

# The Supraethmoidal Roof Cell: An Unreported Sinus Anatomic Variation

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## Keywords

sinus anatomy, variation, endoscopic sinus surgery, complication

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The anatomy of paranasal sinuses has immense morphological variations among individuals. Identifying those variations prior to surgery helps to minimize the complications that might occur in endoscopic sinus surgery, such as perioperative bleeding, retro-orbital hemorrhage, and cerebrospinal fluid (CSF) leak. The established anatomical variations in the frontal sinus include the agger nasi cell, supra agger cell, supra agger frontal cell, supra bulla cell, supra bulla frontal cell, supraorbital ethmoid cell, and frontal septal cell in the frontal sinus recess.<sup>1</sup> The ethmoid sinus includes the infraorbital ethmoid, Haller, ethmoid maxillary sinus, retro-maxillary posterior ethmoid cell, and Onodi cell.<sup>2</sup>

However, there have been no reports on a single cell that is pneumatized in the supraethmoidal and supraorbital regions and extends to the anterior wall of the sphenoid sinus. We present a patient with this unique sinus anatomical variation found on preoperative computed tomography (CT) and confirmed this finding in the operation. The study was approved by the ethics committee of Hunan Provincial People's Hospital.

## Case Report

The patient is a 24-year-old man who presented with nasal obstruction and anosmia for 2 years. From a 3-dimensional CT reconstruction of the sinuses, it can be noted that there was a unique cell situated posterior to the frontal sinus, superior to the medial orbital wall, and superior to the ethmoid roof, and it was pneumatized posteriorly to the anterior wall of the sphenoid sinus. We have named this cell a supraethmoidal roof cell (SERC) (**Figure 1**).

The anterior and posterior ethmoid arteries (AEAs and PEAs) were identified on the CT scan according to the method suggested by Lannoy-Penisson.<sup>3</sup> The SERC was confirmed during the endoscopic surgery (**Figure 2**). Due to careful analysis of the sinus variation on the CT scan preoperatively, the surgery went smoothly without any significant bleeding or skull base injury.

## Discussion

This patient had a unique cell that we have called a SERC. It is of utmost importance to identify those anatomic variations preoperatively to avoid encountering complications such as arterial injury, CSF leak, or incomplete opening of the sinuses. The SERC is somewhat different from a supraorbital ethmoid cell (SOEC), because a SOEC was defined as an anterior ethmoid cell that pneumatizes around, anterior, or posterior to the AEA over the roof of the orbit.<sup>1</sup> Recently, a supraseptal ethmoid sinus cell was reported. It was superior to the nasal septum and attached directly to the ethmoid roof. The AEA ran anteriorly and laterally to it. It might have been formed by hyperpneumatization of the ethmoid labyrinth.<sup>4</sup> However, the SERC seen here developed above the ethmoid roof and extended to the anterior wall of the sphenoid sinus. Both the ethmoid arteries were positioned beneath it, while the anterior skull base was located superiorly. We postulate the SERC is formed by hyperpneumatization of the frontal bone. In a previous study, it was thought that the ethmoid arteries can serve as constant landmarks in the endoscopic endonasal approach to the anterior skull base.<sup>5</sup> It was also noted that the ethmoidal roof usually serves as the outer limit for endonasal surgery. But in a patient with a SERC, the ethmoid arteries are not reliable landmarks for the anterior skull base. Preoperative awareness of this variation is necessary for safe and effective endoscopic sinus surgery.

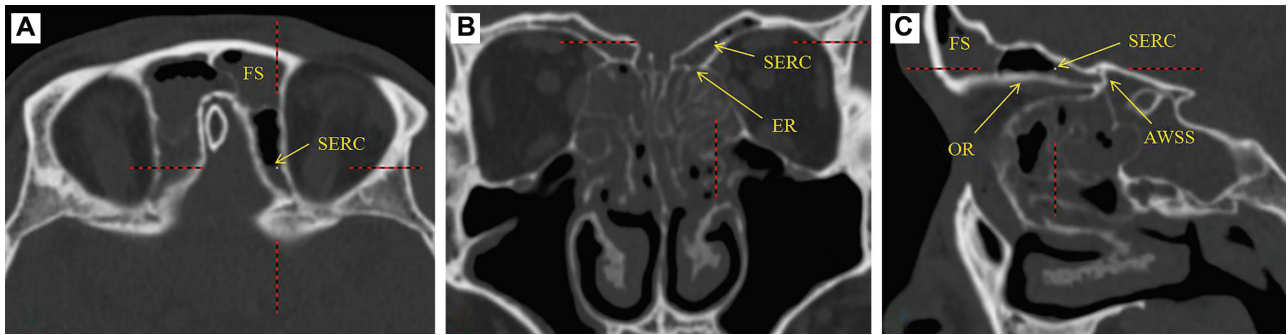
While the origin of SERC is not clear, it could be due to pneumatization from the frontal bone due to its location above the ethmoid roof. To the best of our knowledge, this is the first article to report this anatomic variation, which we have called the SERC. Identifying this cell prior to surgery may help to minimize intraoperative complications and facilitate the management of successful endoscopic sinus surgery.

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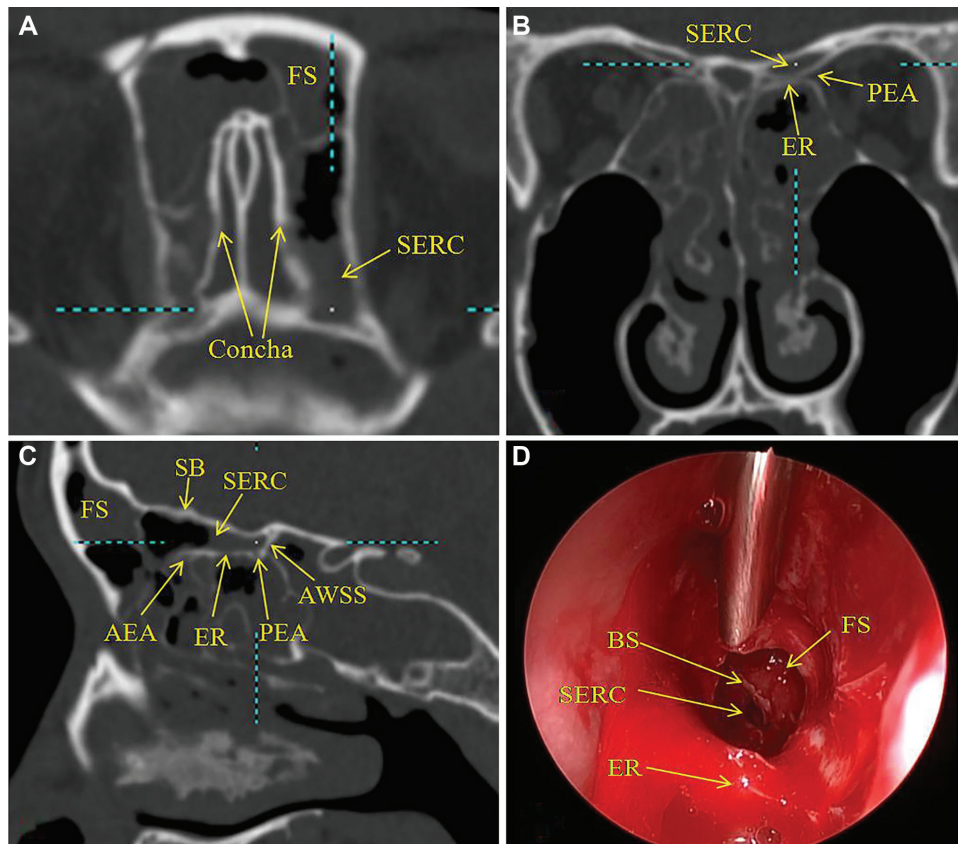
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**Figure 1.** The supraethmoidal roof cell (SERC) lies posterior to the frontal sinus (FS), superior to the ethmoid roof (ER), and toward the anterior wall of the sphenoid sinus (AWSS). Panels A, B, and C represent the axial, coronal, and sagittal planes, respectively. OR, orbital roof.



**Figure 2.** Anterior ethmoid artery (AEA) and posterior ethmoid artery (PEA) were included in the ethmoid roof (ER). The anterior skull base (SB) lies above the supraethmoidal roof cell (SERC). (A-C) Axial, coronal, and sagittal planes, respectively. (D) A 70-degree endoscope, a bone septum (BS) between frontal sinus (FS) and SERC. AWSS, anterior wall of the sphenoid sinus.

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### Author Contributions

**Jianbo Zhou**, conception and design, data acquisition, manuscript drafting; **Yun Xie**, analyzing and reconstruction the CT scan; **Xi Huang**, patient management; **Yiwei Chen**, patient management.

### Disclosures

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### References

1. Wormald PJ, Hoseman W, Callejas C, et al. The International Frontal Sinus Anatomy Classification (IFAC) and Classification

- of the Extent of Endoscopic Frontal Sinus Surgery (EFSS). *Int Forum Allergy Rhinol.* 2016;6(7):677-696.
2. Liu J, Liu Q, Wang N. Posterior ethmoid cell expansion towards the inferolateral region of the sphenoid sinus: a computed tomography study. *Surg Radiol Anat.* 2019;41(9):1011-1018.
  3. Lannoy-Penissou L, Schultz P, Riehm S, et al. The anterior ethmoid artery: radio-anatomical comparison and its application in endonasal surgery. *Acta Otolaryngol.* 2007;127(6):618-622.
  4. Gore MR. The supraseptal ethmoid sinus cell: a previously unreported ethmoid sinus variant. *Clin Case Rep.* 2019;7(7):1306-1308.
  5. Zong Y, Li X, Jiang Y, et al. Transnasal approach to the anterior skull base: an endoscopic anatomic study. *J Craniofac Surg.* 2014;25(3):1041-1043.