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## **Interfrontal Sinus Septal Cell: A Cause of Obstructing Inflammation and Mucocèles**

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*AJNR Am J Neuroradiol* published online 8 May 2008

<http://www.ajnr.org/content/early/2008/05/08/ajnr.A1107.citation>

This information is current as of April 19, 2024.

ORIGINAL  
RESEARCHP.M. Som  
W. LawsonInterfrontal Sinus Septal Cell: A Cause of  
Obstructing Inflammation and Mucocoeles

**BACKGROUND AND PURPOSE:** Recent interest in the origin and complications associated with frontal intersinus septal cells prompted us to review our material looking for cases of the uncommon occurrence of a mucocoele developing within such a cell. The purpose of this article was to present the imaging findings on 4 cases of mucocoeles arising within surgically proven frontal intersinus septal cells.

**MATERIALS AND METHODS:** A retrospective review of the case material in our department of otolaryngology since 2000 was made looking for cases of patients with surgically proven frontal intersinus septal cell mucocoeles. Institutional review board approval for the review was obtained. Four cases were identified that also had CT and/or MR imaging studies. Examples of 4 additional classic frontal sinus mucocoeles and 3 anterior ethmoid mucocoeles were also identified for comparison.

**RESULTS:** All 4 of the cases of frontal intersinus septal cell mucocoeles had an expanded midline frontal sinus cell, which thinned the posterior and/or anterior frontal sinus tables. The classic frontal sinus mucocoeles were either to the left or right side, and any table thinning was off midline. The ethmoid mucocoeles were clearly centered below the frontal sinuses.

**CONCLUSIONS:** The rare occurrence of a frontal intersinus septal mucocoele can be diagnosed on CT and MR imaging studies, because its appearance in the midline is clearly distinct from the more common classic frontal sinus mucocoeles that develop within the left or right frontal sinus proper. Distinction is also routinely made from large anterior ethmoid mucocoeles.

There has been some recent interest in the origin of, and complications associated with, frontal intersinus septal cells.<sup>1-6</sup> The complications are the result of disease within these septal cells obstructing the adjacent frontal sinuses. This is especially true in the uncommon occurrence of a mucocoele developing within such a cell. The purpose of this article was to present the imaging findings on 4 cases of mucocoeles arising within surgically proven frontal intersinus septal cells.

## Materials and Methods

A retrospective review was made of the paranasal sinus cases operated on at our institution since 2000, which involved disease within a frontal intersinus septal cell. From this material, we found 4 cases of surgically proven mucocoeles arising within a frontal intersinus sinus septal cell. These cases were imaged either with CT scans or MR images on a variety of scanners both within and outside our institution. The study was performed with approval of the internal review board No. 06-254. The patients ranged in age from 37 to 68 years, and there were 3 women and 1 man. The images were reviewed by a head and neck radiologist and the otolaryngologist who operated on the cases.

## Results

All 4 of the cases showed an expanded central cell in the frontal sinus obstructing the more laterally positioned frontal sinus cavities (Fig 1-4). There was thinning of the midline anterior and/or posterior frontal sinus tables in all of the cases. In one case, a Pott puffy tumor developed from an expanding central frontal cell (Fig 4). For purposes of comparison, 4 cases of classic frontal sinus mucocoeles were reviewed, and representative images are shown in Fig 5. Three cases of ethmoid mucocoeles were also reviewed, and a representative image is shown in Fig 6. The classic frontal sinus mucocoeles clearly arose in 1 side of the frontal sinuses, and if the frontal sinus tables were thinned, it was off of the midline. The large anterior ethmoid mucocoeles all had their epicenter in the ethmoid complex, caudal to the frontal sinuses, and only impinged off of the midline on the lower frontal sinus. Thus, the frontal intersinus septal cell mucocoeles were routinely distinguished from these other mucocoeles.

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## Discussion

There are 3 principal groups of cells that impact the frontal sinuses. Of these, the supraorbital cells have received the greatest attention with regard to their role in the pathogenesis of frontal sinus disease and its management.<sup>7</sup> These cells pneumatize the orbital plate of the frontal bone posterior to the frontal recess.<sup>8-10</sup> They generally arise from anterior ethmoid cells, but they can also develop from a posterior cell, and they may be multiple. They drain into the frontal recess posterior to the frontal sinus ostium. Their incidence has been estimated at 5%–15%<sup>11</sup> in dissection studies, but imaging studies have detected a much greater prevalence (62%).<sup>3</sup>

The intrafrontal (intrabullar, type III and IV) cells have the lowest incidence estimated at 1%–2%. On review of approximately 600 CT scans, Bent et al<sup>12</sup> detected them in 9 skulls (1.5%). In a later study of 50 patients examined with multiplanar CT, Lee et al<sup>3</sup> found type III cells in 8% of cases.

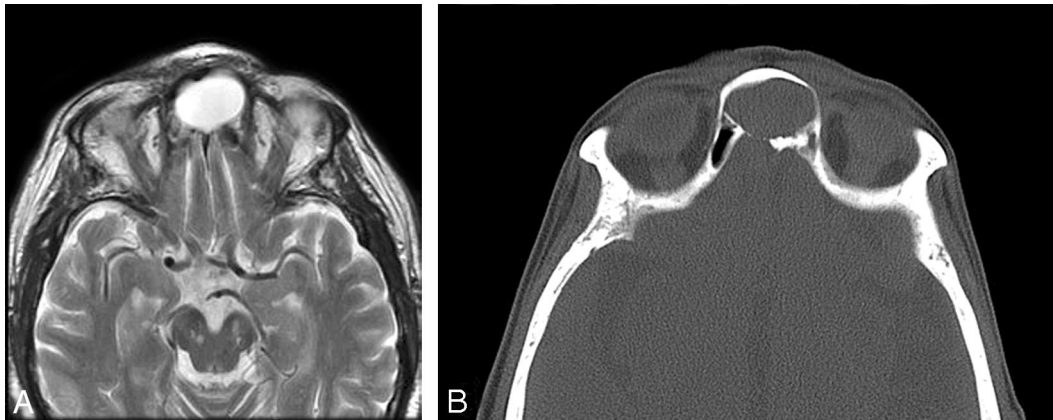
Finally, there is the intersinus septum cell (ISSC), which is common but has received the least attention in the literature. These cells are defined as a pneumatization within the midline or paramedian bony lamella (septum) between the frontal sinuses. Van Alyea<sup>11</sup> noted them to be the most frequent cell, present in 28 (11.6%) of his 242 dissection specimens. In a coronal CT scan study of 300 heads (200 patients with chronic sinusitis and 100 cadavers) by Merrit et al,<sup>13</sup> an ISSC was identified in 34%, 10 having multiple cells. The cells extended var-

Received February 26, 2008; accepted March 2.

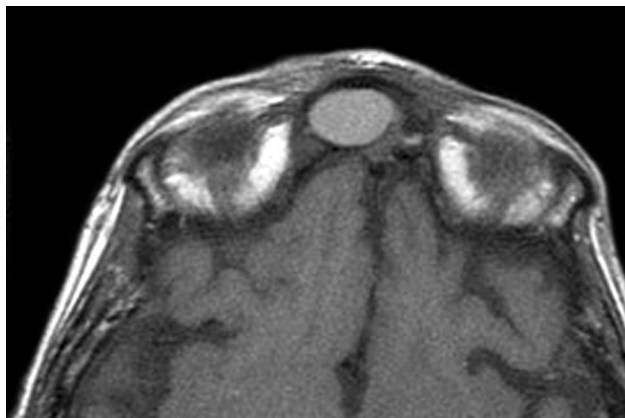
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DOI 10.3174/ajnr.A1107



**Fig 1.** A 37-year-old woman presented with a feeling of pressure in her forehead. *A*, An axial T2-weighted MR image shows an expanded interfrontal sinus septal cell with high signal intensity. *B*, A CT scan shows the mucocoele thinning the midline posterior frontal sinus table.

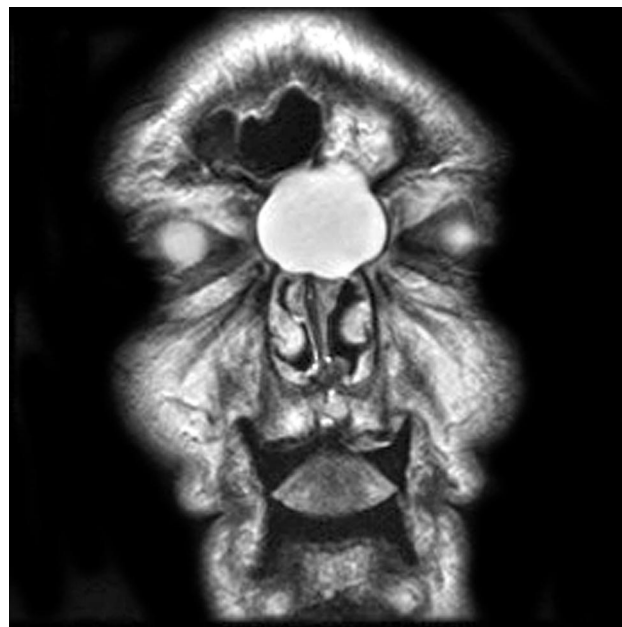


**Fig 2.** A 43-year-old man presented with a headache. An axial T1-weighted MR image shows an expanded interfrontal sinus septal cell with high (proteinaceous) signal intensity. There was thinning of the central posterior sinus table.

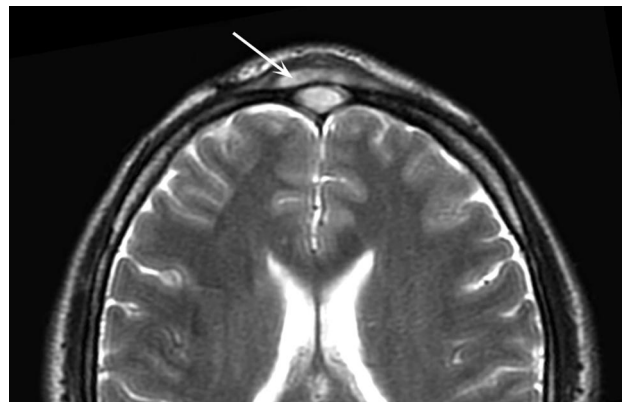
ious distances along the height of the septum. Paradoxically, a multiplanar 3D-CT scan study of 50 heads found a prevalence of 14%.<sup>3</sup> In a prospective CT scan study performed in the coronal and axial planes of 200 consecutive nonsinusitis patients, Som and Lawson<sup>4</sup> found ISSC in 30.5% of the cases, also having variable extension along the septum. However, this study revealed communications between most of these cells (85.5%) and the frontal sinus, suggesting that most of these cells may arise as diverticular extensions from the frontal sinuses rather than by the evagination of anterior ethmoid air cells from the frontal recess.

The literature contains few references regarding pathology of the ISSC. Van Alya<sup>11</sup> noted that the ISSC may pneumatize sufficiently to obstruct the frontal ostium. Merrit et al<sup>13</sup> reported 5 patients in their series of 200 patients with chronic sinusitis to have disease in an ISSC, of which 3 cases failed treatment. Chiu and Vaughan<sup>1</sup> reported enlarging a narrow frontal recess by removing an ISSC. Lawson also stated that, when a deviated intersinus septum is found to impinge on the frontal sinus ostium, an air cell in the lower part of the septum should be suspected.

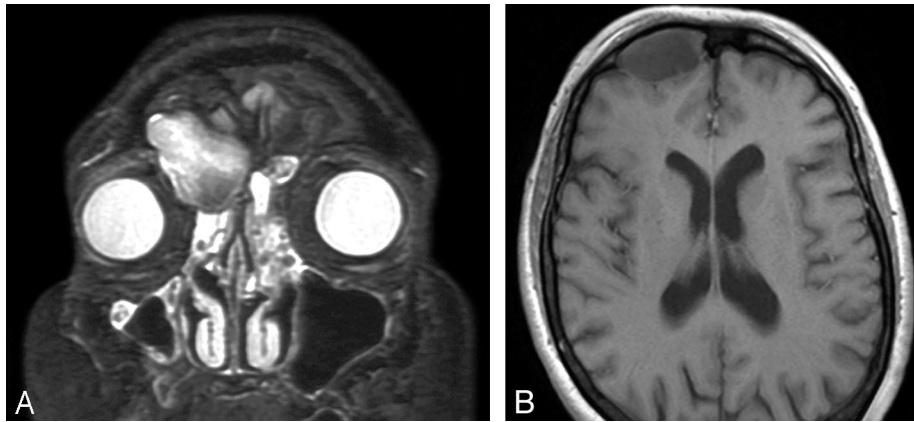
The present study documents that an ISSC may become a mucocoele sufficiently large to unilaterally block the frontal sinus outflow, or it may enlarge massively to form a giant mu-



**Fig 3.** A 57-year-old woman presented with a slowly growing mass in her lower forehead. A coronal T2-weighted MR image shows an expanded interfrontal sinus septal cell with high signal intensity. This mucocoele has obstructed the left frontal sinus proper. At surgery, the right frontal sinus drainage was patent and just behind the mucocoele.



**Fig 4.** A 68-year-old woman presented with a painful forehead mass. An axial T2-weighted MR image shows a minimally expanded interfrontal sinus septal cell with high signal intensity. This mucocoele extended through the midline anterior table and caused a Pott puffy tumor in the overlying scalp (arrow).



**Fig 5.** A 53-year-old man presented with a mass in his upper medial right orbit. A coronal T2-weighted MR image shows a right frontal sinus mucocoele that has expanded the sinus and depressed the superomedial orbital rim. Inflammatory mucosal disease is present in the left frontal sinus, both ethmoid sinuses, and the right maxillary sinus. *B*, A 46-year-old woman presented with a headache. An axial T1-weighted MR image shows a mucocoele expanding the right frontal sinus and thinning the posterior sinus table to the right side, off of the midline.



**Fig 6.** A 32-year-old man presented with a bulge in his medial right orbit and difficulty breathing through the right side of his nose. A coronal T2-weighted MR image shows a large right anterior ethmoid mucocoele. It is clearly centered within the ethmoid complex, caudal to the frontal sinuses. Inflammatory mucosal disease is also present in the left ethmoid cells and the right antrum.

cocele involving both frontal sinuses. Such a mucocoele usually erodes the anterior and/or posterior sinus tables.

Current management of frontal and frontoethmoidal mucocoeles is principally by endoscopic marsupialization into the nasal cavity, with external procedures reserved for inaccessible and recurrent lesions. Intersinus septal mucocoeles present an algorithm shift. Although many small mucocoeles may be successfully treated endonasally, large ones expand bilaterally, often sequestering the lateral recesses of the frontal sinus, and require external surgery (osteoplastic flap) primarily for management.

## Conclusions

When a frontal sinus mucocoele is seen to arise in the midline rather than primarily to one side of the frontal sinus, an uncommon mucocoele arising within an interfrontal sinus septal cell should be considered. This may impact what the surgeon must do to correct the problem.

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