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Management of penetrating arrow injury of the maxillofacial region, case report

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Abstract

An arrow maxillofacial penetrating injury is an unusual traumatic injury sometimes encountered in developing countries. This rare injury has the potential to be dangerous because the arrow is deeply lodged in maxillofacial region crossed by major vessels, and because damage to one of these vessels should always be suspected. Furthermore, removal of a foreign body may result in complications such as massive bleeding or iatrogenic injury to adjacent structure and complications should always be considered in maxillofacial region. We describe a case of a patient who presented with maxillofacial penetrating arrow injury and analyze the problems faced in its management with emphasis on diagnostic imaging, on surgical planning and on careful surgery management.

Keywords: maxillofacial region, penetrating facial injury, penetrating neck injury, arrow injury, foreign body

Introduction

The arrow is one of the oldest weapons invented, and it has ties back to ancient civilizations [1]. This initial practical application of the arrow has been replaced by the firearm and many trauma surgeons of modern times do not acquire experience with arrow wounds [2]. Currently injuries due to arrow are very rare in developed countries but are commonplace in the Eastern Democratic Republic of Congo's Tanganyika region, where living pygmies' communities, ancient inhabitants of the Congo Basin forests and considered as the most ancient people of the earth [3]. Pygmies used bows and arrows to attack Bantu communities during inter-community clashes because they complain to be subjected of massive land grabs [4]. While a fair amount of literature exists on maxillofacial penetrating injury involving guns and knives [5], research in dealing with maxillofacial arrow penetrating injury is uncommon and rarely reported. The management of maxillofacial penetrating traumatic injury by arrow is very challenging due to the nature and shape of the arrow, the difficulty of access and the close relationship of the arrow with important vessels and nerve making removal of the arrow even more dangerous. We describe a patient who presented with maxillofacial penetrating arrow injury and we analyze the problems encountered in its management with emphasis on the diagnostic imaging, on the surgical planning and on the surgical approach to remove the arrow.

Case report

A 40-year-old male farmer presented at Bukavu Provincial Referral Hospital with deeply lodged arrow in the left maxillofacial region (Figure 1). He was assaulted 10 days before presentation. The patient had been involved in an intercommunity dispute between Pygmies and Bantu. He came from Kalemie, a place located more than 500 kilometers away from Bukavu. He was conscious and lucid when he arrived. Physical examination showed a small puncture wound along the left nasolabial fold which was in the process of healing. The rest of examinations were normal with stable vital signs.

Fig. 1. Anterior view. Small puncture wound along the left nasolabial fold in process of healing (arrow).

Craniofacial plain radiographs and a computed tomography (CT) scan were performed. Lateral and anteroposterior view of plain radiograph showed an arrow that had penetrated the maxillofacial region though the left maxillary sinus towards the posterior triangle of the neck (Figure 2). Due to the location of the arrow on standard radiography, we decided to realize CT scan and CT angiography to evaluate the relationship between the arrow and majors vessels in the posterior triangle of the neck.

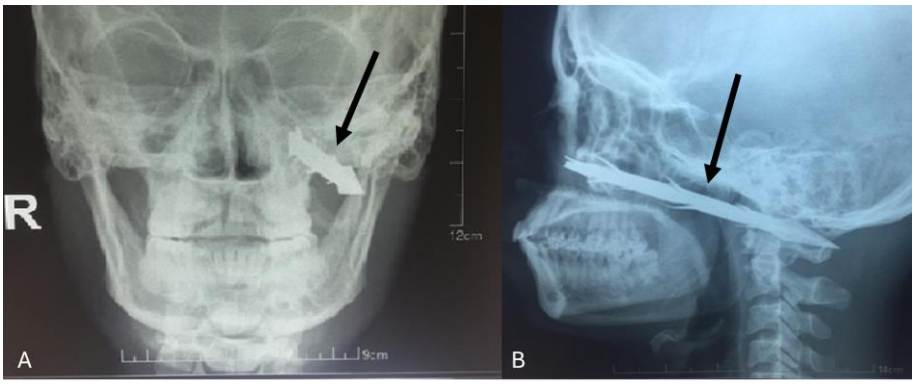

Fig. 2. Plain radiographs, frontal (A) and anteroposterior (B) view. Arrow: the tract of the arrow.

Axial CT scans and 3D reconstruction documented the trajectory of the arrow. The arrow had pierced the anterior wall of the left maxillary sinus, passes through the left maxillary sinus, pierces the posterior wall of the left maxillary sinus, and passes internally to the left ramus of the mandible towards the posterior triangle of the neck beneath the left mastoid process. The tip of the arrow was located laterally to the left transverse process of the cervical vertebrae beneath the mastoid process (Figures 3, 4). No lesions of major vessels were noted on CT angiography showing the arrow crossing the line of large blood vessels and narrowly missing the neurovascular bundles situated at this level (Figure 5).

Fig. 3. Axial CT scan showing the tract of the arrow (arrows). A. Metallic arrow crossing the left maxillary sinus. B. Metalic arrow crossing the left retromaxillary space.

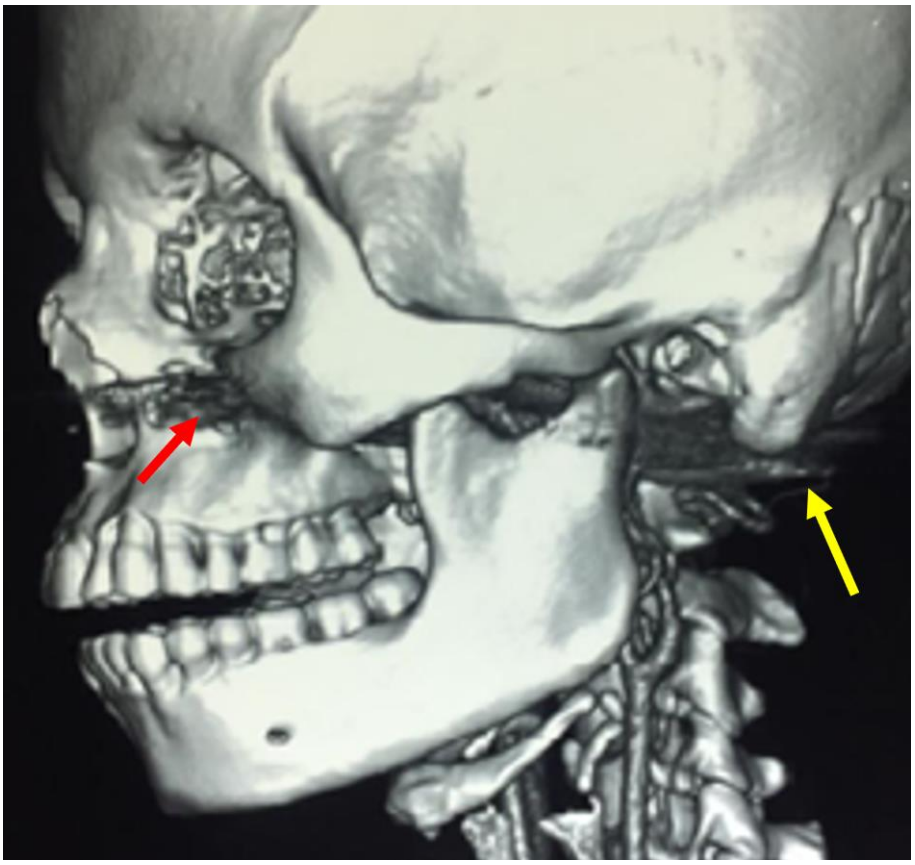

Fig. 4. Left 3D CT reconstruction. Red arrow: the entrance point of the arrow at the level of the anterior wall of the left maxillary sinus. Yellow arrow: the tip of the arrow at the level of the left mastoid process.

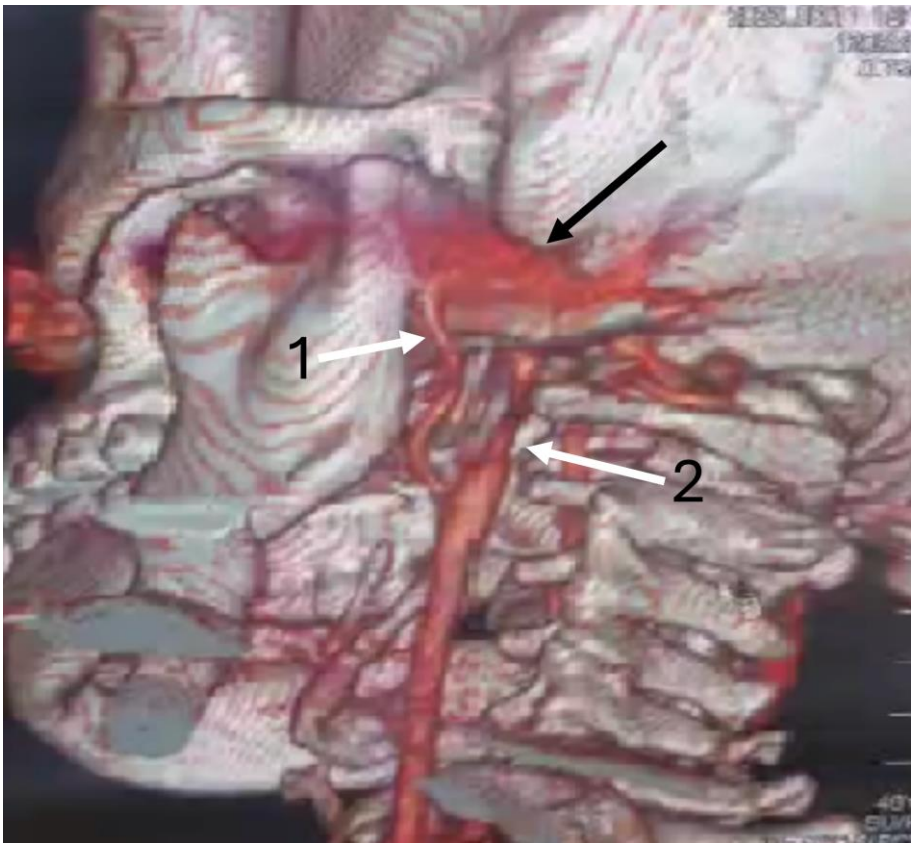

Fig. 5. CT angiography, 3D reconstruction, left view. Black arrow: the arrow crossing the pathway of major vessels (internal and external carotid artery). 1. External carotid. 2. Internal carotid.

As the arrow was deeply embedded in the posterior triangle of the neck beneath the mastoid process, we considered reasonable and safe to remove the arrow by a parotidectomy incision (Figure 6). Surgery was performed under general anesthesia and endotracheal intubation. On the left side of the patient, the parotidectomy incision was used (cervicomastoidfacial incision) which offers an excellent surgical access to the parotid gland, to the common carotid artery, to his two branches (internal and external carotid arteries) and to internal jugular vein, to the facial nerve, to the spinal nerve, and to the hypoglossal nerve (Figure 7). A careful dissection through the sternocleidomastoid muscle, through the posterior belly of digastric and through the stylohyoid muscle was made to expose the tip of the arrow (Figure 7). The arrow was removed by pulling it gently by the tip forward with upmost care to avoid any neurovascular damage (Figure 8). The arrow was 13 cm long and 1 cm wide. An interesting observation showed that the arrow was serrated (Figure 9). We irrigated the wound with standard 0.9% saline solution to eliminate debris; the

wound was sutured layer by layer and a corrugated drainage was left in the wound for two days. The patient had transient facial nerve deficit and was discharged on the fifteenth postoperative day, with disappearance of facial paralysis. He was given tetanus prophylaxis, analgesics and antibiotics.

Fig. 6. Left preoperative view. Arrow: The cervicomastoidfacial incision.

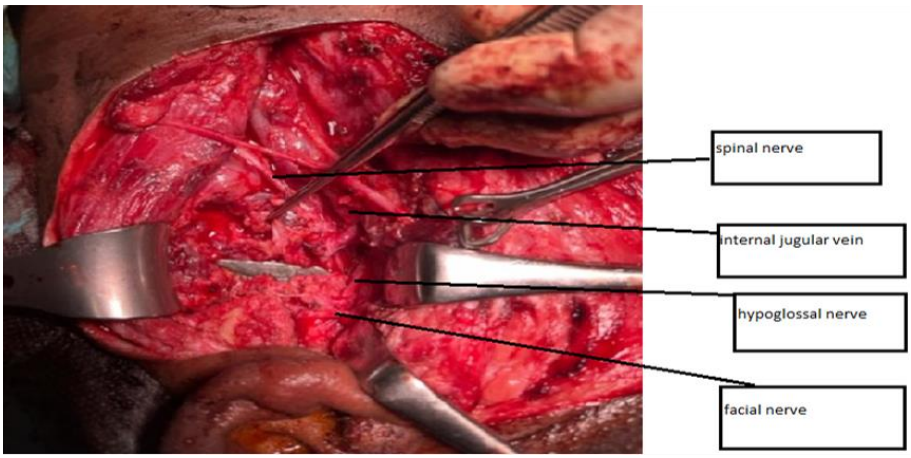

Fig. 7. Left peroperative view. Clear surgical access to different key structures.

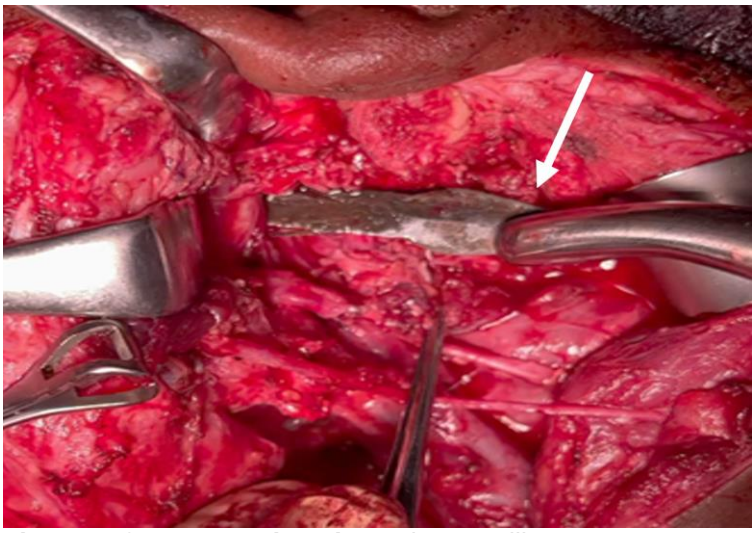

Fig. 8. Left peroperative view. The metallic arrow was removed by pulling on its tip (arrow).

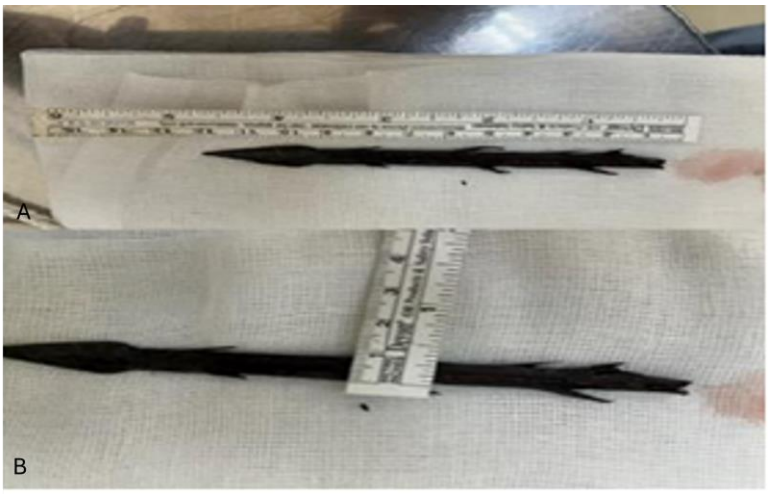

Fig. 9. Barbed arrow. A. The length of the arrow was of 13cm. B. The width of the arrow was of 1cm.

Discussion

The management of penetrating arrow in the maxillofacial region is a challenge due of the difficulty to access the arrow when it deeply lodged in maxillofacial region and due to its close relationship with vital structures. The neck contains many important structures belonging to the vascular, respiratory, digestive, and neural systems, so penetrating neck trauma can cause significant morbidity and mortality [6]. The arrow embedded with poison and located deeply in maxillofacial region must be removed as soon as possible because arrow causes severe wound infection and paralysis depending on the nature of poison and more especially when it reaches blood vessels [7]. In this case the arrow was lodged close to major vessels, therefore it was particularly important to remove it because it could later penetrate the vessel wall and cause severe bleeding.

For assessment of damage to vital structures, appropriate radiographic investigations must be performed because physical examination is not sufficient for determining the severity of the injury and to locate the arrow. In this case, the arrow was lodged deep within the soft tissues, making it difficult to locate the arrow by physical examination because the arrow escaped the palpation. As the patient arrived to the hospital after a long period (10 days), the entrance tract became obliterated, making more difficult to locate the arrow. As a minimum, two plain radiographs taken at right angle should be obtained in order to identify the tract and location of the arrow and its relation with vital structures. CT scan is a very important investigation because it can adequately and accurately delineate the tract and the location of the arrow. As many major vessels are present in the maxillofacial region, angiography is the standard of care in the identification of vascular injuries and to detail the

proximity of the object to large vessels. CT angiography (CTA) is an alternative approach. Damage to the vasculature should be initially suspected until otherwise proven. The CTA is accurate in detecting traumatic aneurysms, dissections and occlusions but in this case the CTA demonstrated that no discernible injury to the major vessels was observed (Figure 5). Appropriate imaging diagnosis can also provide useful information for planning surgical procedure and help to determine wise, safe treatment and the need for caution regarding retained arrow. The surgeon must prepare all necessary interventions to control the bleeding, ea. suturing any major vessels [8].

The surgical approach to remove the penetrating arrow in maxillofacial region can be performed in two ways depending on location, depth of penetration and relationship with vital structures: the anterograde or retrograde route. We choose to take anterograde approach by parotidectomy incision to remove the arrow because it makes sense to remove the deeply embedded arrow in the parotid region under the mastoid process by anterograde approach. Also, the arrow had barbs which not allowed retrograde removal to avoid more extensive neurovascular damage. The direction and number of barbs of the arrow are the other factor that determine the route for arrow removal. In this case arrow had posterior pointing barbs on each side, thus arrow with such posterior pointing barbs are better removed by an anterograde route, so posterior pointing barbs should not damage neurovascular structures.

Surgical extraction of penetrating arrow in maxillofacial region is conducted by the principle of trauma surgery including meticulous tissue dissection, adequate exposure, minimizing hemorrhage, prevention of additional injury, preservation of vital structures, debridement of death tissues, thorough wound irrigation, and application of drain depending on the depth of the wound [9].

Thorough knowledge of the vascular anatomy of the maxillofacial region is especially important. The exploration of neurovascular structures prior to removal of the arrow is of significance to avoid any injury and subsequent neurological impairment. Care should be taken to avoid causing further damage to adjacent structures during removal, especially when an arrow presents with barbs. Arrow with barbs is withdrawn in an anterograde direction along the line of its trajectory to avoid further injury to blood vessels and other structures [10]. Exploration of the wound after foreign body removal should then be performed with major irrigation of the site. When indicated, tetanos prophylaxis and appropriate perioperative antibiotics should be administered [11].

While the initial practical application of the arrow has been replaced by the firearm, it is still in use today in developing countries. Arrow must be removed as soon as possible to avoid infection and abscess formation. The complications of the surgery such as massive bleeding or iatrogenic injury must be considered in maxillofacial region and care should be taken to keep additional damage from extraction to a minimum.

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- **Informed consent**: Written informed consent was obtained from the patient for the publication of this case report and accompanying images.

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Masumbuko Mukamba Franck	Conceptualization, Investigation, Resources, Methodology, Data curation, Validation, Supervision, Writing original draft preparation, Writing review and editing
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Muhindo Busaba Liévin	Conceptualization, Writing original draft preparation, Writing review and editing
Cikomola Gulimwetuga Fabrice	Writing original draft preparation, Writing review and editing
Mubenga Mukengeshayi Léon	Writing original draft preparation, Writing review and editing

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