

Orbital Emphysema as a Result of Chest Tube Placement for Recurrent Pneumothorax

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Abstract

Iatrogenic orbital emphysema from chest tube insertion is a rare but potentially serious complication due to potential optic neuropathy from orbital compartment syndrome. Herein, we present a rare case of orbital emphysema in the setting of pneumothorax and chest tube insertion.

Introduction

Orbital emphysema refers to the infiltration of air or gas within the orbital soft tissue space. It is most commonly associated with a history of trauma or orbital wall fracture [1-3]. However, other mechanisms have been reported including infection, pulmonary barotrauma, and iatrogenic factors such as dental surgery [4]. Signs and symptoms include proptosis, crepitus, and diplopia presenting acutely or over the course of days to weeks [5, 6]. Although orbital emphysema typically follows a benign course and is self-limiting, in severe cases it can cause vision loss and require immediate intervention to prevent complications associated with orbital compartment syndrome [2, 7].

Herein, we present a case report of bilateral orbital emphysema in a single individual after chest tube placement for spontaneous pneumothorax. This case illustrates the potential for dramatic complications of such a procedure and the extensive pathways of communication along the fascial planes from the site of origin to the face and orbital region. This case report includes a review of the current literature.

Case Report

A 62-year-old Caucasian male with a past medical history of spontaneous pneumothorax in 2020 and emphysematous COPD presented to the emergency department (ED) for dyspnea. He was found to have a recurrent pneumothorax and chest tube was placed in the ED with significant improvement in symptoms and oxygen saturation. The patient was admitted to the medical floor and just a few hours later, the patient became tachypneic with moderate respiratory distress and elevated heart rate to 130-140 bpm. Oxygen saturation decreased to 85% on 2 liters of oxygen and was increased to 15 liters via non-rebreather. The chest tube was found to be dislodged and the patient was taken to surgery for chest tube replacement.

A few days later, the patient developed facial and bilateral periorbital edema. CT of the orbits revealed prominent bilateral orbital emphysema with subcutaneous emphysema of the right upper eyelid (fig. 1), and ophthalmology was consulted. The patient reported decreased vision in the right eye from eyelid swelling and closure. Corrected near visual acuity at the bedside was 20/25 (-1) OD and 20/20 OS. There was no relative afferent pupillary defect, ocular motility was full OU, and confrontation visual fields were full OU. Intraocular pressures were 14 mm Hg OD and 12 mm Hg OS. Examination revealed complete ptosis of the right eye with diffuse periorbital emphysema with crepitus. Otherwise, there was no proptosis and the

anterior segment exam was normal in both eyes. It was determined that the vision loss was purely due to the ptosis and not from an orbital compartment syndrome. The patient was reassured and observed throughout the course of his hospital stay. The eyelid edema and orbital emphysema improved without vision loss, pain, diplopia, or other signs of orbital compartment syndrome.

Discussion

Orbital emphysema is extremely rare in the absence of preceding trauma. A review of the literature identifies only a handful of cases in the absence of periorbital injury, and even fewer cases secondary to pneumothorax or iatrogenic factors such as chest tube thoracostomy [8-11]. Retrospective studies suggest that approximately 1 in 5 chest tube insertions for pneumothorax result in subcutaneous emphysema, but the phenomenon in which the subcutaneous air infiltrates soft tissue compartments of the neck and spreads to the face and eyes is comparatively scarce [12-14]. Nonetheless, orbital emphysema can pose significant morbidity in severe cases and urgent ophthalmic consultation is warranted to reduce the risk for vision loss.

To the authors' knowledge, most cases of orbital emphysema in the setting of pneumothorax [8-10] are associated with the presence of bronchopleural fistulas, which are indicated by air leak from a chest tube [8, 9]. It is thought that air travels via a fistulous tract into the mediastinum or the adjacent subcutaneous tissues and ascends via the vascular sheaths into the thoracic and cervical subcutaneous tissues, from which it can then ascend into the inferior orbital fissure, resulting in emphysema of the eyelids and orbit [7, 9]. Furthermore, as air drains from the pleural space via the chest tube, additional air may escape into the subcutaneous tissue at the chest tube site. This air can also ascend via cervical and thoracic fascial planes into the orbit. Thus, proper chest tube functioning and positioning should be checked if orbital or subcutaneous emphysema is present [9].

Treatment is aimed at preventing orbital compartment syndrome, a sight-threatening condition that can occur due to progressive orbital emphysema, leading to increased intra-orbital pressure. This increased pressure can compress the optic nerve or its vasculature, which can impede perfusion of the central retinal artery, resulting in loss of vision [2, 7, 11]. Management for orbital emphysema depends on close observation for orbital signs. Initial assessment includes visual acuity, degree of proptosis, extraocular muscle restriction, pain with eye movement, and intra-orbital pressure, for which intraocular pressure can be used as an index [7, 11]. However, it should be noted that normal intraocular pressures do not exclude orbital compartment syndrome [11]. Imaging is useful for confirming orbital emphysema. Though radiographs and ultrasound can be used, CT has proven to be the gold standard [15, 16]. Regarding treatment, patients with good visual acuity do not need interventions, as the condition typically resolves within 7 to 10 days [7, 17]. Careful monitoring for worsening signs of orbital involvement as well as prompt intervention are required to prevent permanent vision loss. Needle decompression or lateral canthotomy with or without cantholysis can be performed [7, 17, 11]. In addition, the use of "fish gill" incisions for the placement of corrugated drains has been described as a novel surgical technique for treating progressive orbital emphysema [18].

In the case presented here, immediate intervention for the patient's orbital emphysema was not warranted. Per the four-stage clinical classification of orbital emphysema proposed by Hunts et al., our case would be categorized as stage I orbital emphysema with standard protocol consisting of observation only [2]. The patient's reported symptoms included blurry vision and minimal eyelid swelling, with gradual improvement in vision since onset. An absence of proptosis, dystopia, significant visual compromise, rise in intraocular pressure, or central retinal artery occlusion meant that a conservative approach without escalation in management was indicated.

Conclusion

Orbital emphysema is a rare complication of chest tube insertion in the setting of pneumothorax. It usually has a benign, transient course. However, because severe orbital emphysema is associated with significant morbidity secondary to orbital compartment syndrome, rapid diagnosis and intervention is crucial. Review of the literature presents several reports with techniques for management. The present case highlights the need for thorough evaluation for orbital emphysema in the setting of chest tube insertion for pneumothorax;

doing so prevents vision loss.

Statements

Preregistration of Studies

The present study was not preregistered in an independent, institutional registry.

Preregistration of Analysis Plans

An analysis plan was not preregistered in an independent, institutional registry.

Statement of Ethics

This study protocol did not require ethics approval. Written informed consent was obtained from the patient for the publication of the present case report.

Conflict of Interest Statement

The authors declare that there is no conflict of interest regarding the publication of this article.

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Author Contributions

MRL and ES performed literature review and wrote the case report draft. DBK edited the draft and provided project oversight.

Data Availability Statement

The authors have no data to disclose.

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Figure Legends

Figure 1A. Axial view of CT head and orbits demonstrating subcutaneous and orbital emphysema of the right orbit.

Figure 1B. Sagittal view of CT head and orbits showing both pre-septal and post-septal emphysema of the right orbit.

Figure 1C: Coronal view of CT head and orbits showing emphysema in the superior aspect of the right orbit. Note, there is no mass effect on the globe.

