CASE SERIES

Case Series on Anatomical Variants of Paranasal Sinuses on Computed Tomography

Piyush Srivastava, Pooja Shah

Department of Radiodiagnosis, Smt. Kashibai Navale Medical College and General Hospital, Pune, Maharashtra, India

ABSTRACT

A comprehensive understanding of paranasal sinus anatomy is crucial for clinicians. Traditional radiological techniques fall short in detailing the nasal cavity and paranasal sinuses, which are now better visualized through computed tomography (CT) imaging. CT provides detailed anatomical perspectives and identifies common anatomical variants. Recognizing these variants is essential for the safe application of modern endoscopic sinus surgery, as it helps avoid potential complications. Multidetector CT is increasingly used to image the paranasal sinuses before functional endoscopic sinus surgery. Multiplanar imaging, particularly coronal reformations, offers accurate insights into sinus anatomy and its variations, which is vital before surgical procedures. This study focuses on anatomical variants in the nasal fossae and paranasal sinuses observed through CT and highlights several common anatomical variations, excluding broader anatomical variations such as deviated nasal septum and concha bullosa.

Keywords: Anatomic variants, computed tomography, functional endoscopic sinus surgery, paranasal sinuses, sinusitis subject – radiology

INTRODUCTION

The paranasal sinuses are typically composed of four paired air-filled cavities. They play various roles, including reducing head weight, humidifying air, and enhancing voice resonance. These sinuses are named according to the facial bones in which they are located:

1. Maxillary sinus
2. Sphenoid sinus
3. Ethmoid sinus
4. Frontal sinus.

Variant Anatomy

Paranasal sinuses exhibit significant variability between individuals and even between sides within the same individual, in terms of size and bony septations. Notable anatomical variants include:

- Haller cells
- Onodi cells
- Agger nasi cells
- Aerated crista galli
- Anterior clinoid process pneumatization
- Isolated frontal sinus agenesis
- Accessory ostia of the maxillary sinus
- Posterior nasal septal air cell
- Total paranasal sinus agenesis
- Protrusion and/or dehiscence of – internal carotid artery.
  - Optic nerve
  - Maxillary nerve
  - Vidian nerve.
- Pneumatization of pterygoid processes
  - Greater wing of the sphenoid
  - Sphenoid sinus septa attachment on the bony canal of the optic nerve.

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Case 1

A 27-year-old female presented with complaints of nasal obstruction and headache for 1 month.

Address for correspondence:
Piyush Srivastava, Department of Radiodiagnosis, Smt. Kashibai Navale Medical College and General Hospital, Pune, Maharashtra, India.
E-mail: piyushsrivastava2697@gmail.com

Following is the computed tomography (CT) imaging [Figure 1] –

Discussion

Haller cells, or infraorbital ethmoidal air cells, are located lateral to the maxillo-ethmoidal suture along the inferomedial orbital floor. Present in approximately 20% of patients, they are typically asymptomatic.[1,2] However, they can cause complications if infected, narrow the ipsilateral ostiomeatal complex, or lead to inadvertent orbital entry during endoscopic surgery.[3]

Case 2

A 65-year-old female with a history of sinusitis underwent a CT scan for complaints of sinusitis.

Following is the CT imaging [Figure 2] –

Discussion

The Onodi cell, a type of sphenoethmoidal air cell, varies in prevalence from 3.4% to 60%.[4,5] These cells are usually asymptomatic but can become problematic if complicated by sinus disease due to their proximity to critical structures such as the optic nerve and internal carotid artery.[4] Potential damage to these critical structures occurs when attempts to enter the sphenoid sinus endoscopically are made by passing through the posterior wall of the sphenoethmoidal air cell expecting to enter the sphenoid sinus.

Case 3

A 33-year-old male came with complaints of nasal obstruction, nasal discharge, facial pain, headache, halitosis, and anosmia for 14 weeks.

Following is the CT imaging [Figure 3] –

Figure 1: Haller cell (left infraorbital) is best visualized in the coronal plane on CT

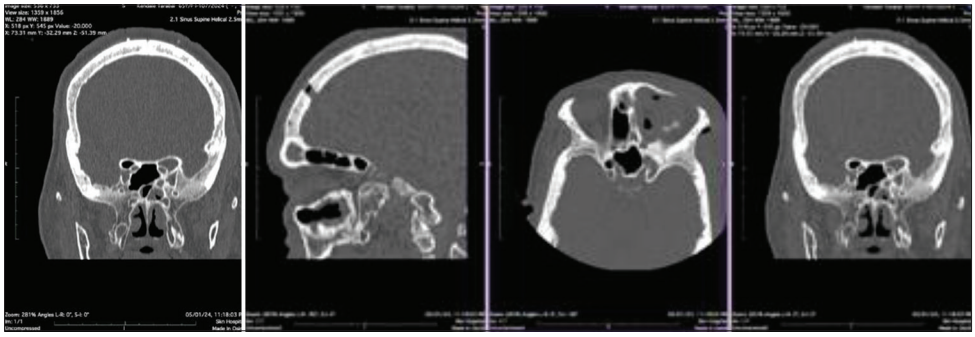

Figure 2: Onodi cell (right superolateral to sphenoid sinus) is best visualized in the coronal plane on CT

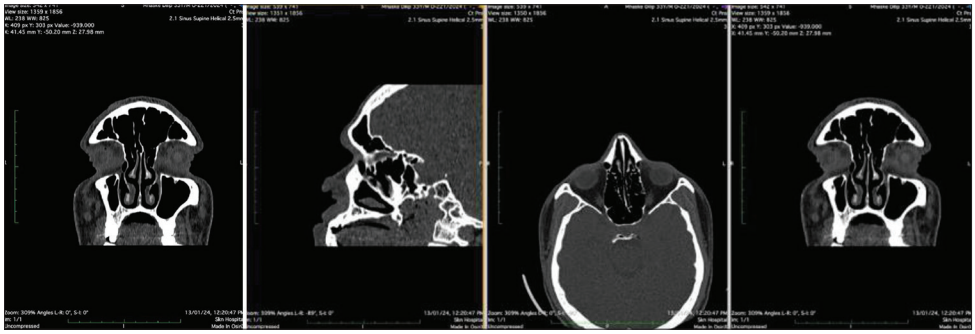

Figure 3: Agger nasi cell (anteroinferior to frontoethmoid recess) is best visualized in the coronal plane on CT

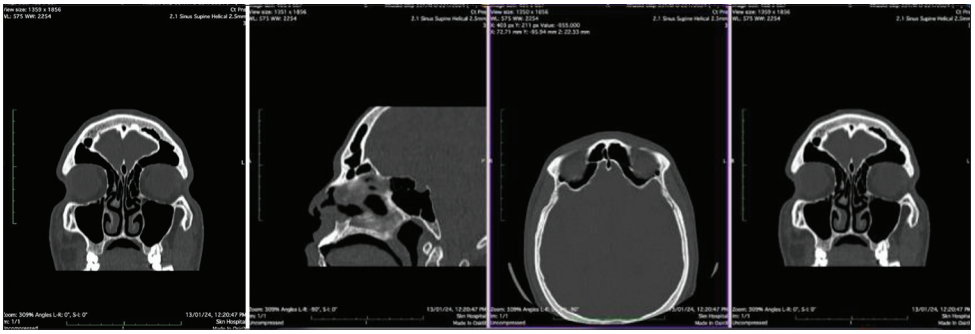

Figure 4: Aerated crista galli in the coronal plane on CT

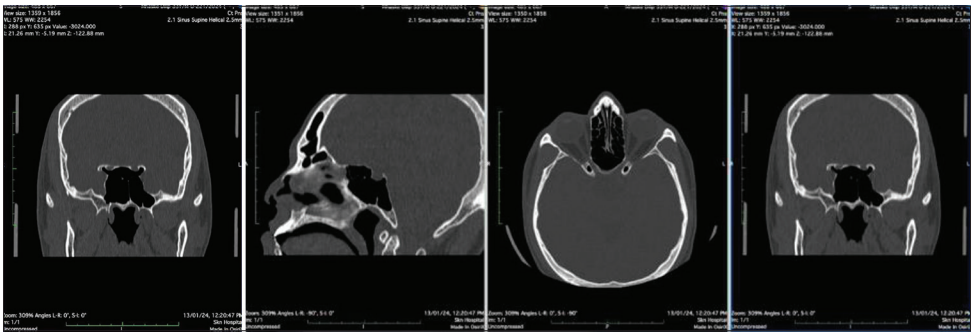

Figure 5: Bilateral pneumatization of the anterior clinoid process in the coronal plane on CT

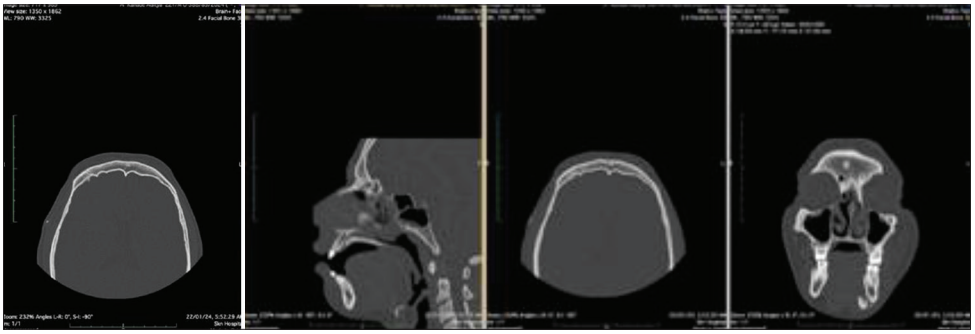

Figure 6: Bilateral aplasia of frontal sinus in the axial plane on CT

Discussion

Agger nasi cells are anterior ethmoidal air cells that can narrow the nasofrontal recess, potentially leading to frontal sinus disease.[6] They are present in 90% of individuals and should not be confused with other types of air cells.

Case 4

A 33-year-old male came with complaints of nasal obstruction, nasal discharge, facial pain, headache, halitosis, and anosmia for 14 weeks.

Following is the CT imaging [Figure 4] –

Discussion

The crista galli, which develops from the mesial mass of the ethmoidal cartilage, typically ossifies postnatally.[7] Aerated crista galli is generally an incidental finding.

Case 5

A 33-year-old male came with complaints of headaches and visual disturbances for 4 weeks.

Following is the CT imaging [Figure 5] –

Discussion

The anterior clinoid processes can occasionally be pneumatised. This condition, found in 6–24% of cases, can lead to complications if the sphenoid sinus wall becomes incompetent.[8]

Case 6

A 22-year-old male with a history of sinusitis underwent a CT scan for complaints of sinusitis. Following is the CT imaging [Figure 6] –

Discussion

Frontal sinus development begins late in intrauterine life and can vary, with aplasia occurring in approximately 5% of cases.[9] This variation can have implications for surgical procedures due to the proximity of the sinus to the orbit and anterior skull base.[10]

CONCLUSION

Anatomical variations in the sinus cavities are common and can be found in many individuals. No significant differences were noted in the incidence of sinus variability between patients with minimal or significant radiological signs of sinusitis. However, recognizing specific anatomical variants is crucial for planning endoscopic or other skull base surgeries to minimize complications.

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