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Pneumocephalus after surgical treatment of NOE fracture: Case report

Pneumoencéfalo após tratamento cirúrgico de fratura NOE: Relato de caso

Neumoencéfalo postratamiento quirúrgico de fractura NOE: Reporte de caso

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Abstract
Introduction: Naso-orbital-ethmoidal fractures are complex fractures involving the bones of the nose, orbit region, maxilla and ethmoid. This complex structure has a close relationship with the brain and the orbital region, which frequently suffer injuries during trauma. Among traumatic brain injuries, there is the pneumoencephalon. The present study aims to report the treatment of a patient who suffered an accident involving a rural animal. Case Report: A 63-year-old male patient was brought to the highly complex hospital for the Oral and Maxillofacial Surgery and Traumatology service, five days after the trauma. The physical examination showed traumatic telecanthus,anisocoria and mydriasis of the right eye, right eyelid ptosis, laceration in the right eyebrow and deviation of the nasal bone to the left. In the imaging exam (computed tomography), traces of fractures were observed in the nasal bone region, medial orbital wall, infra-orbital margin, frontal-zygomatic pillar and right orbital blow out fracture. After a surgical approach to fix the fractures, it was observed the development of a hypodense area in the intracranial region, suggestive of pneumocephalus. Conclusion: These complications, such as pneumocephalus, must be diagnosed early and appropriate treatment must be started as soon as possible to reduce possible sequelae, requiring the intervention of a multidisciplinary team**.**
Keyword: Facial injuries; Brain injuries, traumatic; Fracture fixation.

Resumo
Introdução: As fraturas naso-orbital-etmoidais são fraturas complexas envolvendo os ossos do nariz, região da órbita, maxila e etmóide. Essa estrutura complexa tem estreita relação com o cérebro e a região orbitária, que frequentemente sofrem lesões durante o trauma. Dentre os traumatismos cranioencefálicos, destaca-se o pneumoencéfalo. O presente estudo tem como objetivo relatar o atendimento de um paciente que sofreu um acidente envolvendo um animal rural. Relato de caso: Paciente do sexo masculino, 63 anos, foi conduzido a um hospital de alta complexidade e pronto-atendimento pelo serviço de Cirurgia e Traumatologia Buco-Maxilo-Facial cinco dias após o trauma. O exame físico evidenciou telecanto traumático, anisocoria e midríase do olho direito, ptose palpebral direita, laceração no supercílio direito e desvio do osso nasal para a esquerda. No exame de imagem (tomografia computadorizada), foram observados vestígios de fraturas na região do osso nasal, parede medial da órbita, margem infra-orbitária, pilar fronto-zigomático e fratura blow-out da órbita direita. Após abordagem cirúrgica para correção das fraturas, observou-se o desenvolvimento de área hipodensa na região intracraniana, sugestiva de pneumoencéfalo. Conclusão:Essas complicações, como o pneumoencéfalo, devem ser diagnosticadas precocemente e o tratamento adequado deve ser

iniciado o quanto antes para reduzir possíveis sequelas, sendo necessária a intervenção de uma equipe multidisciplinar.
Palavras-chave: Lesões faciais, Lesões cerebrais traumáticas; Fixação de fraturas.

Resumen

Introducción: Las fracturas naso-orbitarias-etmoidales son fracturas complejas que involucran los huesos de la nariz, la región de la órbita, el maxilar superior y el etmoides. Esta compleja estructura tiene una estrecha relación con el cerebro y la región orbitaria, que frecuentemente sufren lesiones durante los traumatismos. Entre las lesiones cerebrales traumáticas, se encuentra el neumoencéfalo. El presente estudio tiene como objetivo relatar el tratamiento de un paciente que sufrió un accidente con un animal rural. Reporte de un caso: Paciente masculino de 63 años fue llevado al hospital de alta complejidad para el servicio de Cirugía Oral y Maxilofacial cinco días después del traumatismo. Al examen físico se objetivó telecanto traumático, anisocoria y midriasis del ojo derecho, ptosis palpebral derecha, laceración en ceja derecha y desviación del hueso nasal a la izquierda. En el examen imagenológico (tomografía computarizada), se observaron rastros de fracturas en región ósea nasal, pared orbitaria medial, margen infraorbitario, pilar frontal-cigomático y fractura por estallido orbitario derecho. Tras un abordaje quirúrgico para la fijación de las fracturas, se observó el desarrollo de un área hipodensa en la región intracraneal, sugestiva de neumoencéfalo. Conclusión:Estas complicaciones, como el neumoencéfalo, deben ser diagnosticadas de forma precoz e iniciar cuanto antes el tratamiento adecuado para reducir posibles secuelas, requiriendo la intervención de un equipo multidisciplinar.
Palabras clave: Lesiones faciales; Lesiones cerebrales traumáticas; Fijación de fracturas.

1. Introduction

Naso-orbital-ethmoidal fractures are complex fractures involving the bones of the nose, orbit region, maxilla and ethmoid, where the oral & maxillofacial surgeon can treat together, when necessary, with an ophthalmologist and neurosurgeon due to possible eye and neurological, respectively, injuries (Pisano & Tiwana, 2019). From the anatomical point of view, its anterior component consists of a bony pillar formed by the frontal process of the maxilla, nasal process of the frontal bone and proximal nasal bones. Other boundaries include the medial orbital walls and the cribriform plate superiorly (Mehta et al. 2012).

This complex structure has a close relationship with the brain and the eyes, which are often injured during trauma. Although several surgical approaches to NOE fractures have been described, a compromise on the most appropriate technique to reestablish the aesthetics and functions of the structures involved is still challenging, as is the case of the midfacial degloving (MFD) approach that provides exposure to the middle skeleton of the face, as an access route to that region.

Thus, although there are several classification for NOE fractures, the Markowitz classification has been widely adopted. This classification groups the fractures into 3 types, depending on the degree of comminution of the central fragment and the status of fixation of the medial canthal ligament (MCL). Type I fractures have a single central fragment with an attached tendon. Type II fractures have a central segment with a higher degree of comminution and the ligament remains connected to a smaller bone fragment. Type III fractures have a more fragmented central segment and the loss of insertion of the medial canthal ligament (Markowitz & Manson, 1989). The aim in the treatment of these injuries include restoration of the projection of the nasal dorsum; orbital border contours; orbital volume; and, mainly, the intercantal distance.

The traumatic telecanto, for example, is a very common sequel proceeding from this type of fracture, presenting itself as an increase in intercantal distance, related to the loss or not of the insertion of the medial cantal tendon (MCT) (Pawar E (Pawar & Rhee, 2014; Rosenberger et al. 2013). Coronal access is commonly used to provide sufficient exposure to perform the restoration of NOE fractures. However, when the fracture involves the need to reconstruct the lateral infraorbital margin, for example, the coronal access may not be sufficient to achieve the desired exposure, making it necessary for a combined periorbital access. In addition, some fractures need to increase additional skin incisions, such as infraorbital, subciliary, transconjunctival and / or lateral edge of the orbital region incisions (Cultrara et al. 2004).

During the physical examination of palpation, it was verified that the structure of the bones of the nose was maintained, observed a flattening of the nasal dorsum and an increased intercantal distance. If the intercantal distance

2. Methodology

The presente study addresses the case of a patient, in a descriptive and qualitative discussion (Pereira, et al., 2018), with maxillofacial trauma, with the aim of detailing the treatment of the patient's initial condition and postoperative complication, being authorized by the patient through a Free and Informed Consent Term prepared in proper language to obtain knowledge about the destination of the personal information collected in addition to the risks and benefits for such.

The present study aims to offer a brief literature review, through the search of scientific articles and case studies in the MEDLINE, PubMed and Scholar Google databases, on the diagnostic methods and clinical treatment planning of pneumocephalus..

3. Case Report

A 63-year-old male patient, victim of an accident with a rural animal (horse kick), attended a hospital of high complexity for the service of Oral & Maxillofacial Surgery and Traumatology, five days after the trauma. During anamnesis, denied allergies and underlying diseases. Physical examination showed traumatic telecanthus , anisocoria and mydriasis in the right eye, right eyelid ptosis, laceration in the right eyebrow and a deviation of the nasal bone to the left.

The patient complained of diplopia, nasal obstruction and anosmia. On complementary image examination (Computed Tomography), traces of fractures were observed in the nasal bone region, medial orbital wall, infra- orbital margin, frontal-zygomatic pillar and a right blow out was evident. In addition, a hypodense area in intracranial region was suggestive of pneumoencephalus. Furthermore, the opinion of neurosurgery and ophthalmology was requested, where the patient was monitored by the neurosurgeons for regression of the pneumoencephalus; ophthalmology. In regards of thefractures of the facial bones, a naso-orbital-ethmoid (NOE) fracture was diagnosed, requiring surgical treatment. For surgical treatment, a coronal access with pre-auricular extension wasperformed, using the ear helix as a reference, 5 cm behind the hairline (Figure 1).

The elevation of the superficial coronal flap was performed to the aponeurotic galea to a point of 3 to 4 cm above the supraorbital margin. Then, the sub-periosteal flap was exposed and the fractured areas were detached. As there was integrityof the upper 1/3 of the face, it was followed to restore the intercantal space through cantopexy and fixation of the nasal dorsum with a 1.5mm “Y” plate as well as in the fronto-zygmatic region. Also, a sub-tarsal access to fix the infraorbital margin and reconstruct the defect in orbital floor with titanium mesh was used to enhance the surgical treatment (Figure 2).

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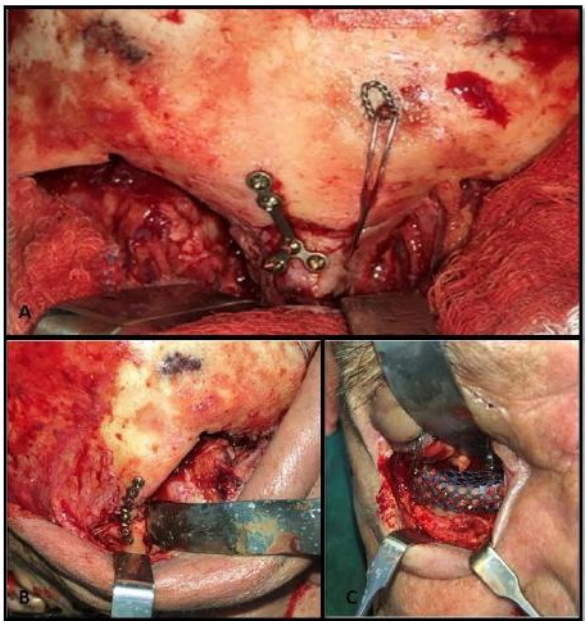
Figure 1: Coronal access showing the region of the naso-orbito-ethmoidal fracture and the fronto-zygomatic buttress.

Source: Authors.

Figure 2: A. Cantopexy with a steel wire no.: 01 and fixation of the fronto-nasal fracture with titanium plates of the 1.5mm system. **B.** Fixation of theright fronto-zygomatic fracture with 1.5mm system plate and screws. **C.** Reconstruction of the right orbital floor with titanium mesh.

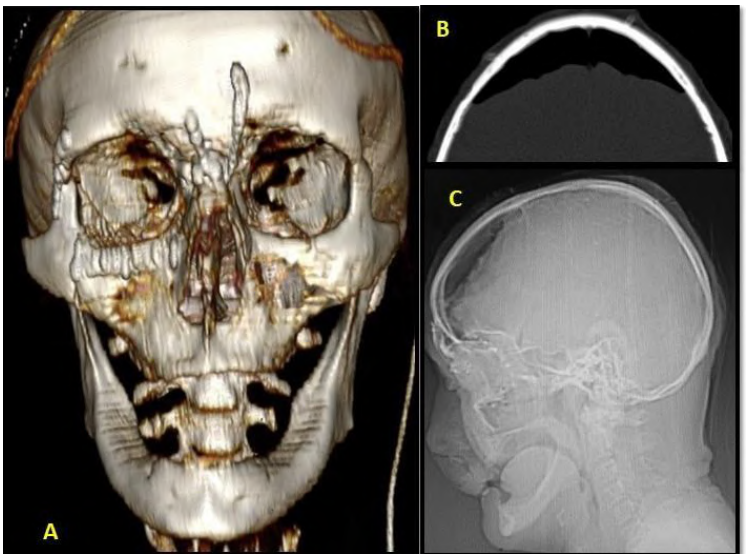


Source: Authors.

In the postoperative period, the patient evolved with no visual complaints. In the postoperative control, although the patient did not present any complaints, it was observed in computed tomography (CT) that, despite the fractures having been well reduced, the patient developed significant pneumoencephalus, with risks of bringing neurological damage, in which case was requested for treatment with neurosurgeon who used a conservative monitoring, hydration with 0.9% saline solution, analgesia and routine CT scans (Figure 3).

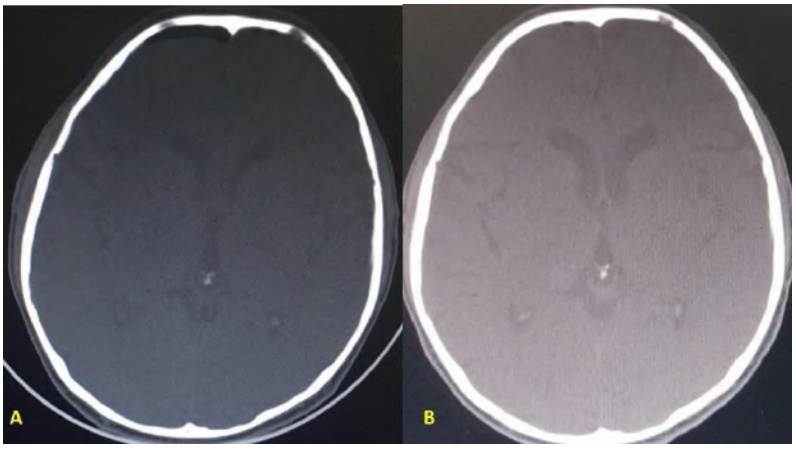
In the postoperative follow-up, a pneumoencephalic regression was observed with 7 days, 15 days, 21 days and 1 month where was observed an almost full regression (Figure 4).

Figure 3 - A. 3D computed tomography, immediate postoperative period. **B.** Computed tomography in an axial view showing a hypodense area inthe frontal region, suggestive of intra-cranial air. **C.** Profile radiography showing a radiolucent area in the intracranial frontal region suggestive of pneumocephalus



Source: Authors.

Figure 4 - A. Day 15: postoperative computed tomography scan showing regression of the pneumocephalus. **B.** Computed tomography of the 1st month after surgery, where there is an absence of intracranial air.



Source: Authors.

4. Discussion

In view of the study, we can classify the fracture as TYPE II. The surgical treatment of NOE fractures is classified as TYPE I, TYPE II and TYPE III. TYPEI fractures are characterized by having only a single central and intact fragment that has the medial tendon inserted, in most cases it does not require surgical intervention, only follow-up; TYPE II are comminuted fractures but still have the medial tendon inserted in its bone base; TYPE III there is also a bone comminution but the medial canthal tendon is disincinced.This type of fracture is more challenging, making cantopexy necessary (Pawar & Rhee, 2014).

Skull and face radiographs have long been used to arrive at the diagnosis of NOE fractures. Currently, computed tomography allows a better diagnostic hypothesis, since it offers images in sections without overlapping, being fundamental for the treatment of the fractures in question (Freess & Suozzi, 2009). Based on this study, computer tomography was used as an auxiliary diagnostic method. The coronal flap offers greater access to injuries and bone fractures, when regarding a trauma

victim, such as the case in question. The surgical treatment performed by the coronal flap, however, has consequences and complications that may involve short-term complications, such as intracranial bleeding and infections, as well as long-term changes, which may be mucoceles, brain abscess and scarring that impair the aesthetics of the patient.[1]The patient under study presents himself in 06 months of follow-up without complications. The treatment of these types of fractures can be the cause of brain complications such as the pneumoencephalus. This ,when small, is asymptomatic and has no mass effect, which in these cases could benefit from conservative treatment , and has no need for the need for surgical approaches (Parreira, 2011).

There are several treatment modalities for pneumoencephaus, such as treatment with O2 supplementation that is commonly used, and that, as the literature shows several case reports in which accelerated resolution of intracranial air collections was presented (Schirmer et al. 2010). In the report in question, the regression of the pneumoencephalus and its symptoms occurred through monitoring with CT scans and hydration with 0.9% saline, without the need for surgical intervention. There are many reports on the incidence and etiology of NOE fractures due to the great importance of the subject for professionals working in the area. This type of fracture corresponds to about 9 to 10% of face fractures.

Therefore, there is a high number of cases, in addition to this data, if not properly treated, this kind of fracture can cause important aesthetic and functional sequelae. NOE fractures often result from motor vehicle acidentes (Pawar & Rhee, 2014). From a large sample of fractures, a rate of 70% of NOE fractures are related to car accidents, 20% with physical aggressions and the others caused by falls, industrial, sporting accidents and accidents with animals (Lima, 2015). The report under study is of a horse kick in a rural area. These fractures are relatively uncommon compared to other facial injuries, representing about 5% to 15% of all facial fractures. They mainly affect male patients aged 20 to 30 years, being rare in children.

This and other typesof fractures can be caused as a result of impacting forces directed on the anterior region of the skull, and bone communication can be observed in cases of projectiles by firearms and work accidents, as it is a small area receiving a large amount of strength.[11] Several authors have reported the traumatic origin as being responsible for 74% to 90% of cases of pneumocephalus. The incidence has been estimated between 0.5% to 1.0% of cases of traumatic brain injury (TBI) (Onur et al. 2009).

5. Conclusion

As much as wide accesses are indicated, there is a possibility of complications which can lead the patient to life-threatening scenarios. These complications, such as pneumocephalus, should be diagnosed early and appropriate treatment should be initiated as soon as possible to reduce eventuals sequelae, requiring the intervention of a multidisciplinary team

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