A rare case of a penetrating cranio-facial foreign body stuck in the skull base

Khadija Salama*, Karim Choukry1, Hicham Negham1, Youssef Oukessou1, Reda Arabi Abada1, Mohamed Mahtar1

ENT and Neck Surgery Department, University Hospital Center Ibn Rochd, Casablanca, Morocco

A R T I C L E   I N F O

Article history:
Received 19 January 2021
Received in revised form 12 February 2021
Accepted 1 March 2021
Available online 3 March 2021

Keywords:
Foreign body
Craniofacial wound
Penetrating
Endoscopic surgery
Case report

A B S T R A C T

INTRODUCTION: Penetrating craniofacial wounds due to foreign bodies, specifically sharp white blades, represent an eventual life threatening condition and a rare case of emergency facial surgery requiring a complex medical care. We report an original case of a penetrating craniofacial wound by a knife with a review of the literature concerning the tendencies, the complications and the specific medical care needed for these particular cranio-facial lesions.

PRESENTATION OF CASE: A 35 year old man admitted to our ENT emergency room with a penetrating craniofacial wound caused by a knife stuck in the cranio-orbital-nasal junction. A craniofacial profile x-ray showed the presence of the metallic foreign body, a knife, penetrating deeply to the base of the skull. Computed tomography showed that the transcranial metallic foreign body arrived in the right sellar region after passing through the nasal cavity and the right sphenoid sinus with hemosinus and supratorial pneumocephaly. The management consisted of multidisciplinary management, and the extraction was performed successfully under 3D endoscopic control.

CONCLUSION: The majority of penetrating craniofacial wounds secondary to foreign bodies, regardless of their size, are rarely associated with major neurological symptoms and their management must be adapted to their potential severity.

© 2021 The Authors. Published by Elsevier Ltd on behalf of IJS Publishing Group Ltd. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

1. Introduction

Craniofacial traumas are one of the most common clinical events of the 21st century. The possibility of associated injuries of the head and neck may determine functional and cosmetic problems in these patients [1].

In particular, penetrating injuries represent a rare but complex variety of craniofacial trauma, with a high life-threatening potential and a rare case of emergency facial surgery requiring a complex medical care [2]. The main causes are aggressions and fights [3]. This type of injury more commonly affects the torso and the limbs rather than the face and neck area both as a result of the far greater surface area of the former and the relative ease with which the etiologic agent can penetrate them without potentially lethal consequences; however, penetrating lesions of the head and neck are described [1].

Penetrating injuries of the maxillofacial region and the neck that result from assault are being seen with increasing frequency in towns usually during fights in clubs, pubs and on the streets. This type of injury may also result from other forms of trauma including road crashes, armed robbery and gunshot wounds. Materials commonly retained within the orofacial regions include pieces of glass, wooden fragments, knife blades and bullets. Penetrating injuries may be superficial or deep. Maxillofacial lesions after assaults and fights in developing countries are far more common in practice than the paucity of reported cases would indicate, but the objects used to inflict injuries seem to vary from one country to another [4].

The clinical presentation varies according to the foreign body (size, type, site of penetration, direction of the impact) but also depending to the associated lesions (cranial, ocular, sinusal and facial ones) [2].

We report a rare case of a cranio-facial penetrating wound due to a white blade stuck in the cranio-orbital-nasal junction, arriving to the opposite sphenoidal sinus. Our case report is relevant regarding the lack of clinical and therapeutic data concerning these lesions, and provides a complete anatomical and physiopathological description with a review of the literature on the optimal treatment and complication's prevention.

2. Case report

A 35 years old man with toxic habits, chronic smoker and alcoholic, without any other past medical and surgical history admitted...
in our ENT emergency department, after a familial fight, for a cranio-facial penetrating wound due to a white blade stuck in the cranio-facial junction (Fig. 1).

The clinical examination found a conscious patient, Glasgow 15/15, with a stable hemodynamic and respiratory state, no neurological deficit, with left orbital edema and bruises, a moderate bleeding from the wound, no oculomotor disorder, and no loss of visual acuity, no nasal obstruction or bleeding or issue of cerebrospinal fluid. Blood tests were run, a complete blood count showing a level of hemoglobin up to 10 d/l, a hemostasis assessment back normal and an identification of the blood group. A Skull X-ray - lateral view was done, showing the presence of the metallic foreign body, a knife, deeply penetrating until the skull base (Fig. 2).

The patient was admitted and hospitalized immediately. We started an intravenous prophylactic antibiotic treatment based on high dose Ceftriaxone with an antitetanus prophylaxis injections and painkillers. The cranio-facial injected CT scan showed the transcranial metallic foreign body arriving to the right sellar region after crossing the left frontal bone, the left ethmoidal notch, the nasal septum and the right sphenoidal sinus with hemosinus and a supertorial pneumoencephalus (Fig. 3a,b). The left eye-ball and optic nerve were intact. We couldn't evaluate vascular structures (specifically, the right internal carotid artery) because of the important artifact caused by the metallic nature of the foreign body.

24 h after admission, the extraction of the foreign body was performed under general anesthesia and lasted 4 h, by a multidisciplinary team composed by ENT surgeons, neurosurgeons, ophthalmologists, maxillofacial surgeons in addition to the anesthesiologists. The first surgical time was based on the right cervical area in order to expose the carotid bifurcation for an eventual saving move, a vascular ligature if needed to control an abundant bleeding from a possible traumatized vessel in the wound territory.

The second surgical time was based on an endoscopic nasal approach using 3D endoscopy. After a preparation of the nose by Xylocaine Naphazoline 5%, a bilateral ethmoidectomy was performed, followed by a trans-ethmoidal sphenoïdolity, associated with a posterior septectomy to enlarge the working zone (Fig. 4a,b).

The sharp foreign body was controlled until its entrance at the anterior wall of the of controlateral sphenoidal sinus, a flush drilling was pursued until the exposure of the point of the knife 2 mm from the right internal carotid. The knife was mobilized endoscopically and extracted by the external approach (Fig. 4c).

The endonasal exploration didn’t find any active bleeding; the skull base was intact, with no visible breach and no issue of cerebro-spinal fluid. The left medial orbital wall was intact and the intraoperative ophthalmological examination didn’t find any lesion in the lachrymal duct or in the eye ball. A careful hemostasis was assured.

The postoperative follow up was simple with a full recovery within 6 days (Fig. 5). No complication was noted 12 months after.

This work has been reported in line with the SCARE 2020 criteria [5].

3. Discussion

Traumatic cranio-facial foreign bodies represent a rare entity threatening the ocular, cerebral and vasculo-nervous structures. The majority of these lesions seem to be caused by metallic objects such as knitting needles, nails, keys and hooks [6].

The clinical situation of penetrating injuries may be accompanied by various pathologic conditions such as bone fractures, vascular lesions, or neurologic deficits. However, there can be no doubt that penetrating wounds of the head and neck are potentially more lethal than those affecting other parts of the body [1]. The eyelids, the canthus, the conjunctiva and the cornea are the usual gateway of the penetrating intracranial trans orbital wounds. Our case shows that also, the paralatero-nasal region can be an entrance site through the nasal cavities. The direction and the strength of penetration of the sharp object are the main factors that influence the type of the wound [7].

The expected complications are the visual consequences secondary to a lesion of the eye-ball, the cranial nerves palsy, the severe infections as meningitis and cerebral abscess, the cerebral contusion and hematoma, the vascular lesions, specially the traumatic aneurysm occurring after 2 or 3 weeks [8,9]. Cerebro-spinal fluid leaks need to be extensively explored to provide a watertight closure, either by direct closure of dural defects or by using grafting materials [2]. Infectious complications are not uncommon after penetrating brain injury, and they are also associated with higher morbidity and mortality rates. The risk of local wound infections, meningitis, ventriculitis, or cerebral abscess are particularly high among these patients because of the presence of contaminated foreign objects, skin, hair, and bone fragments driven into the brain tissue along the projectile track [10].

The early admission in a hospital structure helps to decrease considerably the morbidity and mortality. A complete physical examination, including neurological and ophthalmological, is important and necessary for the lesion diagnosis leading to the appropriate treatment for every patient with a penetrating cranio-
facial trauma. Immediate radiological examination is mandatory because small entrance wound usually does not correspond with size of the foreign body and associated intracranial injury, it’s a very useful to identify the fractures and to delineate the depth and direction of penetration specially when weapon is in situ [11]. The CT scan shows a clear delineation of the cranio-facial bones and is efficient to detect bony fractures. It also precisely evaluates the localization of the foreign body, helping in the surgical planning. The cerebral angiography allows to detect the vascular lesions while it still a debate between surgeons regarding the optimal moment to realize it [12]; Nathoo and al observed that the cerebral angiography at the first day of the admission of the patient returned normal, while the autopsy revealed an aneurysm of the communicant posterior artery that wasn’t discovered [13].

The MRI can only be used when the penetrating foreign body is not magnetic, because the MRI can mobilize the object aggravating the wound [14]. Considering the rarity of the condition, the treatment protocol is often individualized. However, in the beginning, the most appropriate management on the field is to let the foreign object in situ and to transport the patient cautiously to a specialized center. A preparation with a management of the hemodynamic state should be started at the admission of the patient [15].

The management of cranio-facial wounds due to foreign bodies should follow the basic surgical principles, including the extraction of the foreign body under direct visual control in order to avoid or reduce the damage done to cerebral tissue.

Fig. 3. (a) Transcranial metallic foreign body crossing the left ethmoidal notch, the nasal septum and the right sphenoidal sinus with hemosinus and sus tentorial pneumocephalus after crossing the frontal bone.
(b) 3D scan reconstruction showing the site of the penetration of the blade.
A trans-orbital, transcranial, or endonasal approach can be chosen, or we can combine different technics according to the location of the foreign body [16]. A dilemma exists as to how aggressive such injuries should be managed and whether a minimally invasive surgical approach [17].

In our case, we chose an endoscopic trans-ethmoidal approach because there was no sign of intracranial bleeding and neurosurgical assistance was available if needed.

After the extraction of the foreign body, a complete debridement should be done with the ablation of all the bony fragments and foreign matters, the hematoma should be evacuated followed by a careful hemostasis in the entire wound trajectory. If there is evidence of a dural breach, it should be plugged or closed [16].
The antitétan prevention is necessary for all types of foreign bodies and prophylactic antibiotic treatment is systematic [18].

4. Conclusion

Excepting high speed wounds, the majority of penetrating cranio-facial wounds secondary to foreign bodies, no matter their size, are rarely associated with major neurological symptoms and their management should be adapted to their potential severity.

Declaration of Competing Interest

The authors report no declarations of interest.

Sources of funding

None.

Ethical approval

The study is exempt from ethical approval in our institution as it is a “Case report” and not a research study.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Author contribution

K. SALAMA: Investigation, Resources, Writing - original draft, Writing – Review & Editing, Visualization. K. CHOUKRY: Investigation, Resources, Writing – Review & Editing. H. NEGHAM: Investigation, Resources, Writing. Y. OUKESSOU: Review & Editing. R. Abada: Validation, Supervision. M. Roubal: Validation, Supervision. M. Mahtar: Validation, Supervision.

Registration of research studies

Not applicable.

Guarantor

K. SALAMA.

Provenance and peer review

Not commissioned, externally peer-reviewed.

References

[1] P. Costa Ferreira, A. Santa-Colomba, R.F. Barbosa, et al., Cervical impalement injury, J. Craniofac. Surg. 15 (2004), 851Y854.
[2] W.S. Paiva, F. Saad, E.S. Cravalhal, R.L. Amorim, E.G. Figueiredo, M.J. Teixeira, Transorbital stab penetrating brain injury: report of a case, Ann. Ital. Chir. 80 (2009) 463–465.
[3] O. Giraud, N. Teysseres, M. Brachet, Traumatismus maxillo-faciale, EMC (Elsevier Masson SAS), Paris, 2007, Médecine d’urgence, 25–200–C–30.
[4] H.O. Olajjo, A.A. Tahir, A. Ahidjo, A. Madziga, Penetrating arrow injuries of the maxillofacial region, Br J. Oral Maxillofac. Surg. 43 (August 4) (2005) 329–332, http://dx.doi.org/10.1016/j.bjoms.2004.10.026, PMID: 15993286.
[5] R.A. Agha, T. Franchi, C. Sohrabi, G. Mathew, for the SCARE Group. The SCARE 2020 guideline: updating consensus Surgical Case Report (SCARE) guidelines, Int. J. Surg. 84 (2020) 226–230.
[6] J.T. Jacob, A.A. Cohen-Gadol, C.O. Maher, F.B. Meyer, Transorbital penetrating brainstem injury in a child: case report, J. Neurosurg. 102 (3 suppl) (2005) 350–352.
[7] R.E. Turbin, D.N. Maxwell, P.D. Langer, et al., Patterns of transorbital intracranial injury: a review and comparison of occult and non-occult cases, Surv. Ophthalmol. 51 (2006) 440–460.
[8] Y. Nishio, N. Hayashi, H. Hamada, Y. Hirashima, S. Endo, A case of delayed brain abscess due to a retained intracranial wooden foreign body: a case report and review of the last 20 years, Acta Neurochir. (Wien) 146 (8) (2004) 847–850.
[9] S. Yeh, R. Foroozan, Orbital apex syndrome, Curr. Opin. Ophthalmol. 15 (6) (2004) 490–498.
[10] G.A. Grant, Management of penetrating head injuries: lessons learned, World Neurosurg. 82 (1–2) (2015) 25–26.
[11] F.H. Chowdhury, et al., Nonmissile penetrating injury to the head: experience with 17 cases, World Neurosurg. 94 (2016) 529–543.
[12] M.S. Walid, J.C. Velverton, J.S. Robinson Jr., Penetrating orbital trauma with internal carotid injury, South. Med. J. 102 (1) (2009) 116–117.
[13] N. Nathoo, H. Boodho, S.S. Nadi, S.R. Naidoo, E. Gouws, Transcranial brainstem injuries: a retrospective analysis of 17 patients, Neurosurgery 47 (5) (2000) 1117–1122, Nathoo.
[14] M. Domeniciucci, R. Gasho, P. Ciappetta, T. Vangelista, R. Delfini, Surgical treatment of penetrating orbito-cranial injuries. Case report, J. Neurosurg. Sci. 43 (1999) 229–234.
[15] K. Ssexx, D. Koppel, M. Fitzpatrick, A. Pyott, Trans-orbital penetrating head injury with a door key, J. Cranio-maxillofac. Surg. 25 (1997) 353–355.
[16] Surgical management of penetrating brain injury, J. Trauma 51 (suppl 2) (2001) S16–S25.
[17] Mohamed El Sayed, Reem Hassan Saad, Ahmed Ferreir, Undiagnosed impacted knife blade from a penetrative orbital injury: a case report, Int. J. Surg. Case Rep. 53 (November) (2018).
[18] R. Bayron, J. de Louvois, E.M. Brown, et al., Use of antibiotics in penetrating cranio-necerebral injuries, Lancet 355 (2000) 1813–1817.