

Superior ophthalmic vein thrombosis following barosinusitis: a rare case report

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ABSTRACT

Superior ophthalmic vein thrombosis (SOVT) is a rare but potentially serious condition that can arise from various causes, including barotrauma. This case may represent one of the first reported instances of SOVT associated with barosinusitis, identified after exclusion of other potential etiologies. A previously healthy patient developed acute orbital symptoms shortly after exposure to sudden changes in ambient pressure during a flight. Clinical and radiological investigations revealed SOVT secondary to barosinusitis. Magnetic resonance imaging confirmed thrombosis of the superior ophthalmic vein and demonstrated paranasal sinus inflammation consistent with barosinusitis. The patient was successfully treated with anticoagulation and broad-spectrum antibiotics, resulting in rapid resolution of symptoms and radiologic improvement. Barosinusitis, although rare, should be considered a possible etiological factor for SOVT, especially in patients presenting with orbital symptoms after pressure-related activities. Early recognition and appropriate treatment can prevent potentially serious complications.

Keywords: Barotrauma, paranasal sinusitis, venous thrombosis

INTRODUCTION

Superior ophthalmic vein thrombosis (SOVT) is a very rare condition, with an incidence of only 3-4 cases per million each year, but it may lead to serious clinical consequences.¹

SOVT may result from both septic and aseptic causes. Septic etiologies include orbital cellulitis, paranasal sinusitis, and septic cavernous sinus thrombosis (CST), while aseptic causes comprise facial trauma, spontaneous carotid cavernous fistula (CCF), hypercoagulable states, orbital tumors, and Tolosa-Hunt syndrome.^{2,3}

Paranasal sinusitis, a common septic factor, may develop due to viral and bacterial infections, allergies, polyps, and though rarely-barotrauma.⁴ Barotrauma refers to tissue injury or inflammation caused by failure to compensate for changes in ambient pressure. Barosinusitis, a barotrauma-related sinus condition, typically occurs during flight or diving, when reduced barometric pressure leads to expansion of intrasinus air and a resultant pressure gradient between the sinus ostia and the nasal cavity. In cases of inflamed or obstructed sinuses, this imbalance results in a “reverse squeeze” effect, where the mucosa is compressed outward against the bony walls.⁵ Although barosinusitis can occur in the absence of preexisting sinus pathology, it is more frequently observed in individuals with acute sinonasal inflammation.⁶

CASE

A 25-year-old male patient travelling from Sydney to London via Singapore experienced increasing pain on the left side of his face during the first 8-hour flight from Sydney to Singapore. The pain subsided slightly during a 6-hour wait at Singapore Airport, then gradually became intense pain on the left side of his face during the flight from Singapore to London. The patient’s pain became so severe, there was swelling around his eyes and vision decreased, in the 10th hour of the flight, so the plane had to make an emergency landing in İstanbul (**Figure 1**). He applied to the emergency department of Başakşehir Çam and Sakura City Hospital. In the ophthalmic examination, the right eye was normal, and the visual acuity of the left eye was 0.1. Swelling, subconjunctival hemorrhage and conjunctival hyperemia were seen in the left eye. Fundoscopic examination was normal. Pupillary light reflex and oculomotility were intact. CT and MR scan showed left maxillary sinusitis and left superior ophthalmic vein dilatation and filling defect (**Figure 2**). Additional laboratory and imaging studies were performed to exclude other potential etiologies of superior ophthalmic vein thrombosis. The patient’s complete blood count, coagulation profile (prothrombin time, activated partial thromboplastin time, and D-dimer), inflammatory markers (C-reactive protein, erythrocyte sedimentation rate), and autoimmune panel (antinuclear antibody and

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antiphospholipid antibodies) were all within normal limits. Blood cultures were negative. These findings, combined with the absence of systemic prothrombotic conditions or orbital trauma, supported the diagnosis of SOVT secondary to maxillary barosinusitis. The patient, who was thought to have septic thrombosis due to maxillary sinusitis, was given IV vancomycin and meropenem (since he was allergic to penicillin and clindamycin), heparin 2x6000 IU as anticoagulant therapy, and nasal decongestant therapy. On the first day of treatment, visual acuity reached 1.0 and periorbital edema and hyperemia regressed. At the patient's first week follow-up, paranasal sinus CT and contrast-enhanced orbital MRI were performed due to the persistence of pain around the eye. Despite antibiotic treatment, advanced maxillary sinusitis was observed in the patient's paranasal sinus CT, and in the contrast-enhanced orbital MRI, it was observed that the left superior ophthalmic vein dilatation had regressed and there was no filling defect. During the otorhinolaryngologist examination, sinus antrostomy and functional endoscopic sinus surgery (FESS) surgery were recommended to the patient, but the patient did not accept this surgical treatment.

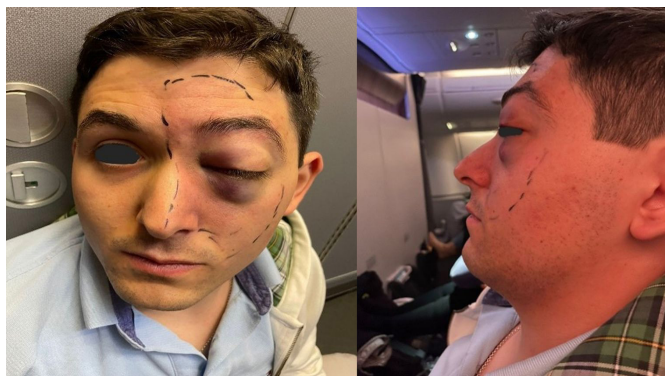


Figure 1. During the flight, the patient experienced sudden swelling on the left side of his face, ecchymosis and proptosis of the left eye, chemosis and hyperemia in the conjunctiva

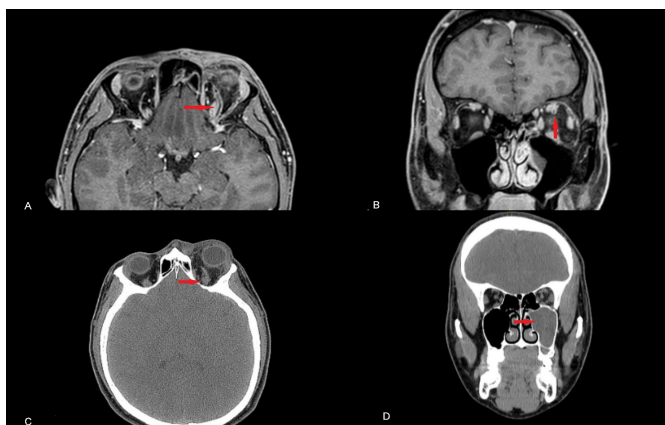


Figure 2. A) Contrast-enhanced MRI-T1-axial section dilation of the left SOV and a filling defect (red arrow), B) Contrast-enhanced MRI-T1-coronal section a filling defect in the SOV (red arrow), C) CT-axial section enlarged SOV (red arrow) and proptosis, D) CT-coronal section shows left maxillary sinusitis (red arrow)

MRI-T1: T1-weighted three-dimensional structural magnetic resonance imaging, SOV: Superior ophthalmic vein, CT: Computed tomography

DISCUSSION

Superior ophthalmic vein, a vein without valves, plays a key role in draining the majority of venous blood from the orbit. SOVT arises from disrupted venous blood flow, which may occur due to blood flow stasis, vessel wall injury, or hypercoagulable conditions. SOVT can have both septic

and aseptic origins. Aseptic causes are attributed to changes in blood flow, driven by either anatomical abnormalities or systemic factors.² Septic causes of SOVT include infections originating from the paranasal sinuses, orbit, teeth, and face. According to the literature, paranasal sinusitis is the most frequently reported cause of septic SOVT.⁷

In the clinical presentation of SOVT, symptoms result from impaired orbital venous drainage and include orbital swelling, pain, chemosis, eyelid edema, proptosis, restricted ocular motility, with or without fundus abnormalities, and reduced visual acuity.² This patient experienced severe pain on the left side of his face that began on his first connecting flight and worsened on the second flight. During air travel, he developed periorbital edema, ecchymosis, proptosis, conjunctival chemosis, and hyperemia, along with limited ocular motility and decreased vision. (**Figure 1, 2**).

The diagnosis is established through magnetic resonance imaging (MRI) or contrast-enhanced computed tomography (CT) scans.¹ CT imaging reveals thickening and dilation of the superior ophthalmic vein, often accompanied by an intraluminal filling defect. Similarly, MRI identifies a filling defect within the vessel lumen.^{1,2} MRI is considered superior to CT in detecting SOVT and cavernous sinus thrombosis, particularly in the early stages, as CT may fail to identify SOVT during this period.⁸ In this patient, we detected thickening and dilatation of the superior ophthalmic vein accompanied by an intraluminal filling defect in the CT and MRI imaging and the patient had deformity in the left maxillary sinus, which may be secondary to chronic sinusitis, thickening of the sinus wall, decreased ventilation, left venous enlargement with an intraluminal thrombus (**Figure 3**). Because the patient's symptoms developed during a long connecting flight, we interpreted the case as superior ophthalmic vein thrombosis, which probably developed secondary to barosinusitis due to barotrauma that developed on the basis of chronic sinusitis.

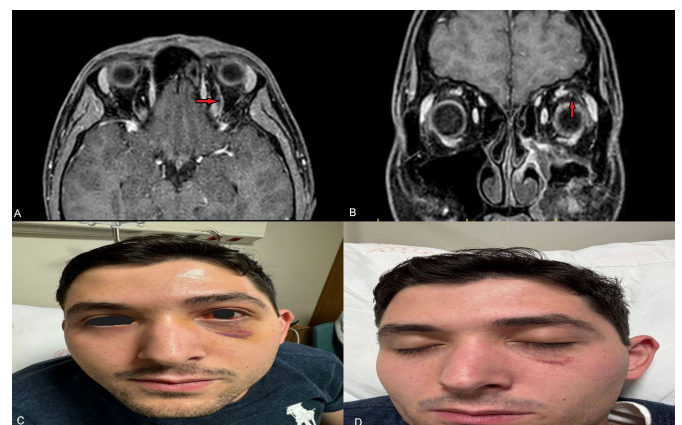


Figure 3. In the first week after treatment; contrast-enhanced computed tomography axial (A) and coronal (B) sections show normal blood flow in the superior ophthalmic vein (red arrow), edema and ecchymosis around the patient's left eye regressed, and proptosis resolved (C, D)

Barosinusitis is defined as acute or chronic inflammation of the paranasal sinuses resulting from barometric pressure differences between the atmosphere and the air inside the sinuses.⁹ Barosinusitis due to barotrauma, reverse impingement or compression injury, can occur in an inflamed or partially obstructed sinus when air expands and increases intrasinus pressure during ascent. Without pressure compensation, this leads to an outward compression injury in which the sinus mucosa is pushed against the bony walls.

This causes mucosal swelling and tearing.⁵ According to the literature, acute barosinusitis typically affects a single sinus, with the frontal sinus being the most commonly involved (reported in 68-100% of cases across various studies).¹⁰ This is followed by the maxillary sinus and, less frequently, the sphenoid sinus.^{11,12}

Vaezaefshar et al.⁵ defined acute barosinusitis, the most common form, as a singular episode of sinus-related pain and inflammation occurring within hours to days after exposure to a known cause of changes in ambient air pressure. Although acute barosinusitis can occur without prior sinus pathology, studies suggest that it is significantly more common in the context of preexisting acute sinonasal inflammation.⁶ From the patient's history, we learned that he had been treated for sinusitis in previous years, which may have predisposed him to this condition.

The most commonly reported symptom of acute barosinusitis is a sudden onset of pain, which is often distinctly localized to the affected sinus.⁵ This patient also had pain that started when the plane started to climb and gradually increased during the flight. On the second flight, he experienced pain accompanied by periorbital edema and decreased vision. Another common complication of barosinusitis is epistaxis, which has been reported at rates ranging from 33% to 66% in different series, but this finding was not present in our patient.¹³ Considering these symptoms, clinical history, and radiological findings, barosinusitis due to barotrauma was considered the most plausible explanation, leading to superior ophthalmic vein thrombosis as a complication of sinusitis.

Management

Due to the rarity of SOVT, its management lacks consensus. Treatment is guided by the underlying pathology. Medical therapy may include antibiotics, steroids, and anticoagulant therapy (ACT) with antibiotics being specifically indicated in cases of septic SOVT. The selection of antibiotics should target pathogens commonly associated with the suspected source of infection while awaiting culture results. The duration of antibiotic therapy remains undefined because of limited consensus.² Because the patient was allergic to penicillin, IV vancomycin, meropenem, and nasal decongestant treatment was started.

The use of corticosteroids has been reported; however, their role remains controversial and not well-defined. Corticosteroids are considered effective in aseptic SOVT caused by autoimmune or inflammatory diseases, as they help reduce inflammation, edema, and orbital congestion, and may alleviate proptosis.¹⁴ Among 88 cases of septic cavernous sinus thrombosis reported by Weerasinghe et al.,¹⁵ 15 patients received corticosteroids for various indications, such as reducing cranial and orbital inflammation, providing replacement therapy, or managing associated conditions like lupus, meningitis, or temporal arteritis. Outcomes were comparable between those who received corticosteroids and those who did not, with no clear overall benefit in recovery, disability, or mortality. Similarly, Mandic et al.⁸ advocated that corticosteroids should be avoided, especially during the acute phase of infection, due to potential worsening of the septic process. Based on these findings, we did not administer corticosteroids to our patient, who was considered to have septic thrombosis.

Concerns about hemorrhagic complications initially made ACT a topic of controversy. In their study on cavernous sinus thrombosis, Weerasinghe et al.¹⁵ reported that ACT was associated with decreased mortality in these patients. Although current evidence supports the use of ACT, the optimal dose and duration remain uncertain.² Our patient was started on low-molecular-weight heparin (2×6000 IU) as anticoagulant therapy. Follow-up imaging performed in the first week showed resolution of the thrombus and restoration of normal blood flow.

In this case, the otorhinolaryngology team recommended functional endoscopic sinus surgery (FESS) to address the persistent maxillary sinusitis that had contributed to the septic thrombosis. However, the patient declined surgical intervention. FESS is considered the standard surgical approach for refractory or complicated sinus disease, including barosinusitis-related complications, as it allows direct drainage and ventilation of the affected sinus and reduces the risk of recurrence.⁵ Despite the absence of surgical treatment, our patient responded favorably to prompt medical therapy, underscoring that early recognition and appropriate management can sometimes obviate the need for surgery in selected cases.

CONCLUSION

This case illustrates a rare presentation of superior ophthalmic vein thrombosis secondary to barosinusitis, an uncommon but clinically important complication of barotrauma. Early recognition and appropriate medical management, including antibiotic and anticoagulant therapy, led to full recovery. Clinicians should consider SOVT in patients presenting with orbital symptoms following pressure-related events, particularly in those with a history of sinus disease.

ETHICAL DECLARATIONS

Informed Consent

The patient signed and free and informed consent form.

Referee Evaluation Process

Externally peer-reviewed.

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

Financial Disclosure

The authors declared that this study has received no financial support.

Author Contributions

All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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