CASE REPORT

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ISOLATED FACIAL WOUND FROM AN AIRGUN IN A CHILD: A LITERATURE REVIEW AND CLINICAL CASE REPORT

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Abstract. Introduction: *Airguns are non-firearm pneumatic barrel weapons whose ammunition consists of solid metal objects – pellets. These weapons are known as BB guns. The muzzle velocity (projectile speed) is classified as low, medium, and high. The severity of injuries to the maxillofacial region is significant, but rarely fatal. The affected structures of the head and face are highly specialized, and their function remains permanently impaired. Treatment of these injuries requires removal of the projectile and wound debridement to reduce post-traumatic scarring.* ***Clinical Case Description:*** *We present the clinical case of a 14-year-old boy who sustained an injury while playing with an airgun, inflicted by a friend of the victim. The patient presented for treatment 10 days after the occurrence of injury, and the treatment included projectile extraction, surgical wound debridement, and 7 days of antibiotic therapy.* ***Discussion and Conclusions:*** *Injuries caused by airguns in the maxillofacial region are serious traumas. They can affect neural and vascular structures, jawbones, sinuses, salivary glands, the eye, etc. Early treatment is a factor that reduces the risks of complications and sequelae.*

Key words: *gunshot wound, airgun wound, airgun, facial trauma, maxillofacial region, clinical case report*

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INTRODUCTION

Ballistic Characteristics of Airguns

Airguns are non-firearm pneumatic barrel weapons that fire solid metal projectiles (pellets) of varying shapes and calibers [1]. Such weapons are commonly known as BB guns [2]. Air rifles are manufactured in various calibers and fire corresponding ammunition such as the diabolo and round pellets [3]. The destructive power of a projectile is determined by its kinetic energy: $E = mv^2/2$ [4]. Ballistic velocity is classified as low (below 400 m/s), medium (400-600 m/s), and high (over 600 m/s) [5]. Pistols are low-energy weapons that cause small wounds with an entry hole, track, and base, or can cause skin abrasions [6]. The critical velocity for a projectile from an airgun to penetrate human skin is between 38 m/s and 70 m/s [7].

Severity of Injuries

Airguns can cause serious injuries to the head, face, maxillofacial region, and eyes [8]. Sharif et al., in an analysis of 41 cases of ocular injuries from airguns over a 10-year period, found that 80% of the cases involve youths under the age of 18 [9]. Shaw and Galbraith describe two fatal cases resulting from penetrating cranial injuries: a 3-year-old child with a subdural hematoma and a 15-year-old boy who died 19 months after the rupture of an abscess around a pellet projectile [10].

According to a study by the National Center for Injury Prevention and Control, CDC, USA, for the period 1992-1994, 95% of the injuries were superficial wounds, and only 5% of the firearm injuries resulted in disability [11, 12]. The persistence of gas (air) in soft tissues after a trauma with a low-energy gas weapon is a prerequisite for the development of both the anaerobic and mixed aerobic-anaerobic infections [13].

Injuries to the Maxillofacial Region

Maxillary Sinus

The penetration of a projectile (pellet) into the maxillary sinus and its lodging in the cavity creates a predisposition for the development of an inflammatory process (sinusitis) [14].

Tongue

The penetration of the pellet into the anterior part of the tongue, in addition to damaging the musculature, also causes damage to the vascular and neural structures [15].

Facial Neural Structures

Depending on the energy of the pellet and the anatomical zone, neural injuries can affect proximal or distal parts of the nerve. Proximal neural injuries are more severe and recovery is more difficult and slower [16]. When the facial nerve is affected, paresis and paralysis of the mimic muscles occur, and when branches of the trigeminal nerve are damaged, hypesthesia, anesthesia, and dysesthesia develop [14].

Treatment Approach

Low-energy skin injuries require surgical treatment and removal of subcutaneously located projectiles (pellets, shot) [17]. Specialized emergency intervention is required for the cranial, ocular, thoracic, abdominal, and vascular injuries [18]. Determining the position of the projectile (pellet) in the tissues is the main diagnostic and therapeutic challenge. The mobility of the projectile in the tissues and the change of its position presents a therapeutic problem [19]. When the pellet is fixed in the surrounding tissues, a foreign body reaction develops, and it remains fixed and asymptomatic, allowing an easy localization of the projectile [20]. In the presence of an inflammatory process, it is possible an abscess cavity to be formed in which the projectile (pellet) is found [19].

CLINICAL CASE DESCRIPTION

We present a 14-year-old boy who, while playing with an airgun, was shot by his own friend in the face, in the lower aspect of the left cheek, near the mandible, above the basis mandibulae. The patient visited a dental practitioner who ordered an orthopantomogram, which revealed a foreign body in the soft tissues projected onto the mandible. The patient was referred directly for consultation with an oral and maxillofacial surgeon. Ten days passed from the time of the trauma to the consultation.

On examination, an epithelializing entrance wound was found. The wound track was palpated as an elongated induration, which was mildly painful. The projectile (pellet) was palpated under the skin (Fig. 1). Distally to the pellet, a continuation of the wound track was found, ending blindly in the soft tissues, and the skin in the area is thinned out.

Fig. 1. Extraoral view of the trauma site – epithelializing entrance wound of the wound track

Fig. 2. Extraoral view of the traumatized area – visualizing the translucent pellet beneath the skin and the sinus tract formed distally

CT scan (October, 2024) revealed an oval foreign body with metal density in the right buccal region, measuring 6.3 x 6.3 mm. No signs of perforation or involvement of the superficial cervical fascia were observed. There was no involvement of the mandibular bone (Fig. 3).

In the orthopantomogram, a strong oval shadow is observed, projected above the basis mandibulae on the right side, with the characteristics of a foreign body (pellet) (Fig. 4).

The surgical intervention for the removal of the pellet was carried out without complications. The foreign body was found and removed (Fig. 5 a, b). In the area of the pellet, a cavity was formed, mirroring the shape of the foreign body (Fig. 6). Distally to the projectile, a sinus tract filled with purulent exudate was found. Antibiotic treatment with Accef 500 mg every 12 hours was administered for 7 days.

Fig. 3. CT scan of the head – visualizing the location of the foreign body in 3D space

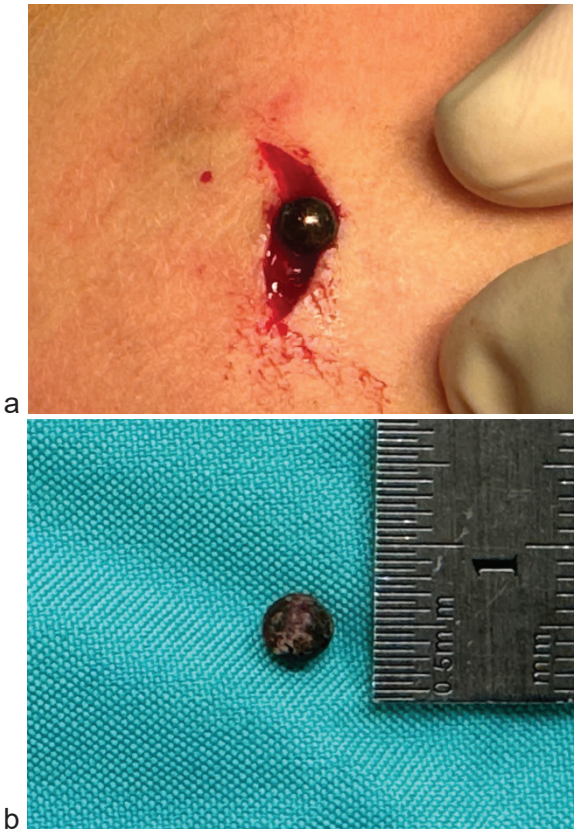

Fig. 5. Visualization of the foreign body in the tissues (5a), and the removed foreign body (5b)

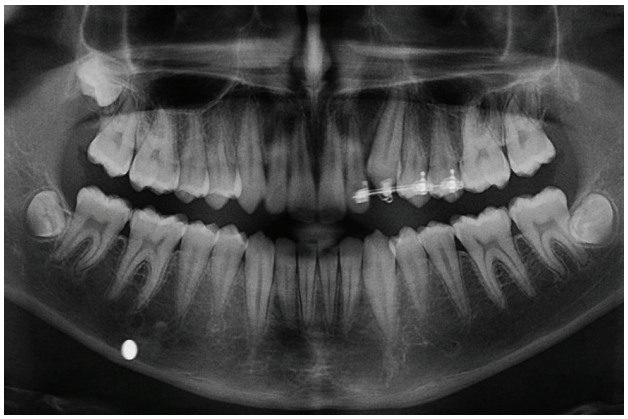

Fig. 4. Orthopantomogram – visualizing the foreign body at the level of the basis mandibulae on the right side

Fig. 6. Impression cavity formed in the tissues by the projectile

DISCUSSION

The easy access to low-energy airguns, such as compressed air pistols and rifles, has led to an increase in firearm injuries, especially among untrained individuals and young people [1]. Advances in technology and improvements in the ballistic and energy characteristics of airguns have resulted in serious injuries, particularly in the maxillofacial region [14, 15]. Injuries often occur unintentionally, in domestic settings, and among family members [21].

The energy of the firearm is the primary factor determining the severity of the injury [7]. The shift from spring-powered to compressed air-powered mechanisms has increased the kinetic energy of projectiles [22].

The anatomical area affected by the firearm determines the prognosis of the injury. Injuries to vital structures can be fatal [17]. Injuries to the orbit and eyeball can lead to severe visual impairment, ranging from decreased vision to complete blindness. Ocular trauma is a major cause of blindness and visual impairment in both the adults and children [23]. Damage to motor nerves results in muscle paralysis, the severity of which depends on the extent of the nerve injury [14]. In the maxillofacial region, injury to the facial nerve causes paralysis of the facial muscles. When the marginal mandibular branch is damaged, paralysis affects the muscles around the mouth [16]. When a projectile passes through the superficial cervical fascia, the branches of the facial nerve, located deeper, are typically spared [24].

The development of an inflammatory process in the area of a gunshot wound is related to the degree of contamination of the projectile and the tissues it passes through [13]. The timing of the surgical intervention to remove the projectile and perform primary wound debridement affects the development of an inflammatory process [25]. Early surgical treatment of a gunshot wound is essential for removing foreign bodies, debridement, and reducing the bacterial load in the wound. Hollier et al. recommend early surgical treatment and reconstruction of the defect in maxillofacial injuries, citing advantages over delayed treatment [26].

Antibiotic therapy should be initiated as soon as possible in gunshot wounds [27]. Guidelines recommend starting antibiotics within 6 hours, ideally within 3 hours [27]. Wound edge approximation promotes primary healing. Before surgical treatment, the potential for healing complications should be assessed, considering factors such as tissue necrosis and infection [28]. Primary closure and healing are recommended, as secondary healing is associated with scar formation and extensive areas of tissue dysfunction [28].

Delayed treatment of gunshot wounds can lead to the development of local chronic abscesses, causing further tissue damage and delayed healing of the type substitutio with significant scarring. Such scarring can lead to undesirable cosmetic outcomes in the maxillofacial region. Scarring changes require additional corrective surgical interventions to achieve the desired esthetic effect [29]. Various surgical techniques are suggested for surgical corrections, including free skin grafts, local soft tissue plasty, and free flaps [30].

In superficial gunshot wounds involving only the skin and subcutaneous tissue, the healing process can be managed to achieve the desired outcome.

CONCLUSIONS

Firearm injuries to the maxillofacial region in non-wartime periods are rare, but children and adolescents are a significant proportion of those affected. Injuries to important structures in this area can have lasting functional and esthetic consequences. Early treatment of these injuries is essential to minimize complications and sequelae.

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Consent for publication: *Consent form for publication was signed by the patient/parent and collected.*

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