SIGNIFICANCE OF PARANASAL SINUS APLASIA

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ABSTRACT

Introduction*: Paranasal sinus aplasia is a rare condition mostly affecting the frontal and sphenoid sinuses and more rarely the maxillary sinuses.*

Material and methods*: The present study retrospectively evaluated axial and coronal 1 mm thick CT scans of paranasal sinuses in 1502 cases. The patients without aeration of the frontal bone and ethmoidal cells above the supraorbital margin (horizontal line) and patients without aerated cells extending beyond the medial wall of the orbit (vertical line) were considered to have frontal sinus aplasia*

Results*: Of 1502 patients with an age range between 16 and 73 years, 819 were females and 683 were males. Of these patients, 42 (0.27%) had bilateral frontal sinus aplasia and 53 (0.35%) had unilateral frontal sinus aplasia. Only two patients had sphenoid sinus aplasia and one patient had maxillary sinus aplasia.*

Conclusion*: Paranasal sinuses represent great structural variations. Fractures, mucocele, primary ciliary dyskinesia, infections, and some syndromes may affect the development of PNSs. Aplasia of PNSs can point to clinically significant diseases and it must be kept in mind and explored during planning for surgical intervention to the sinuses in order to prevent complications. Computed tomography is a useful method in delineating a detailed anatomy of PNSs and detecting anomalies and pathological conditions.*

Keywords*: Paranasal, sinus, aplasia, anomaly.*

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Introduction

Paranasal sinuses (PNSs) are spaces that surround the nasal cavity in the skull. The development of paranasal sinuses and their final shapes exhibit great variations, even between the twins[1]. Paranasal sinuses are considered to have many functions such as increasing resonance of the voice, humidifying and heating of inhaled air, contributing the development of facial structures, and providing thermal insulation of the brain[2].

Paranasal sinus aplasia is a rare condition mostly affecting the frontal and sphenoid sinuses and more rarely the maxillary sinuses[3].

Frontal sinus is located posterior to the supraciliary archus between the internal and external portions of the frontal bone. Ventilation of this sinus varies individually, and it is also different for the right and left halves. Frontal sinus develops very slowly. Ventilation of the sinus starts around the age of two years, and its development continues until adolescence[4].

Frontal sinus shows frequent variations between individuals. Each person has a different frontal sinus configuration. This difference was even suggested to be used for authentication of the identification of an individual by frontal sinus radiography[5]. Maxillary sinus starts developing during the intrauterine third month. Lower boundaries of the sinus and the nasal cavity reach the same plane around the age of 10 years. This development continues until puberty[3]. Many patients with maxillary sinus aplasia are asymptomatic, and the condition is incidentally detected on routine radiography. However, some patients present with chronic headaches, facial aches, and voice problems[6]. Unilateral opacified appearance of the maxillary sinus on plain radiography may be seen as a result of infectious mucosal thickening, tumoral involvement, sinus athelectasis due to chronic sinusitis or aplasia/hypoplasia[7]. Sphenoid sinus is located in the sphenoid bone and its shape and size varies between individuals. Its ventilation starts at age of three years and reaches the size in an adult around the age of 12 years[8]. Sphenoid sinus aplasia is rare and may present with craniofacial abnormalities and syndromes[9].

The aim of the present study was to evaluate the prevalence of paranasal sinus aplasia using computed tomography (CT) scans of the paranasal sinuses in a large patient population.

Materials and methods

The present study retrospectively evaluated axial and coronal 1 mm thick CT scans of paranasal sinuses in 1502 cases. Of these patients, 819 were females and 683 were males. The mean age was 37.6 years, ranging from 16 to 73 years. Right, left, and bilateral aplasia of frontal, maxillary, and sphenoid sinuses were adjudicated by a radiologist (Y.A.) and three otorhinolaryngologists (S. D., A. A., Ö. S.), who were certified by the competency board of the Association of ENT-HNS. The patients without aeration of the frontal bone and ethmoidal cells above the supraorbital margin (horizontal line) and patients without aerated cells extending beyond the medial wall of the orbit (vertical line) were considered to have frontal sinus aplasia[10].

The patients under 16 years of age were excluded considering the fact that the development of frontal sinuses is continued until adolescence. In addition, patients with a previous history of paranasal sinus or facial surgery, trauma or any invasive disorder affecting the area of paranasal sinuses were also excluded from the study.

Results

Of 1502 patients with an age range between 16 and 73 years, 819 were females and 683 were males. Of these patients, 42 (0.27%) had bilateral frontal sinus aplasia and 53 (0.35%) had unilateral frontal sinus aplasia. Only two patients had sphenoid sinus aplasia and one patient had maxillary sinus aplasia. None of the patients with paranasal sinus aplasia had manifest otorhinolaryngologic symptoms.

Discussion

Although there is still a debate over the functions of paranasal sinuses, they are assumed to be involved in various processes such as humidifying and heating inhaled air, assisting in smelling, decreasing the weight of the skull, increasing resonance of the voice, and providing thermal insulation of the brain and orbit. On the other hand, some have suggested that paranasal sinuses have no function at all[11]. Nasal breathing has been shown to be an important factor in the development of the paranasal sinuses[12]. Maxillary and ethmoidal sinuses are presented at birth as rudimentary air cells, and sphenoid and frontal sinuses are not present at birth. Headache, facial pain, nasal drip, and voice problems can be observed in patients with PNS aplasia but most patients are usually asymptomatic or not aware of the symptoms[6]. Paranasal sinuses represent great structural variations. Fractures, mucocele, primary ciliary dyskinesia, infections, and some syndromes may affect the development of PNSs[13].

Cakur et al. (14) screened 410 patients and reported rates of 0.73% and 1.22% for bilateral and unilateral frontal sinus aplasia, respectively. A lower rate of frontal sinus aplasia compared to the 3-12% prevalence rate in other series was attributed to the ethnical characteristics of their population. This rate can vary greatly in different populations. For example, frontal sinus aplasia can be as high as 36% in females and 25% in females of Alaskan Inuits, whereas the rate is 40% in females and 43% in males of Canadian Inuits[15]. Aydinlioglu et al.[16] reported that the frontal sinus could be used for authentication of an individual identity, as it might largely vary between individuals, and in their series screening 1,200 patients, the authors found unilateral and bilateral frontal sinus aplasia in 4.8% and 3.8% of the

cases, respectively. In the present study, the rates of bilateral and unilateral frontal sinus aplasia were 0.27% and 0.35%, respectively.

The appearance of opacities in direct x-rays of the maxillary sinuses should suggest infectious mucosal thickening, and tumor or sinus aplasia. PNS CT scans appear to be the most ideal method to further delineate the lesion[3]. Jafari-Pozve et al.[3] reported three cases with maxillary sinus aplasia, at ages of 68, 20, and 12 years. Two of these cases were asymptomatic and maxillary sinus aplasia was detected on computed tomography obtained before dental implantation. The other patient was previously operated for a cleft palate and had symptoms including chronic headache, nasal discharge, and voice abnormality. In the present study, only one out of 1502 patients had maxillary sinus aplasia.

The prevalence of sphenoid sinus aplasia has been reported to be 1-1.5% and the prevalence of maxillary sinus aplasia has been reported to be 5-6%[8]. Sphenoid sinus aplasia was reported for the first time by Antoniades et al.[17] as Hand-Schuller-Christian disease. Aydinlioglu et al.[18] reported no sphenoid sinus aplasia in 1526 patients; however, two patients had unilateral sphenoid sinus aplasia in their patients. In the present study, only two patients had sphenoid sinus aplasia and none of these patients had any otorhinolaryngologic problem, cranio-facial anomaly, or any other syndrome.

Aydinlioglu et al.[18] screened 1,526 patients and detected maxillary sinus aplasia only in two (bilateral in one and unilateral in the other patient), and absence of unilateral sphenoid sinus in two patients. None of their patients had bilateral sphenoid sinus aplasia. Simultaneous aplasia of multiple sinuses is a rare event. Khanduri et al.[20] reported a 54-year-old female patient with the complaints of nasal obstruction and persistent headaches, who was found to have bilateral frontal and sphenoid sinus aplasia along with bilateral maxillary and ethmoid sinus hypoplasia. Korkmaz et al.[1] reported a 57-year-old female patient with complaints of nasal fullness and chronic episodes of headaches, who had total aplasia in all paranasal sinuses. That patient is the second patient with total paranasal sinus aplasia presented in the literature, suggesting that PNS aplasia might result in decreased pain threshold in this patient.

Some have suggested that aplasia of the frontal and sphenoid sinuses is considerably higher in patients with ciliary dyskinesia and that these conditions could be a part of primary and secondary ciliary dyskinesia[21].

Recognition of maxillary sinus aplasia is particularly important in preventing damage to the orbit during endoscopic sinus surgery[3]. Aplasia of the sphenoid sinus is extremely rare; however, recognition of this condition in advance is crucial in patients who are to undergo transsphenoidal hypophysectomy[22]. It must be kept in mind that aplasia of paranasal sinuses can occur in patients with cystic fibrosis or ciliary dyskinesia and aplasia of paranasal sinuses can be confused with infectious lesions and tumors[23,24]. In addition, clinical presentations and complaints of patients with PNS aplasia can provide information about the functions of PNSs.

In conclusion, aplasia of PNSs can point to clinically significant diseases and it must be kept in mind and explored during planning for surgical intervention to the sinuses in order to prevent complications. Computed tomography is a useful method in delineating a detailed anatomy of PNSs and detecting anomalies and pathological conditions.

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