

Clinical and radiologic findings in angiomatous nasal polyps

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Abstract. Angiomatous nasal polyps (ANPs), a rare subtype of inflammatory sinonasal polyps, pose a diagnostic challenge due to overlapping clinical and radiological features with other nasal tumors. This study aimed to evaluate the clinical and radiological characteristics of six pathologically confirmed ANPs. Six patients diagnosed with ANPs between December 2010 and May 2022 were retrospectively analyzed. All patients presented with nasal obstruction; the mean age was 42 ± 28.4 years. The maxillary sinus was the most frequent origin site (66.7%). On computed tomography (CT) scans, all ANPs exhibited heterogeneous density; most (83.3%) demonstrated bony changes. Magnetic resonance imaging (MRI) was performed in four cases, all showing mild hyperintense signals on T1-weighted images and heterogeneous hyperintensity on T2-weighted images. A peripheral hypointense rim on T2-weighted images was observed in three patients (75%). In conclusion, ANPs are challenging to distinguish from other nasal tumors based on clinical and radiological findings. While CT and MRI reveal certain typical characteristics, MRI provides more specific diagnostic clues.

Introduction

Angiomatous nasal polyps (ANPs) are an uncommon subtype of inflammatory sinonasal polyp, accounting ~4-5% of all nasal polyps (1). They are characterized by significant vascular proliferation and angiectasis, rendering them susceptible to vascular compromise, which may lead to venous stasis, thrombosis and infarction (2,3).

The clinical and radiological characteristics of ANPs frequently resemble those of other sinonasal masses, such as juvenile angiofibroma, inverted papilloma, vascular tumors

such as hemangioma, and malignant lesions. This resemblance complicates diagnosis, highlighting the need for a comprehensive evaluation for accurate differentiation (3-5). Studies have highlighted specific imaging features on computed tomography (CT) and magnetic resonance imaging (MRI) scans that help distinguish ANPs from other sinonasal tumors, including juvenile angiofibroma, inverted papilloma and malignancies (4-6). Recognition of these features is crucial to avoid unnecessary, extensive surgical interventions and to guide appropriate clinical management.

This study aimed to describe the clinical and radiological features of six pathologically confirmed cases of ANP.

Patients and methods

Patient recruitment. This retrospective study was approved by the Institutional Review Board of Chonnam National University Hwasun Hospital (Hwasun, Korea; approval no. CNUHH-2023-127). It included six patients diagnosed with ANP at Hwasun National University Hospital (Hwasun, Korea) between December 2010 and May 2022. This study included six patients with pathologically confirmed ANP. Clinical and radiological features were reviewed and all patients underwent endoscopic sinus surgery for tumor removal.

Imaging. CT was performed in all cases using standard paranasal sinus protocols, while four patients also underwent preoperative MRI. CT was conducted using a 64-slice multidetector-row CT scanner (GE Healthcare). The scanning parameters were as follows: Section thickness, 3 mm; beam pitch, 0.8; gantry rotation time, 0.5 sec; table speed, 30.7 2 mm per rotation; reconstruction interval, 3 mm; tube voltage, 120 kV; and tube current, 120-36 mA. The MRI was conducted on a 3.0T Siemens MAGENTOM Skyra scanner (Siemens Healthineers), including T1-weighted, T2-weighted and contrast-enhanced T1 sequences with 3 mm slice thickness. Sinus opacification was evaluated using the Lund-Mackay scoring system (range: 0-24) (7). The Lund-Mackay scoring system, a validated method for assessing sinus opacification, assigns a score of 0 (no opacification), 1 (partial) or 2 (complete) to each of six sinus regions on both sides, including the maxillary, anterior and posterior ethmoid, frontal and sphenoid sinuses, and the osteomeatal complex. The total score ranges from 0 to 24. Information on the patient's symptoms, symptom duration, medical history and imaging examinations before surgery was collected, as well as data

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regarding follow-up observation and recurrence after surgery. Clinical and imaging data were independently reviewed by two rhinologic surgeons with 22 and 38 years' experience in otorhinolaryngology and 1 radiologist with 22 years' experience in head and neck radiology. Histologically, ANPs are characterized by edematous and fibrotic stroma containing numerous dilated, thin-walled blood vessels, often accompanied by areas of infarction, hemorrhage, and thrombus formation (2,3). No statistical analyses were performed due to the small sample size and the descriptive nature of the study.

Follow-up. Postoperative follow-up was conducted one and two weeks after the operation, followed by visits at three months, six months and annually. Endoscopic examinations were performed at each visit to monitor for recurrence.

Statistical analysis. Data management was performed using R version 4.2.3 (R Foundation for Statistical Computing). Values are expressed as the mean $\pm$ standard deviation or n (%).

Results

Clinical characteristics. The clinical data of six patients were reviewed, including sex, age, symptom duration, medical and surgical history, lesion location and size, follow-up duration and recurrence. Details are presented in Tables I and II.

The cohort consisted of three men (50%) and three women (50%) aged 12-77 years (mean: 42 ± 28.4 years). All patients had unilateral lesions, with four on the left (66.7%) and two on the right (33.3%), and no contralateral sinonasal involvement. Endoscopic examination revealed polypoid masses with necrotic changes in the nasal cavity (Fig. 1). Nasal obstruction was the most common symptom, present in all cases. Rhinorrhea occurred in five patients (83.3%), followed by epistaxis (n=3, 50%), hyposmia (n=2, 33.3%), and cheek swelling and epiphora (each n=1, 16.7%). None of the patients experienced any visual disturbances. The symptoms lasted 1 to 24 months (mean: 10.8 ± 4.5 months). One patient had hypertension (16.7%) and two were smokers (33.3%). Furthermore, two patients had prior endoscopic sinus surgery (33.3%), though none had a history of trauma. All patients underwent endoscopic sinus surgery for polyp removal. Tumor sizes ranged from 2.7 to 5.0 cm (mean: 3.57 ± 0.8 cm). Postoperative follow-up included routine endoscopic examinations to evaluate recurrence. The mean follow-up duration was 63.5 ± 17.4 months (range: 15-132 months), with no recurrences observed.

CT findings. Preoperative contrast-enhanced CT scans were performed for all six patients. The imaging characteristics are summarized in Tables I and III. The maxillary sinus was the most common site of origin (n=4, 66.7%; representative case presented in Fig. 2), followed by the middle turbinate and superior turbinate (each n=1, 16.7%). The mean Lund-Mackay score was 11.5 ± 2.5 (range: 5-20). All cases featured involvement of the nasal cavity, osteomeatal complex, posterior choana and ipsilateral ethmoid sinus. The maxillary sinus was affected in four cases (66.7%), while the sphenoid sinus was involved in one case (16.7%); no frontal sinus involvement was observed. One lesion extended into the nasopharynx (16.7%),

Table I. Summary of the six patients with angiomatous nasal polyps.

Variable	Value
Sex (male/female)	3:3
Age, years	42 ± 28.4 (12-77)
Laterality (left/right)	4:2
Symptom duration, months	10.8 ± 4.5 (1-24)
Common symptoms	
Nasal obstruction	6 (100)
Rhinorrhea	5 (83.3)
Epistaxis	3 (50)
Hyposmia	2 (33.3)
Cheek swelling	1 (16.7)
Epiphora	1 (16.7)
Comorbidities	
Hypertension	1 (16.7)
Smoking	2 (33.3)
Prior sinus surgery	2 (33.3)
History of trauma	0 (0)
Endoscopic sinus surgery approach	6 (100)
Tumor size, cm	3.57 ± 0.8 (2.7-5.0)
Follow-up duration, months	63.5 ± 17.4 (15-132)
Recurrence	0 (0)
Origin site	
Maxillary sinus	4
Middle turbinate	1
Superior turbinate	1
Lund-Mackay score	11.5 ± 2.5 (5-20)

Values are expressed as n (%) or the mean $\pm$ standard deviation (range).

two involved the orbital floor and one reached the infratemporal fossa (16.7%).

All lesions exhibited heterogeneous density on CT. Contrast enhancement was seen in five cases (83.3%), while one lesion showed no enhancement (16.7%). Bony changes were observed in five patients (83.3%), including expansile remodeling (n=5, 83.3%), hyperostosis (n=2, 33.3%) and bony destruction (n=2, 33.3%). Only one patient showed no bony alteration.

MRI findings. A total of four of the six patients (66.6%) underwent additional MRI to evaluate suspected sinonasal malignancy (representative case presented in Fig. 3). All four cases exhibited mild hyperintense signals on T1-weighted images and heterogeneous hyperintense signals on T2-weighted images. A peripheral hypointense rim on T2-weighted images was noted in three patients (75%). Detailed MRI imaging findings are described in Tables I and IV.

Discussion

In the present study, only six patients with ANP were encountered during the enrolment period. ANPs occurred equally in

Table II. Clinical characteristics of six patients with angiomatous nasal polyps.

Patient no.	Sex	Age, years	Side	Symptoms		Duration of symptoms, months	Visual disturbance					History	Trauma or surgery	CT	MRI	Mass size, cm	FU duration, months	Reurrence
				Nasal obstruction	Epistaxis	Rhinorrhea	Hyposmia	Cheek swelling	Epiphora									
1	F	22	Left	Y	Y	Y	N	N	N	N	None	None	None	Y	Y	3.6	52	N
2	M	68	Left	Y	N	N	N	N	N	N	None	None	Sinus surgery 30 yrs ago	Y	Y	2.7	132	N
3	M	17	Left	Y	N	Y	N	N	N	N	None	None	Sinus surgery 1 yr ago	Y	Y	3.3	48	N
4	M	56	Right	Y	N	Y	Y	N	N	N	HTN	None	None	Y	N	2.7	96	N
5	F	12	Left	Y	Y	Y	N	N	N	N	None	None	None	Y	N	4.1	15	N
6	F	77	Right	Y	Y	Y	Y	Y	Y	Y	None	None	None	Y	Y	5.0	38	N

M, male; F, female; Y, yes; N, no; yr, year; FU, follow-up; CT, computed tomography; MRI, magnetic resonance imaging; HTN, hypertension.

men and women, with a mean patient age of 42±28.4 years. The most common symptoms were nasal obstruction (n=6), rhinorrhea (n=5), epistaxis (n=3), hyposmia (n=2), cheek swelling (n=1) and epiphora (n=1). All patients reported symptomatic relief postoperatively. However, improvement was evaluated clinically during follow-up without using a standardized symptom-scoring tool, which represents a limitation of this study. Polyp sizes ranged from 2.7 to 5.0 cm, with a mean diameter of 3.57±0.8 cm. The maxillary sinus was the most frequent site of origin, accounting for 66.7% of cases, consistent with previous reports (3,4).

The precise pathogenesis of ANPs remains elusive, but two prevailing theories have been proposed. One hypothesis suggests that pedicle compression by adjacent nasal structures, particularly when the polyp arises from the maxillary sinus or nasal cavity, leads to stasis, ischemia and necrosis. Batsakis and Sneige (2) proposed that sinonasal polyps are susceptible to vascular compromise at key anatomical sites, such as the polyp pedicle, sinus ostium, posterior end of the inferior turbinate, posterior choana and nasopharynx. An alternative theory attributes ANP formation to hematoma development, which may result from operation, trauma, bleeding disorders or other causes of hemorrhage. In this scenario, sinus hypoventilation promotes blood pooling and stagnation, eventually leading to organized hematoma and reactive tissue changes (2,5-9).

In all six cases in the present cohort, the polyps were located in anatomically vulnerable regions. Four originated near the maxillary sinus ostium, while the remaining two arose from the superior and middle turbinates, where adjacent structures could compress the pedicle. Furthermore, all polyps extended into the posterior choana, contributing to the likelihood of vascular compromise. This is the first reported case series of ANPs from our institution, and two cases demonstrated atypical imaging features, including the absence of a peripheral hypointense rim and subtle bone remodeling. These findings support the first hypothesis, suggesting the development of an inflammatory polyp as the initial event, followed by compression-induced ischemia and necrosis.

Hypertension (HTN), diabetes mellitus (DM) and aspirin use may contribute to the pathophysiology of ANPs (10-12). Elevated blood glucose and blood pressure can compromise blood vessel integrity, increasing the risk of thrombosis and infarction. While aspirin and other anticoagulants inhibit prostaglandin synthesis, dilate blood vessels and prevent clot formation, they may predispose to hemorrhage. In this study, only one patient had HTN and none had DM or were on aspirin therapy. Therefore, no significant association was observed between ANPs and HTN, DM or aspirin use.

ANPs typically appear on CT as sinus-expanding masses with heterogeneous density. Chronic inflammatory obstruction may lead to bony changes such as destruction or hyperostosis (5,6). However, these features are non-specific to ANPs and can be seen in malignant and benign sinonasal tumors, such as inverted papillomas, hemangiomas and juvenile angiofibromas (13). In the present study, CT revealed bony alterations in 83.3% of cases: Expansile remodeling in five patients (83.3%), bony destruction in two (33.3%) and hyperostosis in two (33.3%).

MRI has proven useful in distinguishing ANPs from other lesions. Typically, ANPs show mild hyperintensity on

Table III. CT findings in six cases of angiomatous nasal polyp.

Patient no.	Origin	LM score	Maxillary sinus	Ethmoid sinus	Sphenoid sinus	Frontal sinus	OMC	Nasal cavity	Posterior choana	Nph	Orbit floor	Infratemporal fossa	Bone change	Homogeneity	Contrast enhancement
1	Maxillary sinus	18	Y	Y	N	N	Y	Y	Y	Y	N	N	Expansile remodeling	Heterogeneous	Y
2	Middle turbinate	5	N	Y	N	N	Y	Y	Y	N	N	N	None	Heterogeneous	Y
3	Maxillary sinus	5	Y	Y	N	N	Y	Y	Y	N	N	N	Expansile remodeling, Hyperostosis	Heterogeneous	Y
4	Superior turbinate	20	N	Y	N	N	Y	Y	Y	N	N	N	Expansile remodeling	Heterogeneous	N
5	Maxillary sinus	10	Y	Y	Y	N	Y	Y	Y	N	Y	N	Expansile remodeling, Bony destruction	Heterogeneous	Y
6	Maxillary sinus	11	Y	Y	N	N	Y	Y	Y	N	Y	Y	Expansile remodeling, Bony destruction, Hyperostosis	Heterogeneous	Y

Y, yes; N, no; LM score, Lund-MacKay score; OMC, osteomeatal complex; Nph, nasopharynx.

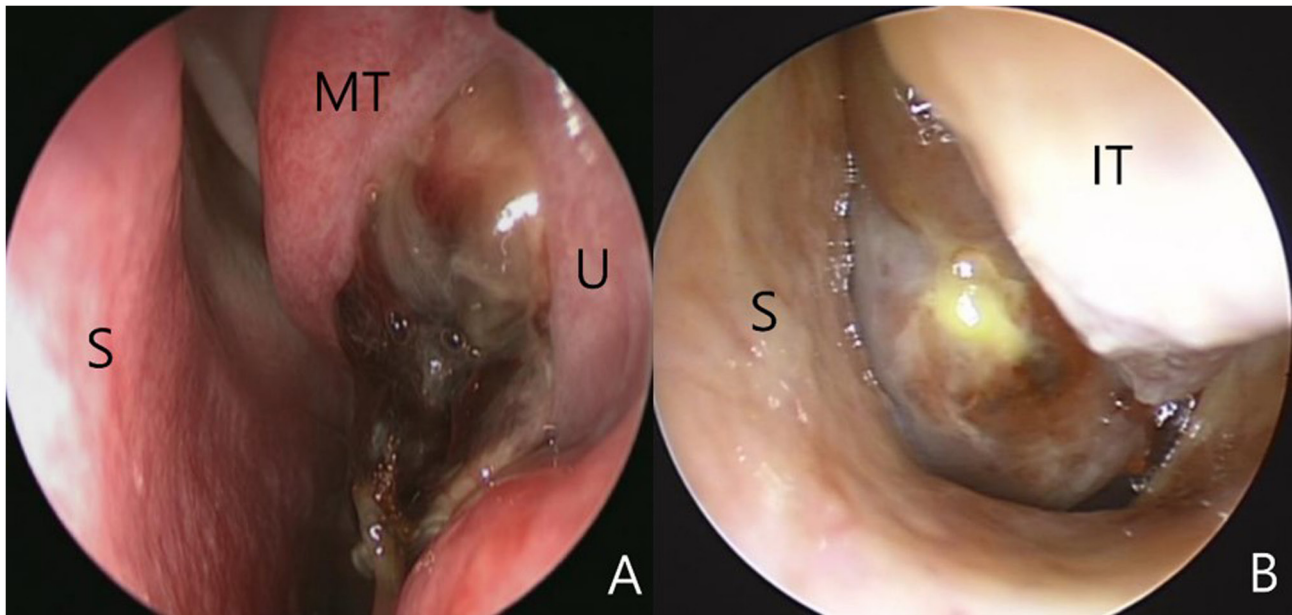


Figure 1. Endoscopic findings of angiomatous nasal polyps in two patients. (A) A 17-year-old male patient presented with an antrochoanal polyp exhibiting a dark reddish appearance and necrotic changes originating from the maxillary sinus in the left nasal cavity. (B) A 68-year-old male patient had a large grayish-to-reddish polypoid mass originating from the middle turbinate, extending to the osteomeatal complex, ethmoid sinus and posterior choana. The mass appeared compressed by the inferior turbinate. S, septum; MT, middle turbinate; U, uncinate process; IT, inferior turbinate.

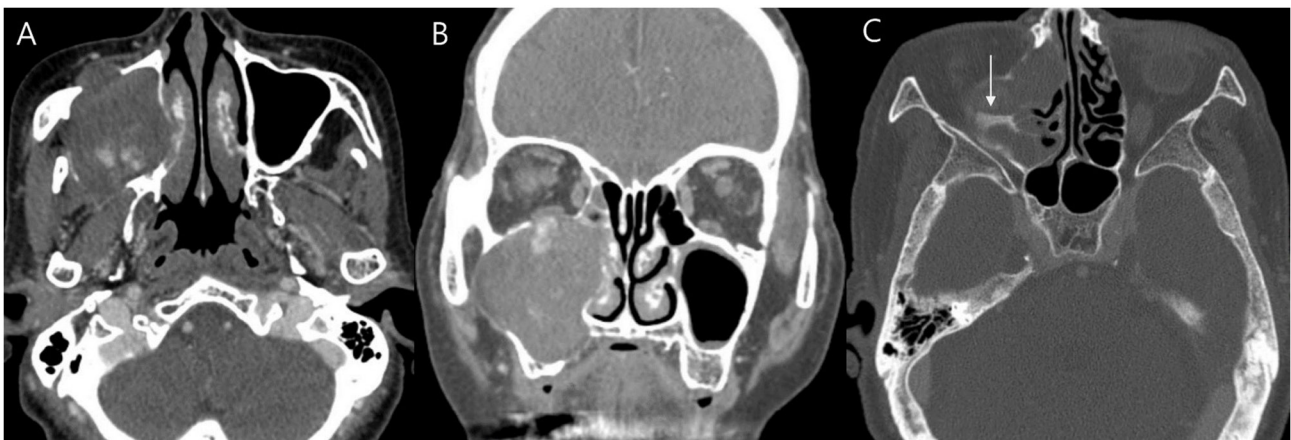


Figure 2. CT findings of an angiomatous nasal polyp in a 77-year-old female patient. (A) The axial CT image demonstrates heterogeneous opacification of the right maxillary sinus with enhancing foci and multifocal bony destruction of the sinus walls. The mass extends into the right infraorbital canal and infratemporal fossa (arrow). (B) Coronal CT image shows extension into the right anterior ethmoid sinus, with bony destruction involving the medial, superior and lateral walls of the maxillary sinus (arrow). (C) Axial CT image with bone window settings reveals hyperostosis of the lateral wall of the maxillary sinus (arrow).

T1-weighted images and heterogeneous hyperintensity with a peripheral hypointense rim on T2-weighted sequences. This rim is often attributed to hemosiderin deposition from prior hemorrhage, supporting the diagnostic value of MRI (5,13,14). In the present study, all four cases with MRI data exhibited mild hypointensity on T1-weighted images and marked heterogeneous hyperintensity on T2-weighted images. A peripheral hypointense rim was observed in three patients (75%), consistent with the typical MRI findings for ANPs. The current findings are consistent with previous reports (4,5), which described heterogeneous T2 signal intensity and peripheral hypointense rims as typical findings. Unlike common nasal polyps, which are often bilateral and exhibit minimal vascularity, ANPs tend to be unilateral, larger in size and display

prominent vascular features on imaging. Furthermore, while inverted papillomas exhibit a cerebriform pattern on MRI and sinonasal malignancies show aggressive bone destruction, ANPs characteristically display benign remodeling with the noted T2 hypointense rim (13). This study is limited by its small sample size, retrospective design, incomplete MRI data for all patients and absence of a control group, which may restrict broader applicability.

Complete surgical excision remains the treatment of choice for ANPs. All six patients underwent endoscopic sinus surgery, with a mean follow-up of 63.5 ± 17.4 months (range: 15-132 months). No recurrences were observed.

Recognizing the imaging and clinical features of ANPs can help avoid misdiagnosis with more aggressive sinonasal

Table IV. Magnetic resonance imaging findings in four cases of angiomatous nasal polyps.

Patient no.	T1-weighted image	T2-weighted image	Peripheral hypointense rim in T2-weighted image	Enhancement
1	Mild hyperintense	Heterogeneous hyperintense	Yes	Heterogeneous
2	Mild hyperintense	Heterogeneous hyperintense	No	Heterogeneous
3	Mild hyperintense	Heterogeneous hyperintense	Yes	Heterogeneous
6	Mild hyperintense	Heterogeneous hyperintense	Yes	Heterogeneous

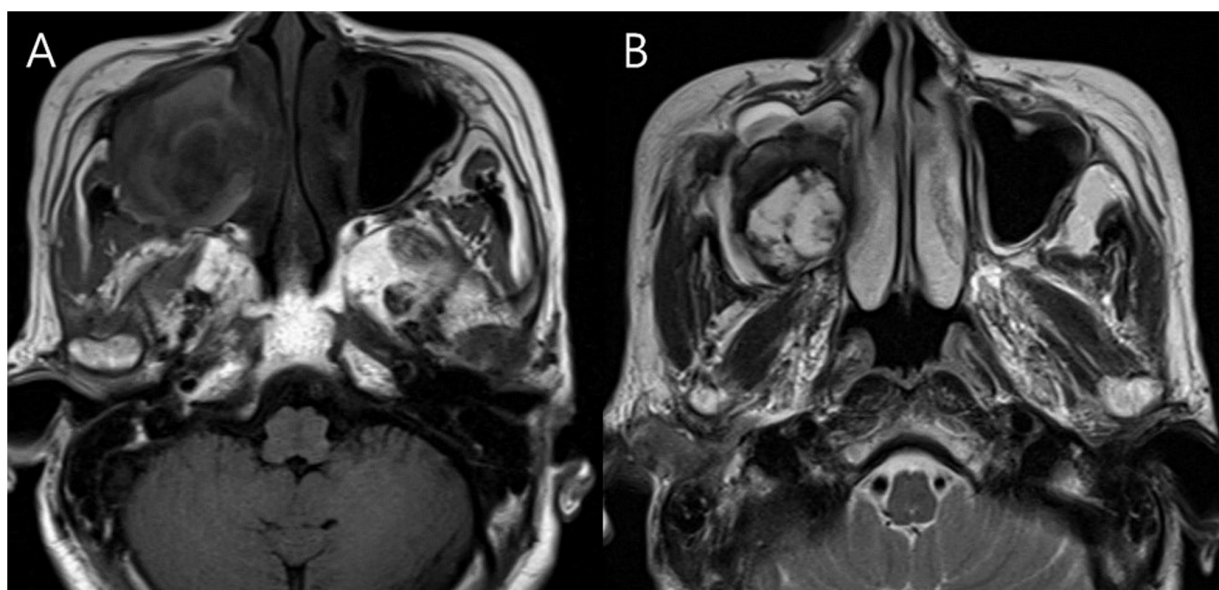


Figure 3. Magnetic resonance imaging findings of angiomatous nasal polyp in the 77-year-old female patient (same patient as in Fig. 2). (A) Axial T1-weighted image reveals a mildly hyperintense mass in the right maxillary sinus. (B) Axial T2-weighted image shows a heterogeneously hyperintense mass with a peripheral hypointense rim.

tumors, reduce unnecessary extensive surgical procedures and allow for more targeted diagnostic and therapeutic strategies.

In conclusion, preoperative diagnosis of ANPs remains challenging due to their clinical and radiological resemblance of other sinonasal tumors. The CT characteristics, such as expansile remodeling, bony destruction and hyperostosis, may support the diagnosis but are not specific to ANPs. Conversely, MRI offers more distinctive signal patterns, providing greater diagnostic specificity. Incorporating MRI into the diagnostic workflow may enhance the accuracy of differentiating ANPs from other sinonasal lesions.

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Availability of data and materials

The data generated in the present study may be requested from the corresponding author.

Authors' contributions

DHL and SY conducted and designed the research, and checked and confirmed the authenticity of the raw data. DHL, SY and SCL performed the experiments, analyzed the data and drafted the manuscript. All authors contributed to data interpretation, table design and manuscript revision. All authors read and approved the final version.

Ethics approval and consent to participate

This study was approved by the Institutional Review Board (IRB) of Chonnam National University Hwasun Hospital (Hwasun, Korea; approval no. CNUHH-2023-127). Patient consent for publication was waived by the IRB due to the retrospective nature of the study.

Patient consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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