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Case Report
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Successful Management of Life-Threatening Intra and Extracranial Complications Secondary to Nasal Septal Abscess in a Child

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Abstract

Introduction: Nasal Septal Abscess (NSA) can occur following minor nasal trauma or as a result of severe Acute Rhinosinusitis (ARS). Sinusitis can cause haematoma formation and separation of mucoperichondrium from the underlying septal cartilage. This serves as a medium for colonisation of bacteria leading to nasal septal abscess formation. In severe cases of nasal septal abscess, infection can spread via the 'danger area' of the face leading to formation of intra-cerebral abscesses, cavernous sinus thrombosis and cranial neuropathies. This is often associated with significant morbidity and mortality.

Aims: To raise awareness of the life-threatening complications developing from sinusitis. We share our experience of successful management of sinugenic intra and extra-cranial complications in a child.

Methods: A case report with relevant literature review.

Case Presentation: A 7-year old Caucasian girl presented with symptoms and signs suggestive of meningitis and septicaemia.

Cross-sectional imaging showed significant acute rhinosinusitis. She underwent endoscopic sinus surgery and drainage of nasal septal abscess. Over the course of a week, her condition deteriorated despite on-going treatment. Her blood cultures grew Panton-Valentine Leukocidin (PVL) Methicillin-Resistant Staph Aureus (MRSA).Two weeks into admission, she developed left hemiparesis. This prompted further head imaging, revealing multiple pathologies including ischaemic regions within the right cerebral cortex and cavernous sinus thrombosis for which she required a 6-month course of warfarin. She was admitted to the paediatric intensive care unit for 4 weeks and required a total of 10 weeks of antibiotics. She received intense physiotherapy to manage her left-sided hemiparesis. She made a full recovery and has remained well over last 4 years.

Conclusion: ARS and NSA can lead to life-threatening septicaemia and intracranial complications with associated morbidity as highlighted in our case. PVL-MRSA infection in the central nervous system is often challenging to treat and require a multidisciplinary approach. Timely diagnosis, surgical intervention and appropriate long-term anti-microbial therapy would contribute to a satisfactory outcome.

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Introduction

Nasal septal haematoma due to collection of blood between the quadrangular cartilage and mucoperichondrium can occur following minor nasal trauma. It may also result from severe acute rhinosinusitis [1]. Sinusitis causes haematoma formation and separation of the mucoperichondrium from the underlying septal cartilage. This can serve as a medium for colonisation of bacteria leading to nasal abscess formation.

Intracranial abscesses are rare but life-threatening complications of nasal septal abscess. This is due to acute thrombophlebitis, the retrograde spread of infection through 'danger area' of the face and migration of septic emboli [2]. This can lead to cavernous sinus thrombosis, intra-cerebral abscess formation and cranial neuropathies [3-5]. This is often associated with significant morbidity and mortality.

We present a rare case of a 7-year old girl with ARS and NSA complicated by neck abscess, intra-cerebral abscess and cavernous sinus thrombosis. We share our experience of successful management of this child.

Case Report

A 7-year-old Caucasian girl presented to our paediatric assessment unit with a 2-day history of fever, vomiting, neck stiffness and generally feeling unwell. She had no previous neurological diseases. In the past medical history, she reported an episode of acute tonsillitis managed conservatively. There was no significant past medical history and she was not on any regular medication.

On admission, she was showing signs of sepsis. Her heart rate was 125 beats per minute with a temperature of 39^{0}C. The rest of her vital observations including cardio-respiratory examination were normal. There was no observed peripheral neurological deficit and her Glasgow Coma Scale (GCS) was 15. However, she complained of pain on lateral gaze in her right eye. Clinically, she had a right 6th cranial nerve palsy (Figure 1). Her white cell count was within normal limits but CRP was significantly elevated at 191. Her liver function test and electrolytes were normal. An Electrocardiogram (ECG) and chest x-ray were performed and these were essentially normal.

The initial clinical diagnosis was meningitis with sepsis. As part of the sepsis 6 management protocol, she was started on prophylactic Intravenous (IV) ceftriaxone. She was also administered IV fluids and oxygen therapy over a face mask to maintain her saturations above 94%. Her serum lactate level was normal.

As part of the diagnostic workup, she had cross sectional imaging in the form of a CT head scan. This showed significant opacification of the ethmoidal and sphenoid paranasal sinuses, worse on the right side in keeping with sinusitis (Figure 2). Subsequently, a lumbar puncture was performed which was normal. The blood cultures taken on the day of admission grew Panton-Valentine Leukocidin Methicillin-Resistant Staph. aureus (PVL-MRSA).

An MRI brain scan was also carried out and revealed fluid within the right mastoid air cells and also in the paranasal sinuses, notably bilateral ethmoid and sphenoid sinuses. There was no evidence of any intracranial pathology to account for the right abducens nerve palsy at that time.

Figure 1: Esotropia of right eye secondary to the right 6th cranial nerve palsy.

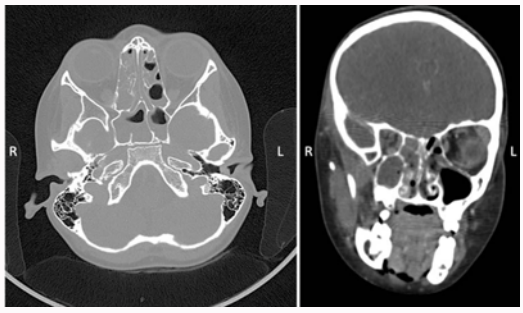

Figure 2: CT scan showing pansinusitis worse affecting the right sided paranasal sinuses.

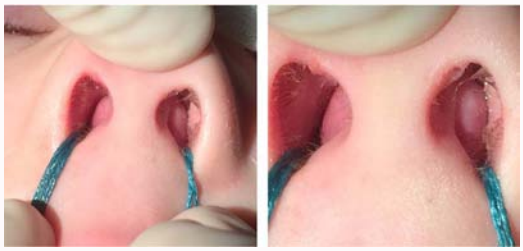

Figure 3: Soft, fluctuant swelling on each side of the nasal septum in keeping with septal haematoma and abscess. After right hemitransfixion incision the abscess was drained. Between two flaps no quadrangular cartilage was found as it had necrosed because of infection.

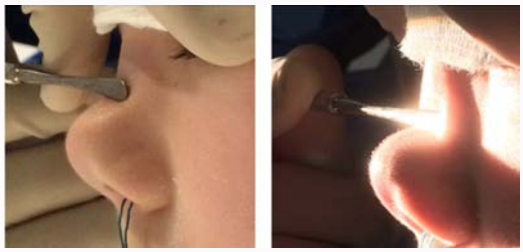

Figure 4: The quadrangular cartilage is missing because of septal abscess. Lack of nasal dorsal support is demonstrated using Freer's elevator.

She was reviewed by the otolaryngology team and conservative management was suggested. In addition to this, she was assessed by the ophthalmologist due to the erythema and pain over her right eye. A right eye esotropia was noted but there were no signs of periorbital cellulitis.

Because of ongoing swinging pyrexia, she was taken to theatre on the third day of admission for Examination Under Anaesthesia (EUA), drainage of septal abscess (Figure 3) and limited Endoscopic Sinus Surgery (ESS). Operative findings revealed loss of the entire cartilaginous septum resulting in deficiency of supratip and dorsal support (Figure 4).

Five days into her admission, as her condition was not improving, a repeat CT head scan was carried out which showed a right pterygomandibular abscess, radiological signs of worsening bilateral ethmoid and sphenoid sinusitis. Repeat MRI brain scan also revealed a 20mm wide x 5mm deep collection on the posterior surface of the clivus, lateralising the right abducens nerve. A gadolinium enhanced volumetric MRI scan revealed this collection to be of low attenuation with an enhancing rim, in keeping with an abscess accounting for the abducens nerve palsy. Under a joint operation by Ear, Nose and Throat (ENT) and maxillo-facial surgeons, our patient underwent drainage of her right pterygomandibular abscess (Figure 5), ESS involving the ethmoid and right maxillary sinuses, as well as left sphenoidotomy.

Six days into her admission, the patient deteriorated clinically with ongoing pyrexia. A repeat blood culture reported the same strain of *Staph. aureus*. She was started on a course of IV flucloxacillin under the advice of the microbiologist. She also had an echocardiography which excluded an infective endocarditis as a cause of her persistent pyrexia and tachycardia.

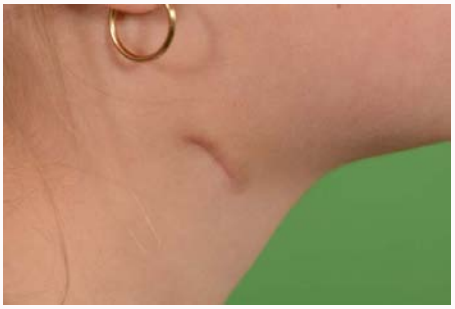

Figure 5: Surgical scar mark after right neck pterygomandibular abscess drainage.

Figure 6: Saddle nose deformity-a long term complication of nasal septal abscess.

Nine days into our patient's admission, she developed left arm and leg weakness. A repeat CT-head and MRI brain scans were performed. Her CT head scan revealed a right parietal infarct correlating with the laterality of the patient's weakness. There was narrowing of the right internal carotid artery and a possibility of arterial spasm due to cavernous sinus infection was also raised. The patient was discussed with neurosurgeons and transferred to a paediatric intensive care at a tertiary referral centre. Here, an MRI scan revealed nasal septum collection, right parapharyngeal abscess as well as few intracranial pathologies including multiple ischaemic areas within right cerebral cortex, cavernous sinus thrombosis and narrowing of basilar artery. Further surgical intervention was carried out for her neck and sinuses but no intracranial surgery was needed.

Postoperatively, she was admitted to the paediatric intensive care unit. She received treatment with a combination of various antibiotics under the supervision of the microbiologist. This included ceftriaxone, clindamycin, rifampicin, vancomycin, metronidazole, fusidic acid and co-trimoxazole for a total duration of 10 weeks. Once she was transferred back to her primary hospital, intense physiotherapy continued to rehabilitate her left-sided hemiparesis. She also required warfarin for a total of 6 months to treat the cavernous sinus thrombosis. She was discharged home after 8 weeks in hospital and continued with outpatient physiotherapy input.

At 4-week ENT clinic review, she had fully recovered from her infection but had developed a saddle nose deformity due to the destruction of her septal cartilage from the septal abscess (Figure 6). Her subsequent clinic reviews were satisfactory and she continued to make progress with her rehabilitation. Four years after her initial presentation and treatment, she continues to do well and is attending school with no concerns socially.

Discussion

The nasal septum separates the right and left nasal cavities. Acute Rhinosinusitis (ARS) describes symptoms associated with inflammation of the sinonasal mucosa. Nasal Septal Abscess (NSA) is a collection of pus between the mucoperichondrium and septal cartilage [1] and has been more commonly encountered in children than in adults following an injury [6].

Paediatric NSA in association with ARS is rare, but has been reported in the literature [6,7]. In severe cases of ARS, deeper brain collections secondary to septic emboli can occur. The nose and paranasal sinuses are located in the danger triangle of the face bounded by the corners of the mouth and the bridge of the nose, including the nose and maxilla [2]. The venous communication between the facial vein and the cavernous sinus via the ophthalmic veins [2] creates an access route for retrograde spread of infection from the nasal area to the brain, causing cavernous sinus thrombosis, meningitis and brain abscess [3-5].

The most common presenting complaints of ARS associated with intracranial complication are fever (83%) and nasal congestion (50%). Neck stiffness was only reported in 17% of cases reported by Nicoliand colleagues [3].

Sowerby and colleagues suggested that during the early stages of abscess formation, that is, during the stage of septic encephalitis, high temperature, chilly feeling, evidence of systemic sepsis are present [4]. Our patient had presented with signs of sepsis, neck stiffness, photophobia and diplopia highly suggestive of an intracranial complication secondary to rhinosinusitis.

As happened with our patient, serial blood cultures, lumbar puncture and brain cross-section imaging should be carried out in such scenarios to aid diagnosis, help in treatment and monitor response to treatment [8].

Schupper and colleagues reviewed the risk factors associated with such complications in 16 patients [5]. They identified that lumbar puncture and sinus cultures were more predictive of a complicated clinical course.

The common pathogens involved in ARS and NSA are Streptococcus pneumonia, *Haemophilus influenza*, and *Moraxella catarrhalis* [9]. Intracranial abscess caused by Methicillin-Resistant Staphylococcus Aureus (MRSA) is rare and often suggest a complication. Bahubali and colleagues conducted an analytical series and review study on MRSA- related intracranial abscesses. They reported 6 out of the 21 cases had unfavourable clinical outcomes when PVL-MRSA was isolated in blood cultures. However, patients who underwent incision and drainage of the abscess and treated with linezolid showed better prognosis compared to those treated with vancomycin [10].

The standard treatment for ARS and NSA is nasal irrigation, abscess drainage and antibiotic therapy. In a recent retrospective study by Nicoli and colleagues looking at outcome of sinusitis-related intracranial infections, all of their patients were managed surgically with over 80% recovering to premorbid state without neurological sequelae [3].

Our patient underwent endoscopic sinus surgery on 3 occasions along with neck abscess drainage on 2 occasions. To achieve full resolution of the infection, she also received a 10-week course

of intravenous and oral antibiotics under the supervision of our microbiologists due to the intractable nature of her disease. She managed to regain full function from her left hemiparesis with physiotherapy. Her right eye diplopia due to the abducens nerve palsy improved with input from our ophthalmologists. At her last review in the clinic, she was noticed to have a mild saddle nose deformity for which she may require reconstructive surgery. However, she has fully recovered and enjoying her full time school without any social issues.

Conclusion

NSA and ARS can lead to life-threatening septicaemia and intracranial complication with associated morbidity as highlighted in our case. PVL-MRSA infection in the central nervous system is often challenging to treat and require a multidisciplinary approach. Timely diagnosis, surgical intervention and appropriate long-term anti-microbial therapy would contribute to a satisfactory outcome.

Acknowledgement

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