Nasal NK/T-cell Lymphoma: Computed Tomography and Magnetic Resonance Imaging Findings

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Background: Primary nasal natural killer (NK)/T-cell lymphoma is the most common cellular subtype seen in nasal lymphomas. It is rare in the Western population but occurs more frequently in Asia, South America, and Mexico. The purpose of this study was to describe the computed tomography (CT) and magnetic resonance (MR) imaging findings of primary nasal NK/T-cell lymphoma.

Methods: During the period between January 1990 and June 2006, the CT ($n = 24$) and MR ($n = 6$) images of 24 patients with biopsy-proved nasal NK/T-cell lymphoma were reviewed retrospectively. Both CT and MR images were evaluated for site and extent of disease and for pattern of involvement of adjacent areas.

Results: The most common symptoms at presentation were nasal obstruction, nasal discharge, and epistaxis. There was involvement of the unilateral nasal cavity in 16, bilateral nasal cavity including nasal septum in 5 and nasal choana in 3. Sites of extension outside the nasal cavity included tumor extension into paranasal sinuses ($n = 15$), nasopharynx ($n = 5$), nasal labial fold ($n = 3$), oropharynx ($n = 2$), infratemporal fossa ($n = 2$), other subcutaneous soft tissue of the face ($n = 2$) and anterior cranial fossa base ($n = 1$). Bony destruction was demonstrated in 18 cases, involving the sinus bony wall ($n = 15$), nasal turbinate ($n = 10$), lamina papyracea ($n = 6$), orbital floor ($n = 3$), and hard palate ($n = 2$). Regional lymphadenopathy was also detected in 3 patients with nasal NK/T-cell lymphoma.

Conclusion: The CT and MR appearances of nasal NK/T-cell lymphoma are nonspecific, and the diagnosis requires histologic confirmation. However, the differential diagnosis of nasal NK/T-cell lymphoma should be included if the images present soft tissue of the nasal cavity with bony erosion or destruction; involvement of the orbital cavity, nasopharynx and infratemporal fossa; and subcutaneous or nasolabial fold soft tissue infiltration, especially in Asian populations. [*J Chin Med Assoc* 2007;70(5):207–212]

Key Words: computed tomography, magnetic resonance imaging, nasal cavity, nasal natural killer/T-cell lymphoma

Introduction

Nasal natural killer (NK)/T-cell lymphoma is a newly recognized entity of non-Hodgkin's lymphoma, which previously manifested clinically, but misleadingly, as lethal midline granuloma or pleomorphic reticulosis.[1,2] It is now definitively categorized in the World Health Organization lymphoma classification system as nasal-type extranodal T-cell/NK cell lymphoma.[3] The tumor cell frequently express a T-cell-associated antigen and the natural killer cell marker CD56 which are independent predictors of poor prognosis and an aggressive course of the disease. It is rare in the Western population but is common in those of Asian origin. Because it is

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E-mail: ccc@mail.vghtc.gov.tw • Received: September 8, 2006 • Accepted: April 19, 2007

difficult to diagnose both clinically and histopathologically, we decided to review the computed tomography (CT) and magnetic resonance (MR) appearance of nasal NK/T-cell lymphoma to determine if there were any features that might distinguish it from other nasal cavity or sinus tumors.

Methods

Twenty-four cases of diagnosed nasal NK/T-cell lymphoma (20 males, 4 females; 14–82 years old; mean age, 57 years) collected from the database of the radiation oncology department at Taichung Veterans General Hospital between January 1999 and June 2006 were retrospectively reviewed. Nasal NK/T-cell lymphoma was defined as primary nasal lymphoma with an NK-cell phenotype determined from histologic and immunophenotypic diagnosis. The clinical staging was according to the Ann Arbor system. Of these cases, CT or MR imaging or both were available for evaluation in all cases. Twenty-four patients underwent axial and coronal CT examination of the sinonasal area with 4 mm of slice thickness, 18 with intravenous contrast medium. Six patients underwent both enhanced CT and MR examinations of the sinonasal area. CT examinations were performed on either of the 2 scanners: Picker PQ2000 or PQ6000 scanner (Philips Medical Systems, Bothell, WA, USA). CT images were obtained in soft-tissue and bone algorithms and filmed in the respective window settings before being entered into the filmless picture archiving and communication systems (PACS). MR imaging was performed using the 1.5 T system (Signa; General Electric Medical Systems, Fairfield, CT, USA). All 6 patients underwent an axial T1-weighted spin-echo sequence (TR/TE, 450-700/8-12; field of view, 22 cm; slice thickness, 5 mm with 0.5 mm interslice gap and matrix size, 256 × 224), axial and coronal T2-weighted turbo spin-echo sequence with fat suppression (TR/TE, 4,500-5,500/80-100; echo train length, 14; field of view, 22 cm; slice thickness, 5 mm with 0.5 mm interslice gap; and matrix size, 256 × 224). In addition, contrast-enhanced T1-weighted spin-echo images with fat suppression were obtained in all 6 patients in the axial and coronal planes after a bolus injection of 0.1 mmol/kg of gadolinium dimeglumine using a 512 × 320 matrix. Scans were reviewed by consensus by 2 radiologists with knowledge of the histologic diagnosis only. Images were assessed for tumor mass enhancement, signal characteristics, location, local extension, bony destruction, soft tissue invasion, and regional lymph node involvement.

Results

The clinical symptoms at presentation included nasal obstruction ($n=19$), nasal discharge ($n=10$), epistaxis ($n=8$), nasal pain ($n=3$), nasal swelling ($n=1$), and fever ($n=1$). Patients had disease primarily in the nasal cavity, with unilateral involvement in 16, bilateral including the nasal septum in 5, and nasal choana in 3. On CT imaging study, infiltrative tumor mass with heterogeneous contrast enhancement within the nasal cavity or nasopharynx and adjacent structure invasion were found. Nasal turbinate and bony destruction were well demonstrated from the bone window setting (Figure 1) and detected in 18 cases. In the 6 patients who received MR studies, the tumor mass showed isointense to muscle on T1-weighted spin-echo MR images; hyperintense to muscle on T2-weighted spin-echo MR images (Figures 2 and 3); and heterogeneous enhancement in

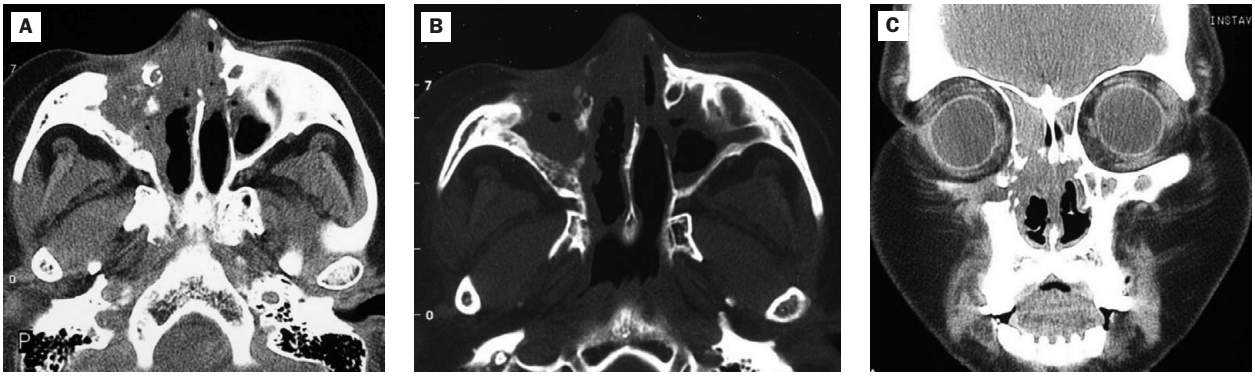

Figure 1. A 14-year-old girl with nasal obstruction caused by nasal natural killer/T-cell lymphoma. Noncontrast enhanced axial section computed tomography (CT) with (A) soft tissue and (B) bone algorithm, and (C) contrast-enhanced coronal section CT show soft tissue mass over the bilateral anterior nasal chamber and both maxillary and ethmoid sinuses with tumor extending anteriorly into subcutaneous soft tissue of the right nasolabial fold. Bony destruction of the nasal septum, bilateral nasal turbinates, bony wall of both maxillary and ethmoid sinuses, and right orbital floor is shown.

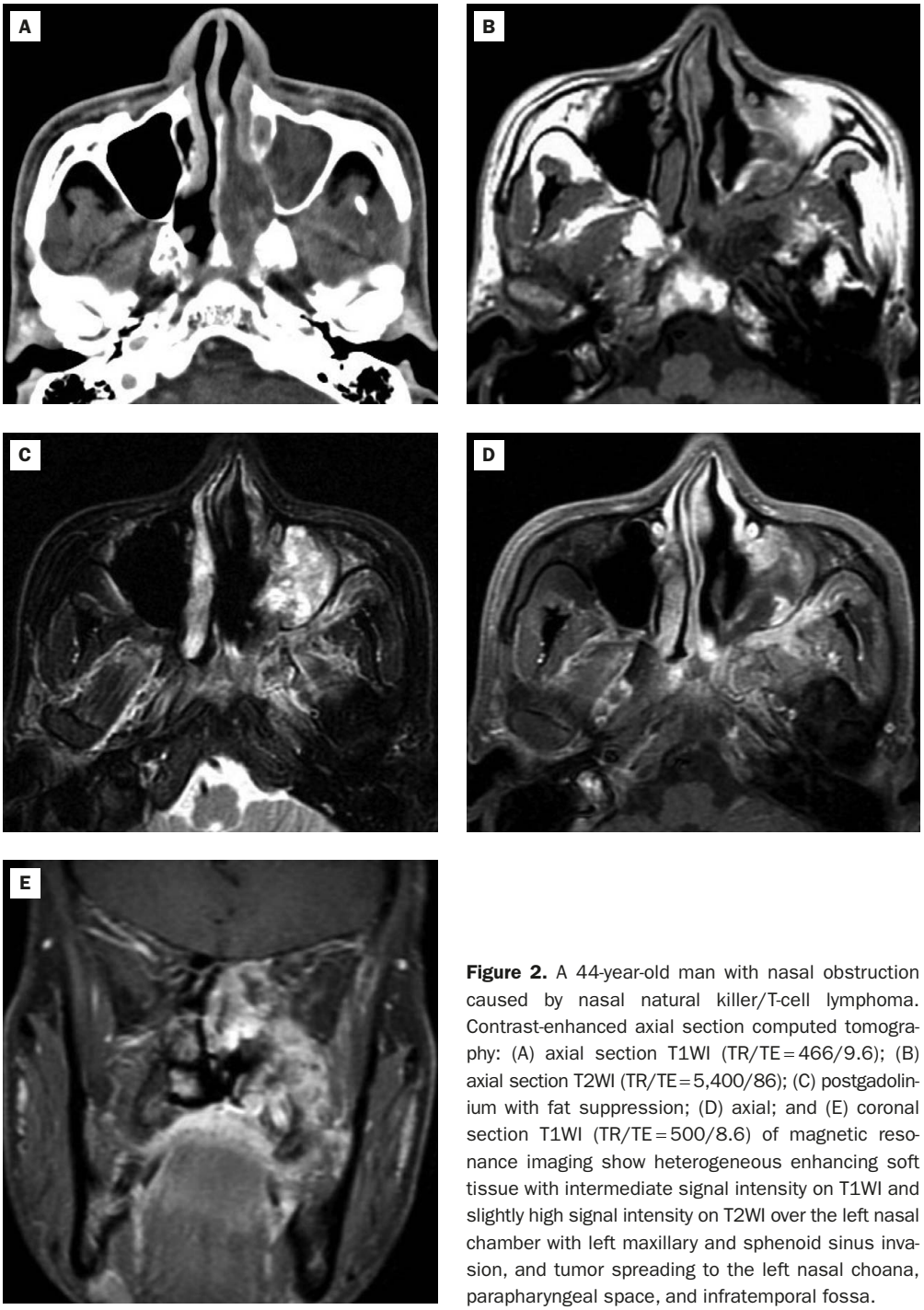

Figure 2. A 44-year-old man with nasal obstruction caused by nasal natural killer/T-cell lymphoma. Contrast-enhanced axial section computed tomography: (A) axial section T1WI (TR/TE = 466/9.6); (B) axial section T2WI (TR/TE = 5,400/86); (C) postgadolinium with fat suppression; (D) axial; and (E) coronal section T1WI (TR/TE = 500/8.6) of magnetic resonance imaging show heterogeneous enhancing soft tissue with intermediate signal intensity on T1WI and slightly high signal intensity on T2WI over the left nasal chamber with left maxillary and sphenoid sinus invasion, and tumor spreading to the left nasal choana, parapharyngeal space, and infratemporal fossa.

all involved soft tissues on CT and MR images. The sinonasal mucosal thickening could be differentiated from tumor via homogeneous T2-weighted spin-echo MR images hyperintensity with respect to muscle and homogeneous enhancement after gadolinium injection. The primary tumor location and extra-chamber involvement in our 24 patients with nasal NK/T-cell lymphoma are detailed in Table 1. Three cases had tumor confined solely over the nasal cavity. Significantly enlarged lymph nodes over the parapharyngeal space or cervical region were noted in 3 cases.

Discussion

Primary nasal lymphomas are rare in the Western population but occur frequently in Asia, South America, and Mexico, where they constitute up to 10% of

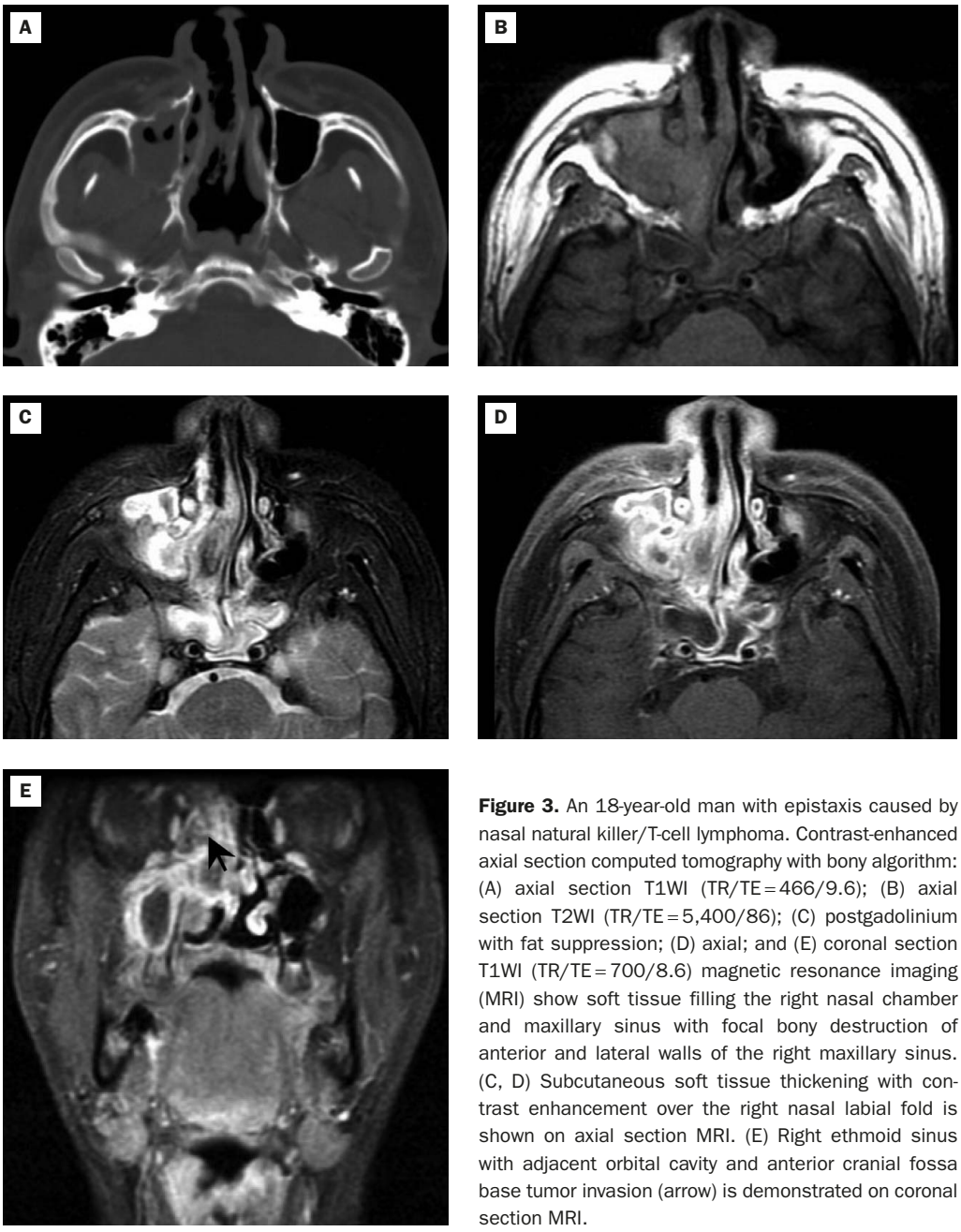

Figure 3. An 18-year-old man with epistaxis caused by nasal natural killer/T-cell lymphoma. Contrast-enhanced axial section computed tomography with bony algorithm: (A) axial section T1WI (TR/TE = 466/9.6); (B) axial section T2WI (TR/TE = 5,400/86); (C) postgadolinium with fat suppression; (D) axial; and (E) coronal section T1WI (TR/TE = 700/8.6) magnetic resonance imaging (MRI) show soft tissue filling the right nasal chamber and maxillary sinus with focal bony destruction of anterior and lateral walls of the right maxillary sinus. (C, D) Subcutaneous soft tissue thickening with contrast enhancement over the right nasal labial fold is shown on axial section MRI. (E) Right ethmoid sinus with adjacent orbital cavity and anterior cranial fossa base tumor invasion (arrow) is demonstrated on coronal section MRI.

non-Hodgkin's lymphoma.[4–7] Of the various cellular subtypes seen in nasal lymphomas, the most common in the Asian population is NK/T-cell lymphoma.[8]

On CT imaging, mild-to-moderate heterogeneous enhancement occurred in all involved soft tissues of our cases. In 2000, King et al[9] described nasal cavity lymphoma with low-to-intermediate signal intensity. On T1-weighted spin-echo images, tumors were of homogeneous signal intensity similar to or slightly higher than that of muscle. On T2-weighted spin-echo images, the signal intensity was higher than that of muscle but lower than that of sinonasal mucosa. After gadolinium administration, all tumors showed moderate enhancement that was greater than that of muscle but less than that of sinonasal mucosa. The MR appearances of our cases were similar to those reported previously in the literature. By and large, MRI is better than CT scan in the demonstration of tumor lesions. The sinonasal mucosal thickening can be differentiated from tumor via homogeneous T2-weighted spin-echo MR images hyperintensity with respect to muscle and homogeneous enhancement after gadolinium injection.

Two-thirds of our cases had unilateral nasal cavity involvement, which was different from other reports.[9]

Table 1. Primary tumor location and extra-chamber involvement in 24 patients with nasal natural killer/T-cell lymphoma

Primary tumor location and extra-chamber involvement	Patients (*n*)
Nasal location of primary tumor (*n* = 24)	
Unilateral	16
Bilateral including nasal septum	5
Nasal choana	3
Extra-chamber involvement (*n* = 21)	
Paranasal sinuses invasion with bony wall destruction or erosion	15
Maxillary sinus	10
Ethmoid sinus	7
Sphenoid sinus	3
Frontal sinus	2
Other bony structure invasion	
Nasal turbinate	10
Lamina papyracea	6
Orbital floor	3
Hard palate	2
Soft tissue extension	
Nasopharynx	5
Nasal labial fold	3
Oropharynx	2
Infratemporal fossa	2
Facial subcutaneous soft tissue	2
Anterial cranial fossa	1
Lymph node involvement	3

Our study revealed that nasal NK/T-cell lymphoma often presented with local destruction or erosion of nasal cavity bony structures (most common sites: maxillary sinus wall, lamina papyracea, and nasal turbinate) with soft tissue mass, which obliterated the nasal passage and adjacent paranasal sinuses in 75% of cases (Figures 1–3). Marsot-Dupuch et al[10] and Kondo et al,[11] however, reported CT evidence of bony destruction in 40% of cases, respectively. Orbital wall destruction (Figures 1 and 3) and intraorbital invasion (Figure 3) were identified in 3 of our cases, but none of these patients complained of visual disturbance. A previous report pointed out that 25% of nasal NK/T-cell lymphoma cases involved vision-threatening complications such as orbital infiltration and uveitis/vitreitis.[12] However, King et al[9] reported that invasion of the paranasal sinuses was less common and of smaller volume when compared with invasion of the nasopharynx and oropharynx.

In our study, we found that involvement of nasopharynx and oropharynx extension occurred in only about 25% of cases but more than 70% of cases had paranasal sinus involvement (Figures 1–3), and 5 cases had infiltrative process of nasolabial folds and subcutaneous soft tissue of the face that might be more uncommon in other nasal cavity lesions (Figures 1 and 3). Lymphadenopathy was only found in 3 cases. This was to be expected because nodal involvement in nasal NK/T-cell lymphoma is uncommon and more often associated with B-cell lineage.[9]

CT with bone algorithms is the best modality for evaluation of bony changes and MR imaging is useful in delineating soft tissue extension, but these imaging features are nonspecific as described by Teng et al[13] and Marsot-Dupuch et al,[10] respectively. Recently, immunophenotype has been shown to significantly affect the outcome of this disease, and the correlation between nasal NK/T-cell lymphoma and Epstein-Barr virus has been demonstrated in the cell genome.[14] Radiologic differential diagnoses of nasal NK/T-cell lymphoma include all etiologies that can cause sinonasal destruction, such as squamous cell carcinoma, esthesioneuroblastoma, Wegener's granulomatosis, chronic infections, sarcoidosis, cocaine abuse, etc. CT or MR features cannot reliably distinguish them, and the differential diagnosis should depend more upon clinical and laboratory studies. Prognostic factors include tumor volume, immunophenotype and extent of lesion. Recognition from the outset of this poor prognosis subtype of lymphoma is important for more effective treatment, such as chemotherapy combined with radiation.

In conclusion, the CT and MR imaging features of nasal NK/T-cell lymphoma are nonspecific, sharing similar findings with other aggressive lesions. The diagnosis requires clinical and histologic confirmation. According to our study, if the images present nasal chamber mass lesion with highly potentiality of paranasal sinuses involvement and facial subcutaneous or nasolabial fold soft tissue infiltration combined with nasopharynx, orbital cavity or infratemporal fossa involvement, nasal NK/T-cell lymphoma should be listed in the differential diagnosis, especially in Asian populations.

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