

# Frontal Sinus Schwannoma: Case Report and Review of Literature

Erwin Zeta Mangubat, M.D., M.P.H.,<sup>1</sup> Lisa Pitelka, M.D.,<sup>1</sup>  
Guy J. Petruzzelli, M.D., Ph.D., M.B.A.,<sup>1</sup> and Richard W. Byrne, M.D.<sup>1</sup>

## ABSTRACT

Although schwannomas are frequently found in the head and neck region, sinonasal tract involvement is extremely rare, especially those of the frontal sinus. We report a patient with an incidentally found right frontal sinus lesion. The patient underwent resection of the tumor via a right craniotomy. The histological diagnosis was consistent with a schwannoma. There has been no radiographic recurrence on 2-year follow-up.

**KEYWORDS:** Schwannoma, frontal sinus, paranasal sinuses, neurilemma

Schwannomas are generally benign, slowly growing neoplasms that are derived from peripheral nerve sheath Schwann cells and characteristically expand and thin the bony confines of the cavities and foramina in which they arise.<sup>1-3</sup> The neck and head region is the most frequently observed region of schwannomas, accounting for 25 to 45% of all cases.<sup>4</sup> However, only 4% of these head and neck lesions involve the sinonasal tract.<sup>5</sup> Within this location, the ethmoidal sinus is most commonly involved, followed by the maxillary sinus, nasal fossa, and sphenoid sinus.<sup>6-8</sup> Frontal sinus involvement is extremely rare, and there are only a few reported cases.<sup>9-12</sup>

We report the case of a 35-year-old man found to have a large solitary right frontal sinus schwannoma.

## CLINICAL PRESENTATION

A 35-year-old man with recent history of a motor vehicle accident, which resulted in a loss of consciousness, was referred to our neurosurgical clinic by an otolaryngologist with a computed tomography (CT) and magnetic resonance imaging (MRI) that demonstrated a solitary right frontal sinus lesion without intracranial extension

or involvement of other paranasal sinuses. On initial presentation, the patient denied any neurological dysfunction, otorrhea, rhinorrhea, or any symptoms of meningitis. On exam, the patient was neurologically intact, and the area around his right frontal sinus was nontender and without lesions.

Initial agreed-upon management among our service, otolaryngology, and the patient was to have him undergo an endoscopic biopsy and, depending on pathology, possible treatment of this lesion. However, due to the patient's work constraints, his scheduled endoscopic procedure was delayed. Follow-up imaging demonstrated that the lesion had grown quite significantly over the 4-month delay in management (Fig. 1). The patient remained neurologically intact on physical examination, but the frontal bone overlying his frontal sinus was now noted to be mildly irregular upon palpation.

## INTERVENTION

The patient underwent a right frontal craniotomy for complete resection of the mass, which included cranialization of the right frontal sinus and layering of a

<sup>1</sup>Rush University Medical Center, Chicago, Illinois.

Address for correspondence and reprint requests: Erwin Zeta Mangubat, M.D., M.P.H., Rush Professional Office Building, 1725 W. Harrison Street, Suite 970, Chicago, IL 60612 (e-mail: emangu1@gmail.com).

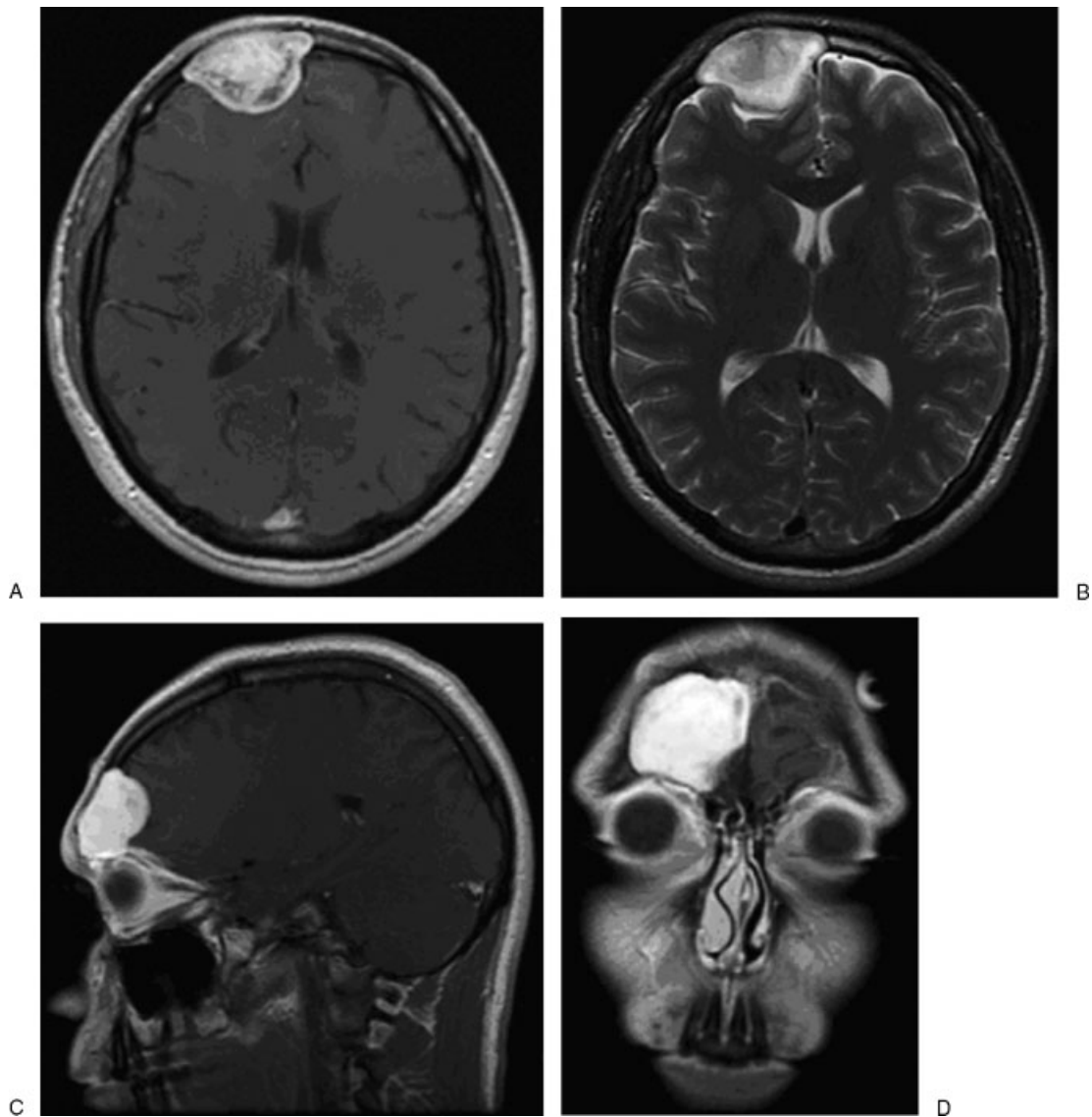
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**Figure 1** This 4-month follow-up T1-weighted postcontrast magnetic resonance imaging demonstrates a well-defined, intensely enhancing mass approximately measuring  $4.3 \times 2.9$  cm in maximum transverse dimension in the right frontal extra-axial space (A). The lesion exhibits a heterogeneous high signal on T2 (B). There is involvement of the right frontal bone, with marked thinning and outward bowing of the outer table (C). The inner table is not well visualized and may be markedly thinned out. There is mass effect on the underlying right frontal lobe, and there is no appreciated focal brain parenchymal abnormality. Involvement of the other paranasal sinuses are not appreciated as well (D).

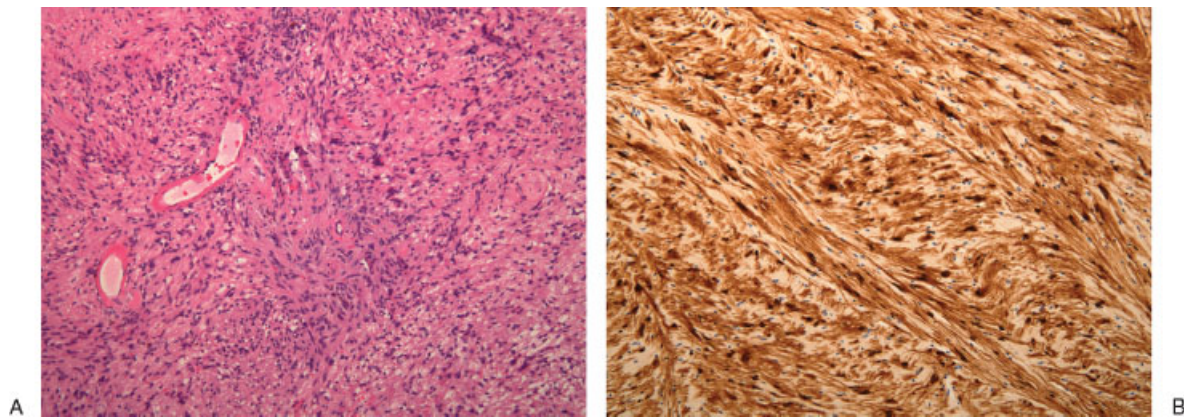
pericranial flap. The dura was found to be intact and uninvolved.

Histology showed a benign spindle cell tumor with features of a schwannoma, which demonstrated strongly positive immunohistochemical staining for S-100, although negative for vimentin, cytokeratin 8/18, and smooth muscle actin (Fig. 2).

Postoperatively, patient remained neurologically intact and was discharged home. Six months postoperatively, imaging demonstrated complete resection of the tumor (Fig. 3). Nine-month (Fig. 4) and 2-year follow-up have demonstrated no radiographic recurrence.

## DISCUSSION

Schwannomas of the sinonasal tract are infrequent, representing less than 4% of the schwannomas of the head and neck. In this location, they have been reported in patients between the ages of 6 and 78 years with no sex or racial predilection.<sup>7</sup> In a 1975 review of American and European literature, Robitaille et al<sup>13</sup> found only 24 cases of schwannomas in the sinonasal tract. Specifically, 10 were in the antrum, eight were in the ethmoid sinus, five were in the nasal cavity, one was in the sphenoid sinus, and none involved the frontal sinus. More recently, only a very few cases of frontal sinus involvement have been reported in the literature<sup>9-12</sup> (Table 1).

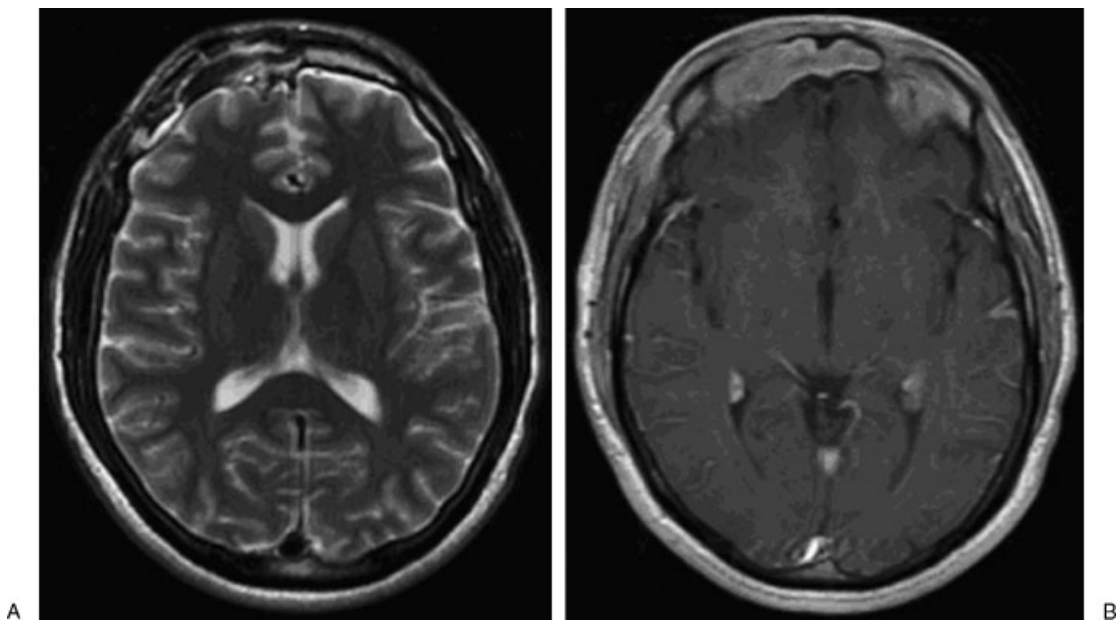


**Figure 2** Microscopic appearance of tumor showing Antoni A pattern with palisading nuclei (hematoxylin and eosin stain) (A). Positive immunohistochemical staining for S-100 confirms diagnosis of schwannoma (B).

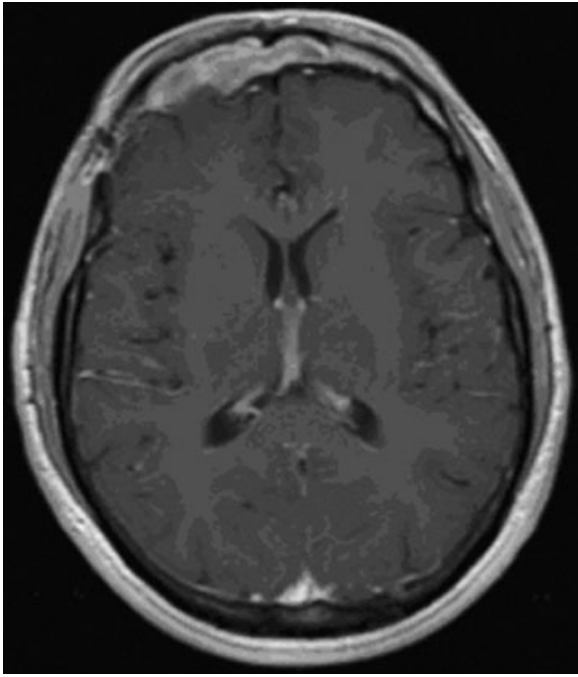
The precise origin of a solitary frontal schwannoma is uncertain, as there are many nerves in the region. The lesion may have arisen from any one of the following nerves: (1) general sensory branches of the ophthalmic division of the trigeminal nerve, either from the anterior ethmoidal branch of the nasociliary nerve or the supraorbital or supratrochlear branches of the frontal nerve; (2) parasympathetic fibers carried by branches of the lateral posterior superior nasal nerves; or (3) sympathetic fibers carried by branches of the lateral posterior superior nasal nerves.<sup>14</sup>

As exemplified in our case, imaging may not be sufficient to allow a definitive diagnosis of a schwannoma in the paranasal location. CT and MRI usually show a contrast-enhancing tumor of varying signal intensity. In general, the appearances on CT imaging are not specific

enough to enable it to be distinguished confidently from other tumors in this region. Postcontrast, the tumors show mottled central hypodense foci with peripheral enhancement.<sup>5</sup> The heterogeneous appearance is related to areas of increased vascularity with adjacent nonenhancing cystic or necrotic regions, which is an important feature in distinguishing it from inflammatory polyps.<sup>11</sup> Also, there is generally no bone involvement<sup>15</sup> unless there is erosion of neighboring bone structures secondary to necrosis caused by pressure of the slowly growing mass. On MRI, schwannomas may typically appear isointense in T1-weighted sequences and hyperintense in T2-weighted sequences. A more uniform enhancement pattern is observed after gadolinium administration.<sup>5,11,15</sup> Due to these nonspecific imaging features of schwannomas, the clinical and radiological differential diagnosis for



**Figure 3** One-month postoperative magnetic resonance imaging demonstrates interval right frontal craniotomy and resection of the large right frontal extra-axial mass (A). There is abnormal soft tissue with homogenous enhancement at the site of the craniotomy consistent with the pericranial flap (B). There remains minimal mass effect on the right frontal brain parenchyma.



**Figure 4** Nine-month postoperative magnetic resonance imaging again demonstrates postsurgical changes without suggestion of recurrence.

a sinonasal mass must include mucocele, polyps, angiofibroma, inverted papilloma, melanoma, squamous carcinoma, adenocarcinoma, sarcoma, lymphoma, esthesioneuroblastoma, meningioma, intraosseous cavernous hemangioma, and aggressive fungal infection.

Histologically, schwannomas present in a biphasic histological pattern: Antoni A and Antoni B areas. Antoni A areas are characterized by spindle-shaped Schwann cells, which occasionally show areas of nuclear palisading surrounding an eosinophilic acellular region, referred to as “Verocay bodies.” In contrast, Antoni B areas are typified by loose myxoid stroma with round nuclei distributed in a haphazard manner. Immunohistochemical positivity for S-100 protein (Fig. 2B), found in neuroectodermally derived tissues, is characteristic for diagnosis. The risk for malignancy in schwannomas is very low; however, there are reports of malignant degeneration in long-standing benign schwannomas.<sup>16</sup>

Treatment of choice for a paranasal schwannoma is wide surgical excision through an approach that

allows adequate exposure, according to the location and extent of the lesion. In some cases, complete excision can be done endoscopically. In others, surgery may involve various combinations of approaches, including skull base surgery. Recurrence is rare after total removal.

## CONCLUSION

Although a frontal sinus schwannoma is extremely uncommon, it should be part of the differential diagnosis of frontal sinus lesions. Because most CT and MRI characteristics of schwannomas are nonspecific, frontal sinus lesions should be submitted to biopsy. Despite their benign nature, these lesions can recur extensively when even small remnants are left behind; therefore, close surveillance is warranted.

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**Table 1 Schwannomas Involved with the Frontal Sinus: Reported Cases with Their Location and Extension**

Report	Year	Paranasal Sinus Location
Miglets et al <sup>12</sup>	1983	Frontal ethmoid
Christenbury et al <sup>9</sup>	1984	Frontal ethmoid
Fujiyoshi et al <sup>11</sup>	1997	Frontal ethmoid
Cakmak et al <sup>10</sup>	2003	Frontal anterior ethmoid
Mangubat et al	2010	Frontal

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