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Barotraumatic blowout fracture of the orbit after sneezing: Cone beam CT demonstration

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Abstract

A 40-year-old man with no history of trauma or previous sinus surgery complained sudden right diplopia after vigorous sneezing. The patient was submitted elsewhere to a MRI study for persisting diplopia, with inconclusive findings. One week later the patient was submitted to a maxillofacial cone beam CT (CBCT) in our Institution. A blowout fracture of the right orbital floor and lateral orbital wall with an intact orbital rim and a ipsilateral maxillary sinus effusion with an air liquid level, were detected at the CBCT study. Our conclusion, confirmed by the clinician, was the patient had a barotraumatic, isolated, pure blowout fracture of the right orbit consequance of the episode of vigorous sneezing. The patient was treated by steroid and antibiotic therapy and diplopia resolved after two weeks. Clinicians and radiologists should be aware that a barotraumatic blowout fracture of the orbit after sneezing should be included among the unusual causes of sudden diplopia. *Clin Ter 2018; 169(6):e265-268. doi: 10.7417/CT.2018.2089*

Key words: *Cone beam CT, Diplopia, Fracture, Orbit, Sneezing*

Introduction

Blowout fracture of the orbit is usually linked to facial trauma injuries (1). Rarely this type of orbital fracture is related to sneezing in patients with no history of trauma or sinus surgery (that instead are the most frequent causes of diplopia, the principal symptom of our patient; 2, 3), and to date just one case with associated orbital emphysema has been reported in the literature (4). Cone beam CT (CBCT) is widely used in the diagnosis of hard tissue anomalies of the maxillofacial district, however its use in maxillofacial trauma is limited and just one extensive study is available only for minor injuries as nasal fractures (5). A case of barotraumatic blowout fracture of the right orbit after sneezing diagnosed by CBCT in a patient with no history of trauma or sinus surgery is reported.

Case report

A forty-year-old man complained sudden right diplopia after vigorous sneezing. No history of trauma or previous sinus surgery was reported by the patient. The patient was submitted elsewhere to a MRI study for persisting diplopia. On MRI a reduced size and a different shape of the right maxillary sinus with respect to the left maxillary sinus, a slightly increased vertical diameter of the right orbit with respect to the left orbit, and a round shape of the inferior rectus muscle on coronal sections (Fig. 1A) were present. A maxillary sinus effusion that was hyperintense on T1 with shading on T2 images was addressed as haemosinus (Fig. 1A-B). After gadolinium i.v. administration a strong peripheral enhancement of the maxillary sinus wall was noted (Fig. 1C).

One week later the patient was submitted to a maxillofacial CBCT (Scanora 3D, Soredex, Tuusula, Finland) with 90 kVp and 13 mA, 20 s rotation time, FOV 13 x 14.5 cm, 0.25 x 0.25 mm pixel size, at our Institution. A blowout fracture of the right orbital floor and lateral orbital wall with an intact orbital rim and a ipsilateral maxillary sinus effusion with an air liquid level were detected at the CBCT study (Fig. 2).

Our conclusion was that the patient had a barotraumatic, isolated, pure blowout fracture of the right orbit as a consequence of the episode of vigorous sneezing. The patient was thus treated by steroids and antibiotic therapy to reduce the risk of sinusitis and orbital cellulitis, invited to possibly avoid nose blowing, sneezing, coughing, and vomiting. Diplopia resolved after two weeks.

Discussion

Blowout fractures of the orbit occur when the fracture fragments extend beyond the orbit into the maxillary or

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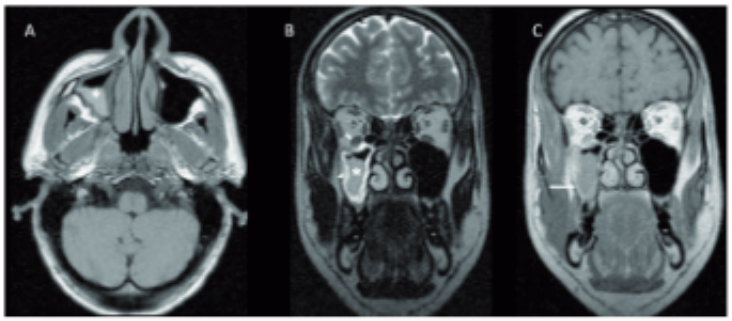

Fig. 1. MRI study.
A: axial T1w image. Hyperintense content of the right maxillary sinus (asterisk), with air liquid level.
B: coronal FSE T2w image. Ovalar shape of the right inferior rectus muscle (arrow). Hyperintense rim (arrowheads) of the right maxillary sinus with an intermediate intensity liquid effusion (aterisk).
C: coronal FSE T1w after gadolinium i.v. administration image. Enhancing rim (arrow) of the right maxillary sinus wall.

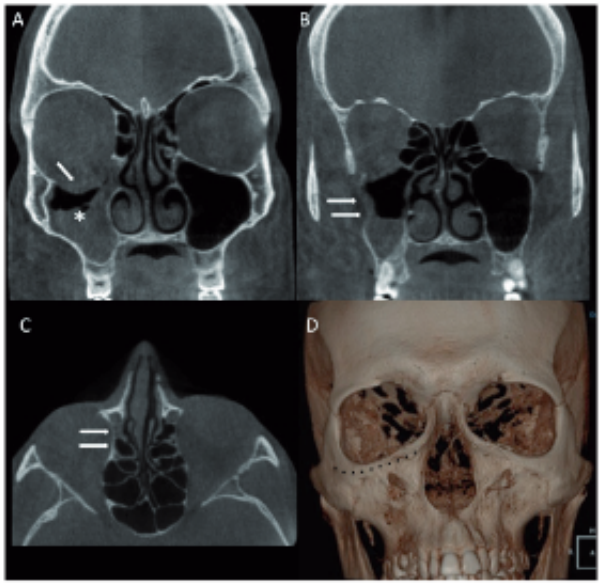

Fig. 2. CBCT study.
A: coronal MPR image. The right orbital floor is collapsed (arrow). Air liquid level (asterisk), in the right maxillary sinus.
B: coronal MPR image. Fracture of the lateral wall (arrows) of the right maxillary sinus.
C: axial MPR image. The right lamina papiracea (arrow) is intact.
D: 3D image. The right orbital rim (dotted line) is intact.

ethmoid sinus due to relative weakness of the inferior and medial wall of the orbit. An orbital blowout fracture is defined as pure if the orbital rim is intact, while the impure type involves the orbital rim and may be associated to zygomatic-maxillary fractures (1, 6). Orbital fractures are commonly related to blunt trauma occurring during motor vehicle accidents, falls, assaults, sport injuries and other traumatic events (7, 8). Isolated pure orbital wall fracture has a relatively low incidence, indeed it is diagnosed in only 13.3% of all facial bone fractures (1). A blowout fracture of the orbit is far less commonly related to sneezing (4) or nose blowing (9-13). Two theories are reported to explain the pathogenesis of orbital blowout fractures (13). The hydraulic theory assesses that fractures of the thin orbital floor are brought about by hydraulic forces, which cause posterior globe displacement and increased orbital pressure (14). The buckling theory states that a direct trauma to the inferior orbital rim may cause the buckle of the orbital floor (15).

Because no trauma was associated with the case we described, the hydraulic theory seems to explain its occurrence. In this case the compressed air forced through the nasal cavity should have energy enough to fracture the thin orbital walls as previously hypothesized by other authors (10, 13). High pressure can be in fact generated during nose blowing or sneezing as experimentally demonstrated both in healthy subjects and in patients with chronic sinusitis or septal deviation (16, 17), and the amount of energy produced is comparable to that needed to fracture the orbital floors obtained from human cadavers in an experimental study (13, 18). As far as we know, only one case of orbital blowout fracture after a protracted episode of vigorous sneezing has been previously reported in the literature, but it involved the medial wall of the orbit and was associated with orbital emphysema, ecchymosis of the right eye, pressure within the orbit, periorbital swelling, inflation of periorbital region and crepitus around the eye, but no pain or vision disturbance (4). In the patient we observed none of these symptoms -and among them especially orbital emphysema- was present, the blowout fracture involved the floor and lateral wall of the right orbit and main symptom complained was diplopia. Furthermore this is the first case studied by CBCT. The value of CBCT in the diagnosis of minor facial injuries as nasal fractures was previously demonstrated (5). In our patient a deformity of the right maxillary sinus with haemosinus and a slightly increased vertical diameter of the right orbit were detected by MRI, but a clear assessment of the thin orbital wall was not possible. CBCT correctly allowed to detect the isolated pure orbital blowout fracture, involving the floor and lateral wall of the right orbit, and effusion with an air liquid level in the maxillary sinus. The diplopia showed by our patient, which resolved after two weeks, could be related to the involvement of the right inferior rectus muscle, that, although not herniated in the maxillary sinus, showed a round shape on coronal MR images. As previously reported, this shape could be related to the involvement of the fascial sling of the inferior rectus muscle in the orbital floor defect (7). The incarceration of extraocular muscles within an orbital fracture is the most commonly reported cause for extraocular movement limitation and diplopia. In orbital blowout fracture diplopia is more frequently associated to a fracture of the orbital floor rather than of the lamina papyracea (1). However it was postulated that traumatic haemorrhage causes swelling of the posterior inferior orbital fat, which contains a network of venules and bands of fibrous tissue, connecting the inferior rectus and inferior oblique muscles to the periosteum of the orbital floor. The swelling creates strain in the fibrous connective tissue of the posterior inferior orbital fat and thus on inferior rectus and inferior oblique muscles with consequent diplopia (19). This mechanism could explain the resolution of diplopia after some weeks in our patient and in other series, where no incarceration of the inferior rectus muscle was observed although an orbital floor fracture was evident (1, 19). Radiologists and ENT physicians should be aware that a barotraumatic fracture of the orbit after sneezing should be included among the unusual causes of sudden onset of diplopia.

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