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Case Report

Penetrating blast injury involving maxilla to infratemporal fossa: An unusual wounding mechanism following heavy tractor wheel explosion

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ABSTRACT

Although most significant maxillofacial injuries are the result of blunt trauma, solitary penetrating facial injuries with retained foreign bodies occur, and can be particularly difficult to manage, since multiple vital structures are concentrated in a relatively small anatomic area. When penetrating facial injuries occur, they are usually caused by low-velocity gunshots, falls, criminal assaults, occupational, or traffic accidents. Occasionally, however, maxillofacial surgeons may be encountered with penetrating facial injuries caused by unusual etiologies. Blast injuries to the face owing to tire or metal rim fragments explosion provide a specific example of such a traumatic event. In addition to initial pressure wave which can produce severe overpressure barotrauma, an exploding wheel tire assemblies or objects in the close tire vicinity may act as a high-speed secondary projectile that can produce serious or even fatal penetrating injuries to the person facing the wheel. This report documents solitary heavy tractor tire blast-induced penetrating injury caused by metallic blunt object (combination pliers) firmly impacted in the right maxillary sinus. The unusual wounding mechanism of this injury is highlighted and the principles in the management of such a case are emphasized.

1. Introduction

Solitary foreign bodies retained in the maxillary sinuses are relatively common in dental and maxillofacial practice and have a special significance to the patient. While maxillary sinus foreign objects commonly involve dental or iatrogenic substrate, such as teeth, dental roots, endodontic material, dental amalgam fillings, or dental implants, traumatically-induced solitary penetration of the maxillary sinus by foreign object that is retained in a place is a quite uncommon occurrence [1]. Although many of these foreign objects do not cause a life-threatening risk, they can lead to functional disorders, infection, pain, and discomfort. Nonetheless, foreign bodies within vital neurovascular areas often require removal. Such injuries may pose both diagnostic and therapeutic challenge due to many factors, such as the type and shape of foreign body involved, inconspicuous skin wound at the site of penetration/impact, concomitant hard and soft tissue facial injuries, difficult access and anatomical relationship and extent of the penetrating foreign body to vital structures. From an interdisciplinary point of view, combining clinical and forensic findings, we present an unusual heavy tractor wheel blast penetrating injury caused by metallic blunt object (combination pliers) firmly impacted in the right maxillary sinus. The unusual mechanism of this injury is highlighted and the principles in the management of such a case are emphasized. To the best of our knowledge, this is the first documented report of solitary penetrating wheel blast injury of the maxillary sinus.

2. Case report

A 24-year-old male equipment operator with history of heavy tractor tire blast injury was referred to our clinic because of solitary penetrating maxillofacial injury. According to surveillance camera

☆ AsianAOMS: Asian Association of Oral and Maxillofacial Surgeons; ASOMP: Asian Society of Oral and Maxillofacial Pathology; JSOP: Japanese Society of Oral Pathology; JSOMS: Japanese Society of Oral and Maxillofacial Surgeons; JSOM: Japanese Society of Oral Medicine; JAMI: Japanese Academy of Maxillofacial Implants.

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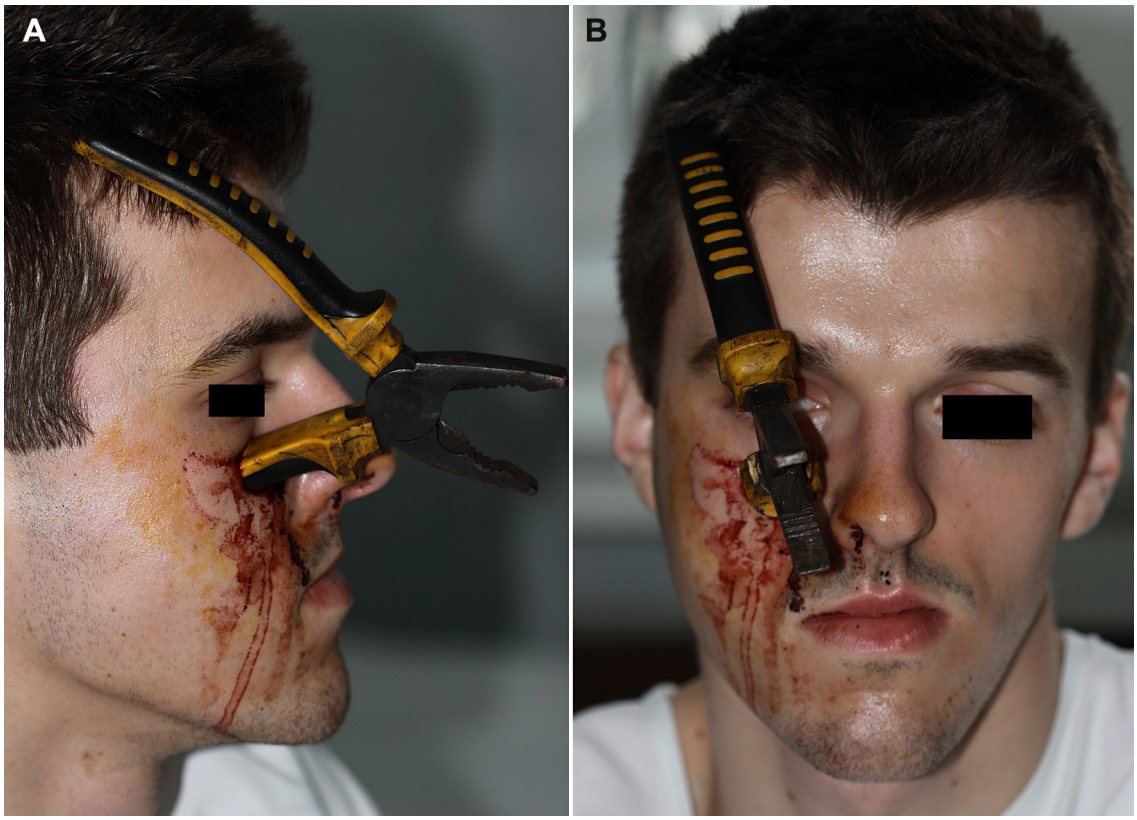

Fig. 1. (a) Lateral and (b) frontal view on the maxillofacial area showing combination pliers handle firmly impacted in the right maxillary sinus.

record, he was servicing heavy tractor multi-piece wheel tire with a combination pliers when metal lock ring suddenly exploded and propelled from a wheel tire, ejecting the pliers forcefully toward his face. On admission, the patient was fully conscious, hemodynamically stable, with blurred vision in right eye. On physical examination, there was an isolated penetrating defect in the right infraorbital area, with pliers' rubber-handle firmly embedded in a place (Fig. 1A and B). An ophthalmologist was consulted, and he noted that the right pupil was reactive with no evidence of eyeball rupture. A CT of the head revealed penetrating metallic, radiopaque pliers handle traversing the right maxillary sinus, creating a wound tract 6.5 cm × 2.2 cm in size (Fig. 2). A blunt handle end produced a lacerated entrance wound in the skin with irregular abraded edges measuring 3 cm × 2.5 cm. On CT-scans, the wound channel ran dorsally and slightly laterally through right maxillary sinus to right infratemporal fossa. In the course of the wound track there were discovered lacerations of soft facial tissues and comminuted fracture of the right maxilla together with a hematosinus. Moreover, there was a right carotid canal fracture with two slightly displaced bone fragments with length for a 4 mm, which were in the immediate vicinity of the right internal carotid artery wall (Fig. 3). The neurosurgery and vascular surgery were consulted and the CT angiogram of the head was ordered for detecting or excluding active bleeding. CT angiography revealed the absence of gross bleeding of the both, common, internal, and external carotid arteries. The intracranial area had a normal appearance, with no evidence of intracranial hemorrhage.

The patient underwent, under general anesthesia, successful removal of the foreign body. Using the careful simultaneous oscillating and vertical pulling motion, the pliers handle was manually disengaged from the maxillary sinus (Fig. 4). The fractured free bone fragments of the right maxilla were removed. After appropriate hemostasis, the wound was sutured in layers. In addition, a balloon catheter was placed to provide reposition and fixation of the maxillary sinus walls, drainage, and to create aerobic environment. The maxillary sinus was abundantly irrigated with povidone/iodine solution. The postoperative course, supplemented by maxillary sinus saline irrigation in conjunction with intravenous antibiotic therapy, was uneventful, and the patient was discharged on day 5 after surgery.

Fig. 2. Lateral CT scan of a patient's head revealing a penetrating metallic, radiopaque pliers handle in the right maxillary sinus and right infratemporal fossa.