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Case Series

Paranasal sinus dysbarism: an unrecognized entity

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ABSTRACT

Sinonasal barotrauma is due to sudden change of surrounding pressure. Divers and aviators are the two main groups that get affected. Many otorhinolaryngologists are not familiar with this entity. We present a case series of five patients, in which three patients had sinus barotrauma due to flight journey and one after scuba diving and other one working in hyperbaric oxygen chamber. All five patients presented with dragging frontal headache, nasal discharge with altered blood, nasal block and were managed conservatively.

Keywords: Barotrauma, Decongestants, Frontal sinus, Inflammation

INTRODUCTION

Sinonasal barotrauma is caused by a sudden change of surrounding pressure. In the presence of obstruction to the normal sinus outflow, a pressure gradient occurs, which is the basic cause of the traumatic event. Divers and aviators are the main population that get affected.1 Additional causes of sinus barotrauma include the use of gaseous anesthetic agents, hyperbaric oxygen therapy, prolonged high-altitude exposure, submarine decompression and vigorous valsalva maneuver.[2] Pathophysiology of sinus barotraumas is related to Boyle-Mariotte's law. It postulates the absolute pressure of an ideal gas being inversely proportional to the volume it occupies if the temperature remains unchanged within a closed system.[3] This was initially reported in World War II aviation literature with its pathophysiology first described by Campbell in 1942.[4] Most commonly, frontal sinus gets effected due to narrow dimensions of the frontal recess and variations in the frontal cells that partially obstruct the sinus outflow. Many otorhinolaryngologist remain unrecognized with this entity due to the lack of differentiating features from other forms of sinusitis and relatively less publications.

CASE SERIES

At our tertiary Centre, we had series of five patients, in which three patients had sinus barotrauma after flight journey, one after scuba diving and one patient had history of working in hyperbaric oxygen chamber. All five young males in their 2nd and 3rd decade, presented with dragging frontal headache, nasal discharge with altered blood and nasal block. Two of the five patients had history of allergic rhinitis. Scuba diving patient had retro-orbital pain. Diagnosis of sinus barotrauma was based on the association of acute pain with rapid change in atmospheric pressure and altitude. On examination,

four of the five patients had altered blood in diagnostic nasal endoscopy (DNE) from the right middle meatus (Figure 1) and one patient had allergic mucoid discharge (Figure 2).

Figure 1: DNE showing altered blood.

Figure 2: Mucoid discharge.

None of patients had allergic polyps, acute sinusitis, or active bleeding. Radiological examination (CT scan) showed that all patients had unilateral right sided frontal sinus collection (Figure 3). All cases had conservative medical management with oral antibiotics (to prevent secondary infection), oral & topical decongestants (to open the sinus ostium) and analgesics for a period of 5 days. Patients were followed up after 5 days with saline nasal douche and steroid nasal spray twice daily for 2 weeks. All patients were symptomatically better and post treatment DNE showed normal nasal cavity without mucoid discharge/collected blood. All the cases were advised during the follow up to use topical/oral decongestants half an hour before the take off and to repeat before landing, if journey is more than 6 hours. For scuba drivers, it is recommended to use 6 hours before diving and to be repeated half an hour before the start of diving as the t ½ of xylometazoline is 6 hours.

Figure 3: Coronal CT with right frontal haziness collection.

DISCUSSION

The tortuous and narrow nasofrontal duct to the middle meatus in the nasal cavity gets obstructed due to mucosal inflammatory changes, which is possibly initiated after an URTI or allergic rhinitis.[5] This causes relatively low pressure at the sinus outlet, resulting in a vacuum effect, which is referred as "the sinus squeeze". These vacuum influences sinus mucosal lining leads to mucosal edema, serosanguineous exudate and submucosal hematoma which may cause epistaxis having altered blood and pain because of pressure on branches of the trigeminal nerve. Some may also complain of orbital/vision symptoms when the sphenoid sinus is involved. In our case series the all the cases complained of frontal headache and blood-stained nasal discharge. The other rarely reported complains are barodontalgia and cloudy nasal discharge, Grading of barotrauma was given by Campbell (Table 1) and newer classification was proposed by Vaezeafsharet et al (Table 2).[2,4] Acute barosinusitis involves a single sinus, with the frontal sinus most affected (68–100%) followed by maxillary and sphenoid sinuses.[2]

Table 1: Campbell and Weismann clinical grading.

Grade	Symptoms	Management
Grade I	Mild transient sinus discomfort which clears promptly	Medical aid is not necessary because of the transient nature of the symptoms
Grade II	Localized pain lasting up to 24 hours	Symptomatic decongestant and analgesics
Grade III	Pain lasting for more than one day	Medical management or medical and surgical management

Table 2: Classification of barosinusitis by Vaezeafshar et al.

Type	Symptoms	Radiology	Management
Acute barosinusitis	One episode of barotrauma and acute sinus pain.	Clear sinus opacification of sinuses.	Medical management surgery being reserved for complications like septal abscess.
Recurrent acute barosinusitis	Acute uni/bilateral pain with more than one episode and acute uni/bilateral pain.	Anatomical abnormalities with normal sinus in between acute episodes.	Medical management and endoscopic surgery to correct anatomical variations.
Chronic barosinusitis	More than one episode and persistence of symptoms, associated with symptoms of chronic sinusitis.	Change of chronic rhinosinusitis is seen on scan.	Require long term medical treatment and surgery to clear up sinus opening blockage.

In our case series as well, we noted that it was the frontal sinus that was involved among all the cases. Estimates of barotrauma range from 34% in divers to 19.5-25% in pilots and 55% in pilots with concurrent sinonasal inflammation.[6] Prevalence of sinus barotrauma in patients who undergo hyperbaric oxygen exposure is around 3%.[7] CT imaging may demonstrate partial to complete opacification of one or more of the paranasal sinuses with anatomical variations showing narrow/blocked ostium.[8] On MRI, acute sinus barotrauma may be seen as an area of hyperintensity on both T1 and T2 which are hypothesized to be related to submucosal hemorrhage. Medical treatment with analgesics and nasal decongestants re-establishes sinus ventilation and decreasing mucosal inflammation. Isolated acute symptomatic episodes can be successfully managed with oral steroids.[9] Trial of medical therapy, like chronic sinusitis, should be attempted before surgery. In recurrent cases, endoscopic sinus surgery may be required to enlarge the natural ostium. The indication for surgery for an episode of isolated acute bar sinusitis is to treat complications such as septal abscess, orbital sequelae, or pneumocephalus.[10]

CONCLUSION

Acute barosinusitis is mostly related with recent upper respiratory tract infection, therefore, avoiding significant altitude changes during episodes of acute viral inflammation is the first and most important step that should be emphasized to patients who are affected. Medical management is the main stay of treatment, but in the presence of recurrent difficulties or chronic discomfort, surgical treatment may be required. Prophylaxis with NSAID's, local/systemic decongestants may aid in preventing sinus barotrauma in future.

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