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Original Research Article

Role of Computed Tomography (CT) in Isolated Acute and Chronic Sphenoiditis

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Abstract:

Background: Sinusitis is a common condition affecting the paranasal sinuses, particularly in children. It is primarily caused by viral upper respiratory infections, with allergic rhinitis being a significant predisposing factor. Other underlying causes include nasal airway obstruction, immunodeficiencies, ciliary dysfunction, and cystic fibrosis. The sphenoid's isolated illness is often overlooked due to its remote location and difficulty of access.

Aim: A study of the isolated sphenoid sinus disease with discussion of the clinical symptoms, radiological findings and complications.

Methods: Patients were retrospectively identified through a computer-assisted search of all CT scan reports conducted for clinical symptoms associated with the sinonasal region, including headache, nasal obstruction, recurrent sinusitis, chronic sinusitis, acute sinusitis, allergic sinusitis and culture of organisms from department of microbiology at MVJ Medical College and Research Hospital from March 2017 - January 2018, to ascertain the presence of isolated sphenoid sinus opacification, mucosal thickening, and related complications. Fifty-five instances of isolated sphenoid illness were recognized.

Results: We detected 55 instances of isolated sphenoid illness, constituting 20.1%. Twenty-seven females and twenty-eight guys. Seven patients in the under 20 age group, twenty-six patients in the 21-40 age group, fifteen patients in the 41-60 age group, and seven patients beyond 60 years old. Nine instances had acute sphenoid sinusitis with an air-fluid level. Chronic sphenoid sinusitis was seen in 27 instances. Nineteen patients had asymptomatic sphenoid opacification. A neuro-ophthalmic complication was seen in one instance.

Conclusion: Asymptomatic opacification of the sphenoid sinus is prevalent. Routine imaging of the paranasal sinuses in uncomplicated acute sinusitis is not advised. It is ineffective for distinguishing between viral and bacterial sinusitis and often does not alter therapy in simple acute sinusitis.

Keywords: Sphenoiditis, Paranasal Sinuses, Upper Respiratory Infection, Computed Tomography.

Introduction

Sinusitis is characterized by the inflammation of the paranasal sinuses. This condition is prevalent among children, often leading to morbidity, however seldom causes severe problems [1]. The primary predisposing factor for acute bacterial sinusitis is a viral upper respiratory illness affecting the nose and paranasal sinuses [2]. Bacterial sinusitis is predicted to occur in 5%-13% of viral upper respiratory infections in young children. Allergic rhinitis is the second most significant predisposing factor for bacterial sinusitis [3]. Additional underlying causes that may contribute to sinusitis in children are nasal airway obstruction, immunodeficiencies, ciliary dysfunction, and cystic fibrosis [4].

Material & Methods

Patients were retrospectively identified through a computer-assisted search of all CT scan reports conducted for clinical symptoms related to the sinonasal region, including headache, nasal obstruction, recurrent sinusitis, chronic sinusitis, acute sinusitis, allergic sinusitis and culture of organisms from department of microbiology, at MVJ Medical College and Research Hospital from March 2017 - January 2018, to ascertain the presence of isolated sphenoid sinus opacification

and mucosal thickening and its correlation with clinical symptoms. The primary objective of this research was to identify the quantity of individuals with isolated sphenoid sinus illness. The computed tomographic images of the paranasal sinuses in the axial and coronal planes were analyzed. A total of 263 CT scans indicating sinusitis were detected. Studies including malignancy, motion artifacts, polyps, and post-operative condition were omitted from these patients. All CT exams were conducted using a single slice CT scanner (Toshiba Asteion, Japan) until December 2013, and a 16-slice MDCT scanner (GE Brivo 385, Milwaukee, USA) from January 2014 onwards. The imaging parameters for the scout film and the PNS scan are delineated as follows: Scout film Kv 120, mA 10 WW/WL: 500/50. PNS scan in the axial plane at 120 kV, 90 mA, with a 10 mm interval, 2.5 mm thickness, a pitch of 0.562:1/5.62, and a rotation period of 1 second, using retro reconstruction of images at 0.625 mm thickness. PNS scan in the coronal plane: kV 120, mA 200, interval 10 mm, thickness 2.5 mm, pitch 0.562:1/5.62, rotation duration 1 second, with retrospective reconstruction of images at 0.625 mm thickness. Images were obtained and analyzed on the GE Advantage workstation using a vertebral window with a width of 2000 HU and a level of 350 HU. The photos were stored on magnetic optical discs and external hard drives.

The findings of the CT test were analyzed by four seasoned radiologists, each possessing over five years of expertise in interpreting PNS CT scans. Each scan was assessed for the existence of sinusitis and underlying bone abnormalities. All scans were analyzed using bone window settings. The evaluation included mucosal thickness, air-fluid levels, sinus opacification, septal deviation, presence or absence of concha, and the patency of the osteomeatal unit. The left and right aspects of the frontal, ethmoid, sphenoid, and maxillary sinuses were evaluated individually for mucosal disease. The illness was assessed as either present or absence.

Statistical analysis: All research data were analyzed using SPSS version 17.0 software. The Chi-square test was used. A p-value of less than 0.05 was deemed suggestive of a meaningful difference. The correlation between sphenoid sinus opacification and mucosal thickness was quantified and shown as percentages. All data were examined with SPSS software.

Results

We detected 55 instances of isolated sphenoid illness (20.1%) among 27 female (49%) and 28 male participants (51%) aged 12 to 72 years. Seven patients in the under 20 age group, twenty-six patients in the 21-40 age group, fifteen patients in the 41-60 age group, and seven patients beyond 60 years old. Table 1. The predominant symptoms were headache or retro-orbital/frontal face discomfort in 15 instances, nasal obstruction in 10 patients, mucopurulent rhinorrhea in 6 patients, fever in 5 patients, and diplopia in 1 patient. One example encountered problems, whereby the patient was diagnosed with isolated third cranial nerve palsy.

Nine patients (16.3%) had acute sphenoid sinusitis with an air-fluid level. Chronic sphenoid sinusitis accompanied by mucosal thickening was seen in 27 instances (49%). Nineteen instances (34.5%) had asymptomatic sphenoid opacification.

A neuro-ophthalmic consequence was seen in one instance involving a 12-year-old boy who arrived with a headache and an inability to open his right eye for four days. He had no temperature, no indications of illness, and no prior history of trauma. The general physical examination was unremarkable. The neurological examination indicated right-sided oculomotor nerve palsy. The complete blood count and biochemistry tests were unremarkable, with the exception of lymphocytosis and thrombocytosis. CT and MRI of the head revealed opacity in the right sphenoid sinus, whereas the other sinuses and brain seemed normal. The patient was started on therapy with intravenous ceftriaxone and metronidazole. He received intravenous antibiotics for 10 days, followed by a transition to oral cefuroxime axetil for an additional 10 days. His ultimate result was exceptional.

Table 1: Age Distribution

Age group	No. of Patients
1-20	7
21-40	26
41-60	15
>60	7

Table 2: Clinical symptoms

Clinical symptom	No. of Patients

Headache/retro-orbital pain/Facial pain	15
Nasal obstruction	10
Mucopurulent rhinorrhea	6
Fever	5
Diplopia	1

Table 3: CT findings

CT Findings	No. of patients
Opacification	19
Air fluid level	09
Sclerosis of sinus walls	06
Mucosal thickening	27

Figure 1: Patient showing right sided ptosis

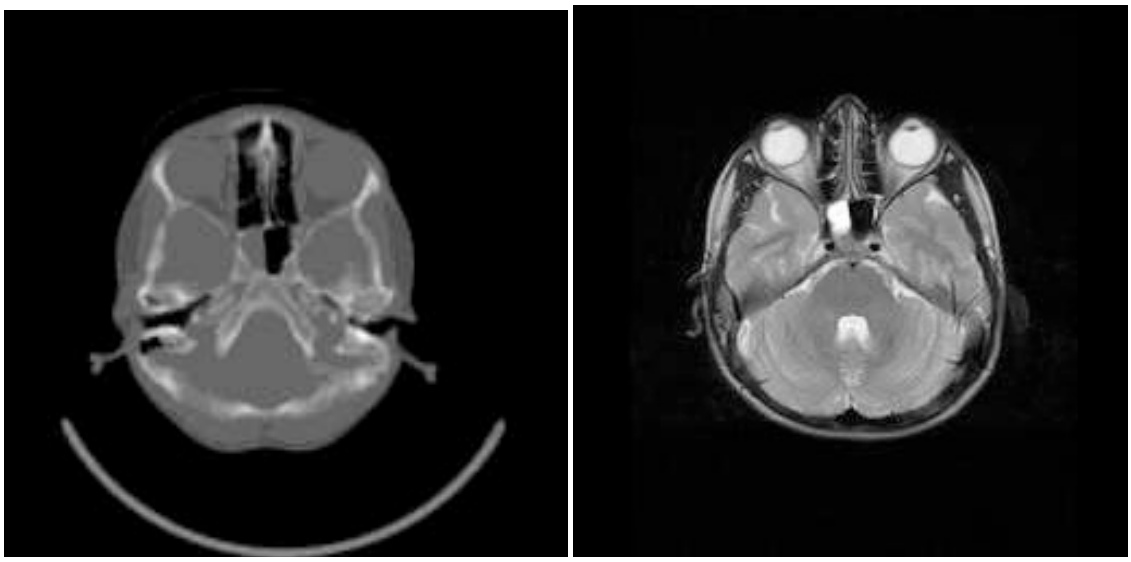

Figure 2: CT and MR scan showing: Right isolated sphenoid sinus opacification

Discussion

The diagnosis of sinusitis should be made clinically, not on the basis of imaging findings alone. No imaging studies are indicated for uncomplicated acute sinusitis. CT of the paranasal sinuses is the imaging modality of choice in patients with persistent, recurrent, or chronic sinusitis. Cranial/orbit CT with contrast, to include the sinuses, is indicated for suspected orbital or intracranial complications of sinusitis. MRI, while not as good as CT for depicting bone details, is more sensitive for evaluating intracranial complications that are not demonstrated on an initial CT scan. Sinus ostial obstruction is a very common cause of an opacified paranasal sinus. An air-fluid level suggests acute sinusitis; in chronic sinus disease, one may see mucosal thickening and sclerosis of the bony sinus walls.

Sinusitis is defined as inflammation of the paranasal sinuses. It is common in the pediatric population and

often causes morbidity but rarely results in serious complications [1]. The most common predisposing factor for acute bacterial sinusitis is viral upper respiratory infection that involves the nose and paranasal sinuses. The second most important predisposing factor for bacterial sinusitis is allergic rhinitis [2]. Other underlying factors that may lead to sinusitis in children include nasal airway obstruction, immunodeficiencies, ciliary dysfunction, and cystic fibrosis [3]. Common symptoms of acute sinusitis are purulent nasal drainage, high fever and headache that is typically above or behind the eyes [4].

Sphenoid sinusitis is an uncommon entity in adults. Van Alyea had described the sphenoid sinus as the most neglected sinus [5]. It affects children in pre-adolescent and adolescent age, clinically apparent between the age of 5 and 15 years [6]. The low incidence of isolated sphenoiditis is due to its deep position away from the current of nasal secretions, irritants and pathogens [7].The low rate of sphenoiditis can also be explained by the low secretion rate of its lining mucosa and therefore decreased drainage problems as compared to other paranasal sinuses [8]. The clinical presentation of isolated sphenoiditis is usually vague and nonspecific that makes delay in diagnosis [9]. Other symptoms include blindness, opthalmoplegia, cavernous sinus thrombosis, meningitis, cerebral infarction and cranial nerves palsy [10].

The sphenoid sinus is often referred to as the neglected sinus [11]. Infection usually occurs in conjunction with infection of the other paranasal sinuses. Isolated acute sphenoiditis is rare [12] and it is reported almost uniquely in older children [13]. It merits particular concern, due to potentially serious and even fatal complications. It is frequently misdiagnosed because of its atypical presentation.

Orbital and intracranial complications of sinusitis are uncommon but may cause significant morbidity and mortality [14]. The orbit is prone to spread of infection through the lamina papyracea, a thin bone that separates the medial orbital wall from the ethmoid sinuses. Medial wall periosteal abscess is the most common complication. Periorbital cellulitis and ocular findings (abnormal visual examination, opthalmoplegia, or proptosis) are common at presentation [14].

Intracranial complications most commonly result from extension of frontal sinusitis. Intracranial spread of infection is likely through progression of septic thrombi or transmission of septic emboli through valveless diploic veins of the skull base that penetrate the dura. Symptoms at presentation that suggest intracranial complications include Pott's puffy tumor, altered consciousness, seizures, hemiparesis, and cranial nerve palsy [14]. Complications include meningitis, encephalitis, epidural and subdural suppuration, orbital abscess, and, less commonly, brain abscess and dural sinus thrombophlebitis [15]. Radiographs are limited in the evaluation of the paranasal sinuses because they cannot localize the pathology well and cannot evaluate the osteomeatal complex. In addition, radiographs both underdiagnose and over diagnose soft-tissue changes in the paranasal sinuses as compared to CT scan [16].

Computed Tomography CT scans are the gold standard study guiding management of sinusitis because they accurately depict the sinus anatomy, including soft-tissue changes, anatomic variations; the osteomeatal complex, and complications, especially those involving the orbit or intracranial structures [15]. The differentiation between viral and bacterial sinusitis and the decision about whether to treat with antibiotics may be difficult [12]. With the advent of multidetector CT scan volume isometric imaging, it is possible to obtain axial images and reconstruct the coronal planes [16]. CT is the study of choice in patients with recurrent or chronic sinusitis before functional endoscopic sinus surgery (FESS) as it provides a road map for surgery [17]. If suspicion exists for complications of sinusitis — such as preseptal or postseptal cellulitis, subperiosteal abscess, orbital cellulitis or abscess, cavernous sinus thrombosis, osteomyelitis of the frontal bone, subdural empyema, epidural or brain abscess, meningitis, brain infarction, or mycotic aneurysm — then intravenous contrast CT, including the brain and sinuses, is indicated [18].

Magnetic Resonance Imaging MRI can identify mucosal thickening and differentiate mucosal thickening from sinus secretions [19] and it is not associated with ionizing radiation. However bony detail of the osteomeatal complex, bony erosions, limited availability, and higher costs compared to CT impedes its routine use.

A high incidence of soft-tissue findings is noted on radiographs, computed tomography (CT), and magnetic resonance imaging (MRI) in patients who have no clinical evidence of sinus disease but have undergone these examinations for other reasons. Incidences of 33%-50% have been reported [20]. In our study the incidence of asymptomatic sphenoid sinus opacification is 34.5% consistent with previous studies. MRI studies have also shown that soft-tissue changes in sinuses can last months following an acute infection (18). Clinical correlation is critical for evaluating the significance of the imaging findings. In addition, most patients with clinical diagnosis of acute sinusitis will also have radiographic abnormalities correlating with sinusitis and, therefore their management will not change [21].

It is well recognized that disorders of the paranasal sinuses, and in particular of the sphenoid sinus, can cause significant neuro-ophthalmic morbidity [11].

Several publications [13] have reviewed the anatomic features of the sphenoid sinus and emphasized the proximity of important neurovascular structures such as the optic nerve, first two divisions of the trigeminal nerve, and the carotid artery to the internal environment of the sphenoid. Using high resolution CT, Johnson et al. [14] reported that 14% of their patients had no bony separation of the carotid artery. Schatz and Becker [6], in a review of the CT anatomy of the sphenoid sinus, noted that the mucosa of the sinus so closely approximates the bone that the normal mucosa cannot be visualized on CT and, therefore, any bulge of soft tissue that is seen in the sinus is abnormal.

Abnormalities were detected in only 7% of the routine CT scans, 8% of the posterior fossa CT scans, and 6% of the MR scans, confirming that even with more advanced radiologic techniques demonstration of sphenoid sinus disease is uncommon. Clinicians and radiologists managing patients with neuroophthalmic complaints should appreciate the proximity of important neurovascular structures to the sphenoid sinus and recognize that sphenoid sinus disease can threaten vision.

Conclusion

Chronic isolated sphenoid sinusitis in adults is a rare but serious condition. Its unspecific presentation may delay the diagnosis and can lead to devastating complications. It may involve several intracranial structures, with potentially severe or even fatal complications. Prompt diagnosis and antibiotic therapy is essential to minimize mortality and morbidity. CT scan of the head is the examination of choice and MRI may be considered, if necessary. Uncomplicated cases can resolve with optimal antibiotic therapy.

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