, the evolution of the general and biological status, as well as the local aspect of the lesions being slowly favorable. On the 5th postoperative day, a 3D reconstruction of the skull is performed, which confirms the stability of the bone structure. After a total number of 17 days of hospitalization, the patient was discharged, remaining that, at 6 weeks postoperatively, to perform the extraction of the means of immobilization and the planning of further reconstructive interventions.

Following the difficult path to rehabilitation, approximately one month after the initial intervention, the patient performs in a private system a Mandibular and Maxilla Cone Beam Computer Tomography (Fig. 2), which plays a crucial role in establishing the restoration of the den-tal arch and teeth.

At approximately 5 months after the accident, reconstructive interventions are continued, the patient being readmitted to the hospital. At this moment, the bone defect from the level of the alveolar ridge 12-16 is compensated with a graft harvested from the level of the right iliac crest, which is further fixed with screws. This will provide support for subsequent dental implants. The postoperative evolution is favorable, with a total number of 8 days of hospitalization. During the bone graft integration process, the patient wears a removable dental prosthesis (Fig. 3).

The definitive dental implants were fixed after 6 months of osteointegration and allowed the patient to

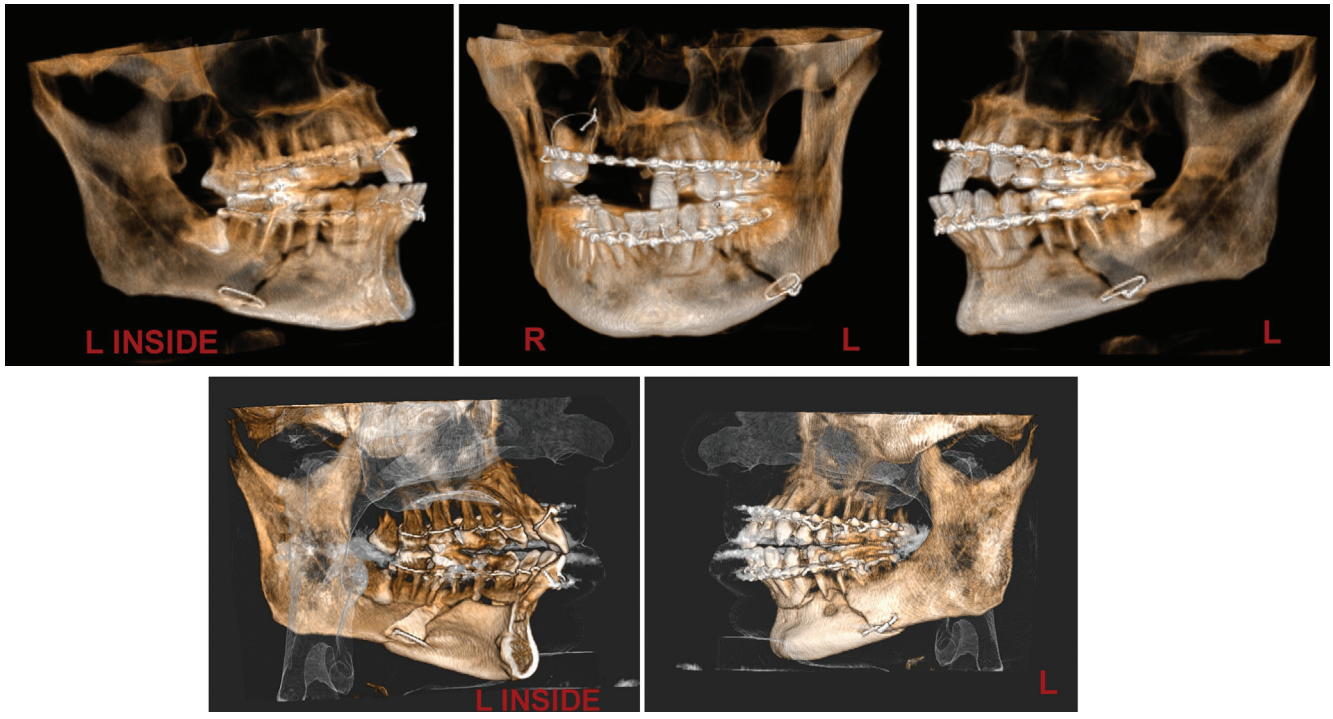

Figure 2. Cone Beam Computer Tomography of the mandible and maxilla.

Figure 3. Postoperative appearance with temporary removable dental prosthesis.

Figure 4. The patient at 5 years post-accident.

resume normal activity and function. At 5 years after the accident, the patient leads a normal life, but has remained sensitive to gum and upper lip (Fig. 4).

DISCUSSION

In Romania there are very strict laws regarding the use of guns, which can be seen in the low number of wounds and deaths resulting from shooting. According to the World Health Organization Mortality Database, in 2016 in Romania there were 27 deaths resulting from the shooting, of which 4 were unintentional shooting [15].

The forensic expertise in this case consisted in analyzing the provenance of the injury, making a differential diagnosis of the traumatic injuries, finding that it was produced by firearm; the en-trance hole

was determined, the distance from which it was fired, the number of shots, the identity of the weapon with which it was fired was established. Also, the severity of the injuries, the time needed for medical care for the healing, the possible infirmities, disabilities that may remain.

The gun used in the exposed case is a self-defence, non-lethal, 10x28 caliber weapon that uses rubber bullets, being very popular both in Romania and Russia. Self-defence guns that use rubber bullets are characterized by a high stopping power and were not designed to cause penetrating injuries, even at short ranges [16, 17]. Disruption of the tissues and penetration into the body occurs when strains applied by the bullet exceed the viscoelastic properties of the tissues. In addition to the stretching and crushing phenomena, there are also shock waves generated by the bullet, which cause lacerations and fractures around the impact area [17-19]. Due to these multiple effects of the bullets on the tissues, Wang described 3 zones of injuries. The first zone is known as the permanent cavity and is given by the direct crushing effect of the bullet as it advances through the tissues. The second is the contusion area adjacent to the primary bullet path, while the third is the area away from the impact site, where the injuries were caused by the generated shock waves [20].

Gunshot wounds at the face level represent a therapeutic challenge for the trauma team. The primary act is the stabilization of the patient, according to the ATLS guidelines, which follows the ABC code. There is a new interpretation of this code that applies whenever there is a catastrophic bleeding, so that the code changes into C-ABC (C - from catastrophic bleeding). In the case of our patient there was an active bleeding at the time of the primary evaluation, but not important enough to be life threatening. For airway stabilization, whenever possible, orotracheal intubation is preferred. In case there is a distortion of the local anatomy due to the extensive lacerations in the face, the tracheostomy is a saving alternative, which was also the preferred solution in our patient [21].

The first surgical objective must be rigorous debridement of all devitalized tissues as well as abundant lavage, the risk of infection secondary to these types of lesions being a significant one. Whenever possible, early and definitive surgery with fixation of fractures, within the first 72 hours, is preferable, in order to obtain improved function and superior aesthetic result [22].

In conclusion, self-defence weapons have significant destructive potential on the tissues when certain strict handling rules are not respected, as well as the optimal shooting distance. Facial gunshot wounds present many difficulties of therapeutic approach that are maintained after the initial stabilization, but most of them can be addressed as an outpatient [4]. This case demonstrates the major danger of accidentally unloading firearms, requiring complex measures of facial reconstruction, multiple surgeries, long hospitalization, significant costs. In the rehabilitation process, the psychological conditions must always be taken into consideration, on one hand regarding the way in which the incident (accident or suicide attempt) occurred and on the other hand the aesthetic aspect that can be deeply affected. Due to the need for multiple surgeries, it is imperative that the patient is psychologically stable to accept a long period of recovery and social reintegration.

The continuous improvement of firearms, the relatively easy accessibility in some countries, puts us in the face of real ethical problems of the modern world. There is a need for a restrictive legislation regarding the firearms regime, the development of information programs among young people explaining the danger of handling weapons, involving forensic experts who can pre-sent concrete cases, all these measures aiming to reduce accidents. A sustained, coordinated campaign, starting with the educational institutions and the media, can lead to the desired result.

Conflict of interest

The authors declare that they have no conflict of interest.

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