RESEARCH ARTICLE

Fibrosarcoma arising in the paranasal sinus: a clinicopathological and radiological analysis

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Objectives: To analyze the clinicopathological features and the CT and MRI features of patients with paranasal sinus fibrosarcoma.

Methods: Seven patients with surgically and pathologically confirmed paranasal sinus fibrosarcoma were enrolled. Their CT and MRI data and imaging features were retrospectively analyzed in detail.

Results: The study participants were two males and five females (median age, 43 years; range, 22–73 years). CT or MRI showed a well-defined ($n = 5$) or ill-defined ($n = 2$), irregular ($n = 6$) or oval ($n = 1$) mass, with heterogeneous ($n = 7$) density. The lesions were isointense ($n = 4$) or hypointense ($n = 2$) on T_1 weighted images, and showed heterogeneous ($n = 6$) mild hypointensity on T_2 weighted images. Expansive ($n = 6$) and osteolytic ($n = 1$) bone destruction were observed. The tumors showed marked heterogeneous delayed enhancement ($n = 6$) on contrast-enhanced MRI images.

Conclusion: Paranasal sinus fibrosarcomas should be included in the differential diagnosis when a sinonasal neoplasm appears as a well- or ill-defined unilateral large irregular mass with characteristic mild hypointensity on T_2 weighted MR images and shows expansive or osteolytic bone destruction and a marked heterogeneous delayed contrast-enhancement pattern.

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Introduction

Fibrosarcoma is an uncommon malignant neoplasm, with the extremities being the most common site of involvement. Primary fibrosarcomas of the head and neck are rare, accounting for only one percent of fibrosarcoma arising in these regions.^{1,2} The paranasal sinus is one of the rarest locations for fibrosarcoma, with only a few cases having been reported in the literature since the year 2000,^{1–6} although there have been comprehensive reviews on the treatment results and demographic

and clinicopathological features of paranasal sinus fibrosarcoma.^{7,8} The tissue origin of paranasal sinus fibrosarcoma seems to be the periosteum rather than mucosal connective tissue.⁹ Paranasal sinus fibrosarcoma is commonly seen in middle-aged patients, with both genders being equally affected.⁷ It can be further divided into infantile type and adult type,^{4,10} and in routine clinical practice, adult-type sinonasal fibrosarcoma is easy to misdiagnose as other neoplasms because of its rarity and non-specific symptomatology.^{2,7} Additionally, although basic information on this disease has been reported, there are only limited studies examining the imaging characteristics of paranasal sinus

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fibrosarcoma. Therefore, correct pre-operative diagnosis of this disease remains a challenge for radiologists.

In the present study, to help improve pre-operative diagnosis and treatment, we used CT and/or MRI to assess the imaging characteristics of seven cases of primary paranasal sinus adult-type fibrosarcoma.

Methods and materials

Design and patients

This retrospective study was approved by the hospital's Institutional Review Board (No. 201612636). Written informed consent was obtained from all patients or their immediate families. Details of seven patients with adult-type primary sinonasal fibrosarcoma who were treated in our hospital from January 2010 to November 2016 were retrieved from the hospital database. All seven patients received complete surgical resection and were confirmed as sinonasal fibrosarcoma on pathological examination. One patient underwent CT scans, one underwent an MRI examination and five underwent both CT and MRI scans. The six CT scans were unenhanced and the six MRI examinations included imaging with and without contrast enhancement. The clinical and imaging data of the seven cases were extracted for further analysis.

Imaging protocol

CT examinations were performed with a 320-detector volume CT system (Aquilion ONE, Toshiba, Japan) or a Somatom Definition dual-source CT (DSCT, Siemens Medical Systems, Forchheim, Germany). The scan parameters were as follows: 3 mm section thickness, 0.5 mm slice thickness reconstructions, 120-kV voltage, 90- to 270-mA current and 256×256 matrix. MR images were obtained on a 1.5 T superconductive unit (Signa HDxt, GE Medical Systems) using a head and neck coil. The sequences included transverse T_1/T_2 weighted images with the following parameters: repetition time/echo time = 400/10 ms for transverse T_1 weighted images and 4200/98 ms for transverse T_2 weighted images; field of view = 18×18 cm for transverse images; matrix size = 512×512 ; 4–6 signal acquisitions; and a slice thickness/gap of 4/1–2 mm. Contrast-enhanced sagittal, coronal and transverse T_1 weighted images were obtained after an intravenous injection of gadopentetate dimeglumine (Magnevist, Schering, Berlin, Germany) at a dose of 0.1–0.2 mmol kg^{-1} at a rate of 1.5 ml s^{-1} .

Imaging analysis

Three radiologists specializing in head and neck diseases independently evaluated the CT and MRI features of the sinonasal fibrosarcoma, including size, shape, margin, location, CT/MRI intensity, bone destruction pattern (expansive or osteolytic), calcification, regional lymph node involvement and enhancement features after the injection of intravenous contrast agent. The

investigators were all blinded to the clinical findings and to the histopathological results, and inconsistencies were resolved via consensus.^{11–14} CT attenuation values of the lesion were measured in Hounsfield units (HU) using 18–20 mm² circular regions of interest (ROIs). ROIs were placed on the solid parts three times, and the average CT attenuation was then calculated.¹³ Areas of bone destruction or calcification in the solid parts were avoided. We defined “expansive bone destruction” as the bone profile becomes expansive and the bony cortex becomes thin and/or defective. The “osteolytic bone destruction” means a moth-eaten appearance made up of multiple ill-defined coalescing lucent areas and implies cortical involvement. Areas of suspected calcification were analyzed when the CT attenuation values fell in the range of 90–300 HU on unenhanced scans.

Follow-up

The follow-up period was estimated from the first day of treatment to the day of death or the date of the last follow-up examination.

Results

Clinical data

The two males and five females in this study had a median age of 43 years (range 22–73 years). The clinical symptoms contributing to the diagnoses were diverse and non-specific, and included nasal obstruction ($n = 5$, 71.4%); pain ($n = 3$, 42.9%); and epistaxis ($n = 5$, 71.4%). The duration of symptoms varied from 40 days to 1 year. The results of routine laboratory tests, including routine blood tests, renal function tests, and routine stool tests revealed no significant abnormalities in any patient. Details are given in Table 1.

Imaging findings

The imaging findings of the seven sinonasal fibrosarcoma cases are shown in Table 2. Each case exhibited a single tumor, with four (4/7, 57.1%) being located on the right maxillary sinus, two (2/7, 28.6%) on the left maxillary sinus and one (1/7, 14.3%) on the ethmoid sinus. Five tumors were well-defined and two tumors were ill-defined. The mean long diameter (maximum tumor diameter in axial, coronal or sagittal CT and/or MRI images) of the tumors was 5.04 cm. The tumors were irregular (a term used to describe the lesions' shape when the tumors' edges were obviously uneven, jagged or infiltrating appearance) in six (6/7, 85.7%) cases (Figure 1), and oval in one (1/7, 14.3%) case (Figure 2). All the six tumors were heterogeneous on unenhanced CT images (Figure 3), with the mean CT value for the ROIs being 33.2 ± 3.4 HU. On the MRI images, compared with the signal intensity of cerebellum parenchyma at the same level, the lesions were isointense ($n = 4$) or hypointense ($n = 2$) on T_1 weighted images, and showed heterogeneous mild hypointensity on

Table 1 Clinical features of seven cases with paranasal sinus fibrosarcoma

Case	Sex	Age, years	Symptoms	Tumor number	Laboratory test	Treatment	Follow-up duration (month)	Rec	Met	Results
1	F	22	Pain	Single	NE	Total maxillectomy	66	Y	N	PD
2	F	41	Pain	Single	NE	Total maxillectomy	39	Y	N	PD (death)
3	M	43	Nasal obstruction and epistaxis	Single	NE	Total maxillectomy	65	N	N	CR
4	F	48	Nasal obstruction and epistaxis	Single	NE	Total maxillectomy and RT	37	N	N	CR
5	M	73	Nasal obstruction and epistaxis	Single	NE	Total maxillectomy	58	N	N	CR
6	F	25	Nasal obstruction and epistaxis	Single	NE	Lateral rhinotomy	—	—	—	—
7	F	50	Nasal obstruction, epistaxis and pain	Single	NE	Total maxillectomy and RT	56	Y	Lung and liver	PD (death)

CR, complete response; F, female; M, male; Met, metastasis; N, no; NE, negative; PD, progressive disease; Rec, recurrence; RT, radiotherapy; Y, yes.
—, loss of data mark.

T_2 weighted images ($n = 6$) (Figure 1). A notch sign (the observation of an irregular indentation from the margin of the lesion to the center area)¹⁵ could be observed in one patient (Figure 4). The tumors showed marked heterogeneous delayed enhancement ($n = 6$) on the contrast-enhanced MRI images (Figures 1–2). All the seven cases demonstrated bone destruction, including expansive ($n = 6$; Figure 3) and osteolytic ($n = 1$; Figure 5) patterns. Calcification and regional lymph node involvement were not observed in any cases.

Treatment

Radical surgical resection was performed in all the seven patients, including total maxillectomy ($n = 6$) and lateral rhinotomy ($n = 1$), in combination with radiotherapy ($n = 2$). At surgery, the tumors were observed to have originated from the maxillary sinus ($n = 6$) or ethmoid sinus ($n = 1$). Post-operative MRI examination was performed to evaluate the extent of resection. Gross total resection was achieved in six patients (6/7, 85.7%),

and subtotal resection was achieved in one patient (case 7).

Pathological findings

Masses were irregular ($n = 6$), or oval ($n = 1$) with a grayish-white appearance. Bone destruction of the sinus wall was observed in all seven cases. All tumors were solid but heterogeneous in texture, particularly the larger tumors, which showed patchy necrotic areas.

Microscopically, the tumors were typically comprised of elongated or spindle cells in a fascicular arrangement with high vascular growth. The tumor cells contained abundant eosinophilic cytoplasm. The nuclei were lightly stained (hematoxylin-eosin staining), with some mitotic figures ($n = 7$) and giant tumor cells ($n = 3$, “weakly +” not included). Local cystic necrosis ($n = 4$, “weakly +” not included), mucinous degeneration ($n = 6$) and pseudocapsule ($n = 3$) could be detected. Immunohistochemical analysis revealed that the lesions were positive for vimentin ($n = 7$) and in some cases for CD34

Table 2 CT and MRI features of seven cases with paranasal sinus fibrosarcoma

Case	Sex	Site	Size (cm ²)	Shape	Margin	CT density	MRI signal intensity	Bone destruction	Enhancement pattern
	Age, years						T1WI, T2WI		
1	F/22	R. maxillary sinus	5.1 × 3.6	Irregular	Well-defined	Heterogeneous	Iso-, mild hypo-	Expansive	Marked, heterogeneous, delayed
2	F/41	R. maxillary sinus	3.9 × 3.1	Oval	Well-defined	Heterogeneous	Iso-, mild hypo-	Expansive	Marked, heterogeneous, delayed
3	M/43	L. maxillary sinus	4.3 × 3.5	Irregular	Well-defined	Heterogeneous	Iso-, mild hypo-	Expansive	Marked, heterogeneous, delayed
4	F/48	L. maxillary sinus	5.3 × 4.5	Irregular	Well-defined	Heterogeneous	Hypo-, mild hypo-	Expansive	Marked, heterogeneous, delayed
5	M/73	R. maxillary sinus	4.5 × 3.8	Irregular	Ill-defined	Heterogeneous	Hypo-, peripheral hypo-	Expansive	Marked, heterogeneous, delayed
6	F/25	Ethmoid sinus	5.6 × 3.3	Irregular	Well-defined	None	Iso-, mild hypo-	Expansive	Marked, heterogeneous, delayed
7	F/50	R. maxillary sinus	6.6 × 3.9	Irregular	Ill-defined	Heterogeneous	None	Osteolytic	None

F, female; L, left; M, Male; R, right.

Figure 1 MR images showing the signal features and heterogeneous marked enhancement pattern in a 43-year-old male with left maxillary sinus fibrosarcoma (case 3). (a) The mass shows characteristic slightly hypointense signal intensity on T_2 weighted images (arrow). A patchy hyperintense area could be observed (arrowhead). (b) The tumor is irregular, and its margin is well-defined on T_1 weighted imaging (arrow). (c–e) Marked and heterogeneous enhancement is observable on enhanced T_1 images (arrows). Invasion of the left ethmoid sinus (d, arrowhead) and patchy unenhanced areas are observable (c, d, asterisks).

($n = 3$, “weakly +” not included). Stains for cytokeratin, S-100, human melanoma black-45, desmin, and smooth muscle actin were negative in each mass, thus ruling out epithelial, neurogenic, or myogenic tumors. We divided this disease into three grades: low-grade ($n = 3$), intermediate-grade ($n = 1$) and high-grade ($n = 3$), according to the Mentzel's grading standard adopted by the World Health Organization.¹⁶ Details are given in Table 3.

Follow-up

All patients except one (case 6) received follow-up after discharge. The mean follow-up time was 53.5 months (range, 37–66 months). No recurrence or metastatic disease occurred in the patients (cases 3–5) including a high-grade patient (case 3), who underwent surgery during the 3–5 years follow-up period. Two patients (cases 1 and 2) experienced local

Figure 2 MRI findings of a 41-year-old female with right maxillary sinus fibrosarcoma (case 2). (a) The mass shows slightly hypointense signal intensity on T_2 weighted images (arrow). (b) The tumor is oval, and its margin is well-defined on T_1 weighted images (arrow). (c–e) Marked, heterogeneous and delayed enhancement is observable on enhanced T_1 images (arrows), with the enhanced and unenhanced areas arranged alternately. Thin rim enhancement was displayed (e, white arrowheads).

Figure 3 Unenhanced CT images showing the heterogeneous characteristic and expansive bone destruction in a 48-year-old female with left maxillary sinus fibrosarcoma (case 4). (a) A slightly lower density irregular mass (black arrow) could be observed in the left maxillary sinus. (b) An expansive bone destruction pattern is observable on bone-window CT image (arrowheads). (a, c and d) The mass shows heterogeneous density with sporadic patchy lower density areas (asterisks).

recurrence at 12 and 5 months after surgery, who then underwent palliative resection of recurrent tumor, followed by adjuvant radiotherapy. Unfortunately, one patient (case 2) died of the uncontrolled recurrent lesion and systemic failure during a 54-month follow-up period. By contrast, the lesion of the other patient (case 1) remained stable during a 34-month follow-up period. One patient (case 7) suffered local recurrence and distant metastatic disease (lung and liver) at 52 months after surgery, who died of cachexy 4 months later. Details are given in Table 1. The overall survival and disease-free survival time was

not evaluated because of the small sample size in this study and many censored data.

Discussion

Adult-type fibrosarcoma, a malignant tumor of fibroblasts, is an uncommon neoplasm of the nasal cavity and paranasal sinuses.³ Pathological diagnosis of paranasal sinus fibrosarcoma depends on the presence of a characteristic “herringbone” pattern consisting of elongated spindle-shaped cells and positive markers for vimentin and/or CD34.^{3,17} Sinonasal fibrosarcoma is a highly malignant neoplasm with a high risk of local recurrence and low risk of distant metastasis. It is resistant to chemotherapy,^{3,7} and hence the mainstay of treatment for these tumors is complete surgical resection with clear margins, or surgical resection followed by adjuvant radiotherapy.^{7,18} In this study, we observed that three patients experienced local recurrence and one patient suffered from distant metastasis, suggesting that local recurrence is more commonly seen than distant metastasis. Our finding provided further evidence for the recurrence and metastasis characteristics of sinonasal fibrosarcoma.

In the present study, the median patient age was 43 years, with a male-to-female ratio of 2:5. In the studies of Bercin *et al*³ and Koka *et al*¹⁸, sinonasal fibrosarcoma usually presented in the third and fourth decades of life, more commonly among males. However, a larger sample size study has demonstrated that it presents frequently in the fifth to seventh decades of life without

Figure 4 MR images showing the notch sign and an intracranial extension in a 25-year-old female with right ethmoid sinus fibrosarcoma (case 6). The mass shows a patchy lower signal intensity area on axial T_2 weighted image (a, white arrow) and unenhanced area on enhanced axial T_1 weighted image (b, black arrow) in the center, which displays a irregular indentation unenhanced area from the front edge of the tumor to the center area (notch sign) (black arrowheads) on enhanced sagittal (c) and coronal (d) T_1 weighted images. An intracranial extension could be observed (c and d, white curved arrows).

Figure 5 Unenhanced CT images showing the bone destruction pattern in a 50-year-old female with right maxillary sinus fibrosarcoma (case 7). An osteolytic bone destruction pattern is observable in the ethmoid bone, the medial, lateral walls of the right maxillary sinus (a, b, white and black arrows, respectively).

Table 3 Pathological features of seven cases with paranasal sinus fibrosarcoma

Case	Grade	Nuclear atypia	Giant tumor cells	Mucinous degeneration	Hem	Necrosis	Pse	Vim	CD34	SMA	CK	S100	HMB-45	Des
1	Moderate	+	+	+	+	+	–	+	+	–	–	–	–	–
2	High	+	++	+	+	Weakly+	+	+	+	–	–	–	–	–
3	High	+	–	+	+	++	–	+	Weakly+	–	–	–	–	–
4	Low	+	–	+	–	–	+	+	–	–	–	–	–	–
5	Low	+	Weakly +	++	+	+	–	–	–	–	–	–	–	–
6	Low	+	–	–	–	–	+	+	–	–	–	–	–	–
7	High	+	+	+	+	++	–	+	+	–	–	–	–	–

CK, cytokeratin; Des, desmin; Hem, hemorrhage; HMB, human melanoma black; Pse, pseudocapsule; SMA, smooth muscle actin; Vim, vimentin;

+, positive; –, negative.

a significant gender bias.⁷ Longitudinal study of multi-center with larger sample size is needed to confirm the demographic characteristics of this disease. The clinical symptoms of paranasal sinus adult-type fibrosarcoma are non-specific, and mainly include nasal obstruction, pain, hypoesthesia and epistaxis.¹ Ocular, auditory, facial and oral symptoms have been observed when the tumors were in a greatly advanced stage.⁶ In this study, the patients mainly presented with nasal obstruction, pain and epistaxis. These symptoms are likely to be secondary to occlusion of the nasal or paranasal sinus cavities, the invasion of bone and sinus mucosa and tumor necrosis respectively.

Because of the rarity of this kind of entity and the limited number of adequately documented cases, the radiological characteristics of paranasal sinus fibrosarcomas remain to be determined. As observed in the present study, paranasal sinus fibrosarcoma commonly presents as a solitary lobulated or irregular heterogeneous mass, with a well- or ill-defined margin on CT/MRI images. Five cases showed well-circumscribed masses, likely resulting from the incidence of a tumor pseudocapsule.^{19,20} When adjacent structures such as orbit or skull base are infiltrated, the margin of the tumors may be ill-defined. Actually, in our series, pseudocapsule could be observed in three tumors (cases 2, 4 and 6) under the light microscope. Interestingly, tumors with pseudocapsule in this study commonly manifested as lower histological grade, and lesions with ill-defined margin commonly showed higher histological grade. Our findings indicated that well- or ill-defined margin potentially reflected the histopathological alteration. Paranasal sinus fibrosarcomas appeared as heterogeneous soft-tissue density masses with areas of patchy fluid attenuation. We attributed the heterogeneity to the following two aspects: mucinous degeneration areas within the tumor and inadequate blood supply to the tumor center. On MRI, the lesions showed a characteristic signal change. In the present study, the tumors commonly tended to be isointense or mildly hypointense on T_1 weighted imaging, and demonstrated

heterogeneous mild hypointensity on T_2 weighted imaging, reflecting high cellularity, a high nuclear-to-cytoplasm ratio and the presence of abundant fibrous tissues.²¹ The most common location of fibrosarcoma in the sinonasal region was previously found to be the maxillary sinus,⁷ and most of the lesions in the present study also arose from the maxillary sinus.

Bone destruction is a common observation in sinonasal fibrosarcoma. Paranasal sinus wall defects or compression, and osteolytic or expansive bone destruction of ethmoid, maxillary, or orbital bones have been sporadically described in previous reports.^{2,3,5,6} In our study, six cases presented expansive bone destruction with sinus wall thinning or defects, and one case demonstrated osteolytic bone destruction with the adjacent ethmoid and maxillary being involved. Presumably, the different pattern of bone destruction is related to the pathological differentiation. Low-grade sinonasal fibrosarcoma is slow growing, and the adjacent bone structure becomes compressed.²¹ In contrast, poorly differentiated paranasal sinus fibrosarcoma presents an invasive growth pattern because of the greater degree of pleomorphism and nuclear atypia followed by bone erosion. In fact, we also found that the bone destruction pattern is generally consistent with the grade of the tumor in the present study. The poorly differentiated paranasal sinus fibrosarcoma (case 7) presents an invasive osteolytic bone destruction pattern, and the moderately to well-differentiated tumors (cases 1, 4–6) present expansive bone destruction pattern. Clinically, we also observed local recurrence and distant metastatic disease in lung and liver in case 7 during the follow-up, which in turn reflected the relationship between the bone destruction pattern and tumor malignant degree. However, due to the small sample size and retrospective nature in this study, more evidence should be collected to support this finding in the clinical study with large sample size and/or basic research in the future. In addition, enlarged regional lymph nodes were not observed in any of the cases in this study. As with other sarcomas, sinonasal fibrosarcomas do not tend to metastasize via

the lymphatic route, although local recurrences are quite common.²² Furthermore, calcification was uncommon in this study.

In the present study, paranasal sinus fibrosarcoma showed a characteristic marked heterogeneous delayed enhancement. Furthermore, we observed that the enhanced and unenhanced areas were arranged alternately in several cases (cases 1–5). This enhancement pattern is likely dependent on the vascularity, cellularity and collagen distribution within the tumor. Histologically, sinonasal fibrosarcoma were characterized by two main microscopic patterns: a highly cellular component and a mucinous degeneration component. We attributed the “heterogeneous enhancement” to the different blood vessel density in the low or high cellularity areas. In addition, we think the marked delayed enhancement pattern is related to abundant collagen fibers or stroma, and vasculature.²⁰ The contrast agent can permeate into the abundant fibrous tissue, where it is maintained for a long time, thereby causing the characteristic marked delayed enhancement pattern.

The differential diagnosis of paranasal sinus fibrosarcoma includes benign and malignant sinonasal region disease. Inverting papillomas most commonly arise from the lateral nasal wall and rarely occur primarily within a sinus cavity.²³ They are commonly isointense on both T_1 and T_2 weighted images, with a columnar shape and a convoluted cerebriform enhancement pattern.^{23–25} Benign sinonasal polyps are mainly situated in the middle meatus or the outflow tract of the sinuses. They are usually bilateral with an appearance that is commonly bags-shaped, and have a characteristic semi-translucent appearance.^{26,27} However, the diagnosis of patients with a unilateral mass should be based on radiographic imaging, possible biopsy, and careful follow-up. It is to be noted that chronic sinusitis such as mucocoeles may also present with bone erosion, an expansile process, and low T_2 signal intensity due to the dehydration of retained secretions.^{21,27} However, they usually show no enhancement after contrast agent injection. In addition, ossifying fibroma in the sinonasal tract commonly appears on CT as a sharply circumscribed round to oval lesion with a sclerotic eggshell rim and central radiolucency, with a variable amount of internal calcification,^{28–31} which is different from fibrosarcoma.

Some histopathologically benign but biologically locally invasive and recurrent tumors such as inflammatory myofibroblastic tumor and desmoid-type fibromatosis should be differentiated from fibrosarcoma. Specifically, the majority of sinonasal inflammatory myofibroblastic tumors appear isointense on T_1 weighted imaging and hypointense on T_2 weighted imaging, with an ill-defined margin, focal bony erosion, infiltrative growth pattern and mild homogeneous or intermediate homogeneous/heterogeneous enhancement.^{32–34} Desmoid-type fibromatosis in the head and neck region commonly shows an elongated shape, a rim of surrounding fat, high signal intensity on T_2 weighted

images, and iso-signal intensity on T_1 weighted images, with characteristic non-enhancing low signal intensity bands that are correlated with dense collagenous stroma within the mass.^{35,36}

Malignant sinonasal region tumors, such as paranasal sinus cancer, lymphoma and metastasis, should also be differentiated from paranasal sinus fibrosarcoma. Paranasal sinus cancers, which mainly include squamous cell carcinoma, adenocarcinoma and salivary gland-type carcinoma, are associated with hardwood dust, leather tanning, nickel and radium.²⁵ Squamous cell carcinomas and adenocarcinomas are heterogeneous in density and hyperintense on T_2 weighted images, with common bone destruction, surrounding tissue infiltration and regional lymph node involvement. As a kind of salivary gland-type carcinoma, adenoid cystic carcinoma has a characteristic growth pattern of an expansile or destructive nature, a high rate of cranial nerve involvement, a low rate of lymphatic metastasis and a high rate of developing metastases.^{37,38} Sinonasal Lymphoma has a highly aggressive appearance with local bone destruction. CT or MRI may provide clues to the diagnosis on the basis of the involvement of multiple sites, extensive involvement of the surrounding soft tissues and/or the presence of cervical lymphadenopathy.³⁸ Metastases to the nasal cavity and paranasal sinuses are uncommon.³⁹ They usually involve a history of malignancy, and the imaging findings vary according to the primary lesion type.^{39,40}

It is very important for radiologists to know the advantages and disadvantages of different imaging modalities. Basically, CT can only show the lesion, and give it some basic hard tissue description, size and delineation. By contrast, cone beam CT is becoming more and more used in paranasal sinus diseases diagnosis for its higher resolution image and lower exposure dose. In such cases, cone beam CT could be also used since the HU analysis did not really lead to final diagnosis. In addition, MRI, the next method of choice in paranasal sinus diseases diagnosis, could give us more helpful information about the diagnosis of the lesions in the head and neck area for its higher soft tissue resolution, multiparameter imaging and multiple positions imaging.

In conclusion, although rare, paranasal sinus fibrosarcomas should be included in the differential diagnosis when a sinonasal neoplasm appears as a well- or ill-defined unilateral large irregular mass with characteristic mild hypointensity on T_2 weighted MR images and shows expansive or osteolytic bone destruction and a marked heterogeneous delayed contrast-enhancement pattern.

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