**Original Report**

**MR Imaging of Nasal T-Cell/Natural Killer Cell Lymphoma**

**OBJECTIVE.** Nasal T-cell/natural killer cell lymphoma is a distinct clinicopathologic entity derived from natural killer cells. The purpose of the study was to describe the MR features of this rare nasal cavity tumor and correlate MR findings with stage of disease.

**CONCLUSION.** Nasal T-cell/natural killer cell lymphoma frequently exhibits diffuse invasion of the nasal cavity with necrosis, midline destruction, and extension into the nasopharynx. These features may be seen in both early- and late-stage disease.

Lymphoma of the nasal cavity is a rare tumor, accounting for only 3% of all extranodal non-Hodgkin’s lymphomas [1] and 8% of those extranodal lymphomas localized to the head and neck region [2]. The tumor cells frequently express T-cell (T) associated antigens and the natural killer (NK) cell marker, CD56. These findings have led to the subsequent recognition of a distinctive lymphoma subtype called nasal T/NK cell lymphoma [2–8]. Despite the characteristic pathologic features of nasal T/NK cell lymphoma, difficulty in the diagnosis of nasal T/NK cell lymphoma, both clinically and pathologically, is well recognized. Furthermore, to our knowledge, the MR features of this specific group of lymphomas have not been described. In this study, we document the MR appearances of this rare tumor in seven patients.

**Subjects and Methods**

Eight Chinese patients with histologically proven nasal T/NK cell lymphoma were referred to our institution between January 1996 and July 1998. Seven of these patients (five men, two women; age range, 34–63 years; mean, 43 years) underwent MR imaging at presentation. These seven patients with MR examinations constituted the study cohort. Six of the seven patients presented with newly diagnosed primary nasal lymphoma and one presented with relapse isolated to the nasal cavity 3 years after successful treatment for nasopharyngeal lymphoma. Images were obtained on a 1.5-T MR unit (Philips Gyroscan, Eindhoven, the Netherlands) using a head coil (30-cm diameter). All patients underwent an axial T1-weighted spin-echo sequence (TR/TE, 500/20; field of view, 22 cm; slice thickness, 4 mm with no interslice gap; and matrix size, 256 × 202) and a coronal T2-weighted turbo spin-echo sequence (TR/TE, 2500/100; echo train length, 14; field of view, 22 cm; slice thickness, 4 mm with no interslice gap; and matrix size, 256 × 202). In addition, contrast-enhanced T1-weighted spin-echo images were obtained in six patients in the axial (n = 5) and coronal (n = 6) planes after a bolus injection of 0.1 mmol/kg of gadolinium dimeglumine using a 512 × 512 matrix. Scans were reviewed by consensus by two radiologists with knowledge only of the histologic diagnosis. Scans were assessed for tumor signal characteristics, site, volume, and local extent; bone and nasal turbinate destruction; and regional nodes. The MR findings were correlated with the stage of disease.

Endoscopic examination of the nasal cavity, nasopharynx, oropharynx, hypopharynx, and upper aerodigestive tract was performed on all patients. Histologic evaluation and immunohistochemical studies were performed on the biopsy specimens obtained from the tumor. The diagnosis of nasal T/NK cell lymphoma was based on the criteria described by Jaffe et al. [7]. All patients were staged according to the Ann Arbor system [9] with modification for extranodal lymphoma. Clinical staging procedures included complete history and physical examination; complete blood count; blood chemistry studies; serum lactate dehydrogenase level;
Results

The patients’ symptoms at presentation included nasal blockage (n = 5), nasal discharge (n = 5), nasal swelling (n = 2), weight loss (n = 2), fever (n = 2), epistaxis (n = 1), and sore throat (n = 1). Nasal cavity lymphomas were of low to intermediate signal intensity. On T1-weighted images tumors were of homogeneous signal intensity similar or slightly higher than that of the signal intensity of muscle. On T2-weighted images the signal intensity was higher than that of muscle but lower than that of sinonasal mucosa, and was homogeneous in six patients and heterogeneous in one patient in whom the tumor displayed superimposed areas of lower and higher signal intensity. All the tumors in the six patients who received an injection of gadolinium showed moderate enhancement that was greater than that of muscle but less than that of sinonasal mucosa. There was involvement of both sides of the nasal cavity in five patients and unilateral involvement in two. In the 12 sides of the nasal cavities with disease, tumor was small and localized to one region (n = 2), moderate and localized to more than one region (n = 2), or involved the entire nasal cavity (n = 8). Tumor volume ranged from 5 to 50 cm³ with a mean of 18 cm³. Sites of extension outside the nasal cavity included tumor extension into the nasopharynx (n = 4), oropharynx (n = 1), paranasal sinuses (n = 3), and palate (n = 1). Of the seven patients, three tumors showed areas of necrosis. There was destruction of the nasal turbinates (n = 4), nasal septum (n = 4), and hard palate (n = 1). There was no regional lymphadenopathy. The stage of disease was I_E, single extranodal organ or site (n = 6); and stage IV_E, diffuse or disseminated involvement of one or more distant extranodal sites with or without associated lymph node involvement (n = 1). The one patient with stage IV_E disease had disseminated disease to the bone marrow. Large-volume tumors involving both sides of the nasal cavity with extranasal extension, necrosis, and destruction of the nasal turbinates and bone were found in both stages I_E and IV_E.

Discussion

Non-Hodgkin’s lymphomas of the nasal cavity and nasopharynx are uncommon tumors. Nearly half (45%) of all malignant lymphomas of the nasal cavity and nasopharynx are derived from T/NK cells while 21% are derived from T cells and 34% from B cells [10]. The nasal T/NK cell lymphomas are rare among Western populations but more common in those of Asian descent [4, 5] and are highly associated with Epstein-Barr viral infection [5]. The disease may present clinically as a lethal midline granuloma or midfacial destructive lesion [3, 4] and is known for its predilection for other extranodal sites such as the skin and gastrointestinal tract, highly aggressive course, and poor prognosis [7, 10]. Nasal T/NK cell lymphoma is a distinct clinicopathologic entity with a characteristic immunophenotypic profile of CD2⁺, CD56⁺ (natural killer cell marker) and CD3⁻. The tumor often shows polymorphic lymphoreticular infiltrates and necrosis [11]. Angiocentricity is seen in about half of all cases but is also found in other lymphoma subtypes. In the past the identification of an underlying lymphoma was extremely difficult and many of these cases would have been labelled as polymorphic reticulosis or midline granuloma [12]. Diagnosis is confused further by the large array of other diseases with signs and symptoms that may partly overlap with those of nasal T/NK cell lymphoma. These include malignant midline granuloma, Stewart’s granuloma, progressive lethal granulomatous ulceration, malignant midline reticulosis, angiocentric immunoproliferative lesion, and angiocentric lymphoma [13].

In this study, the nasal T/NK cell lymphomas were of intermediate signal intensity on T1- and T2-weighted images (Figs. 1 and 2). The intermediate signal is common for many malignant tumors of the head and neck and contrasts to the very hyperintense signal intensity on T2-weighted images that is found almost exclusively in benign membrane and mucosal diseases. Nasal T/NK cell lymphomas in this study showed a predilection for diffuse invasion of the nasal cavity (Fig. 1), often involving both sides. Even in the

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smaller volume lymphomas there was a tendency to spread as a diffuse thin sheet of tumor along the walls of the nasal cavity to envelop the nasal turbinates and nasal septum (Fig. 2). In larger volume disease a more discernible mass was seen with destruction of the underlying nasal turbinates (Figs. 3 and 4). Midline destruction of the nasal septum occurred in half of the patients (Fig. 4) and involved the palate in one patient. Destruction of the lateral wall of the nasal cavity was not seen, although in one patient the lymphoma caused bowing of the nasal wall into the maxillary antrum. Tumor necrosis, which is a typical histologic feature of nasal T/NK cell lymphoma [7], was shown on MR imaging in all but one of the patients with a tumor volume of greater than 15 cm³ (Figs. 3 and 4).

The T/NK cell lymphomas were confined to the nasal cavity in two patients. The remaining five patients had tumor extensions outside the nasal cavity, most frequently into the nasopharynx. In two of these two patients, a small volume of tumor extended just beyond the nasal cavity into one wall of the nasopharynx. Two patients showed invasion of a wider area of the nasopharynx, and in the fifth patient the lymphoma extended inferiorly into the oropharynx. Invasion of the paranasal sinuses was less common and of smaller volume when compared with those invading into the nasopharynx and oropharynx. Tumor extension superiorly through the cribiform plate into the cranium was not seen. Regional nodal disease was not identified in this study. This was to be expected because nodal involvement in nasal T/NK cell lymphoma is rare and more commonly associated with the B-cell lymphomas [10].

The diagnosis of nasal T/NK-cell lymphoma requires histologic evidence. MR features alone cannot reliably distinguish this tumor from other nasal cavity tumors such as squamous cell carcinoma, minor salivary gland tumor, esophageal carcinoma, endemic lymphosarcoma, and lymphop epithelioma. In particular, the aggressive carcinomas, such as adenocarcinoma and undifferentiated carcinoma, can show a similar low to intermediate signal intensity on T1- and T2-weighted images [14] and are frequently accompanied by bone destruction [15]. Nonneoplastic conditions including Wegener’s granulomatosis, sarcoidosis, cocaine abuse, and infections such as leprosy, syphilis, tuberculosis, and fungus may also cause midfacial destruction. However, the differential diagnosis relies more on clinical and laboratory findings than radiologic findings.

In accordance with the literature, most of the patients with nasal NK/T cell lymphomas in this study presented at an early stage with nearly 90% classified as stage I_E [5]. Disseminated disease carries a poorer prognosis and was present in one patient (stage IV_E). The patient with disseminated disease showed a large-volume necrotic bilateral nasal cavity tumor extending into the paranasal sinuses and nasopharynx with extensive destructive changes in the nasal septum and palate. However, large-volume disease accompanied by necrosis, bone destruction, or extranasal disease was also found in patients with early stage I disease. This limited sample suggests that there may be a disparity between the severity of the radiologic findings and the stage of disease. Further studies will be required to determine the correlation between the extent of tumor, degree of tissue destruction, and tumor volume revealed by MR imaging and the various clinical characteristics, disease stage, and, ultimately, clinical outcome.

In conclusion, patients with nasal T/NK cell lymphoma frequently present with only localized disease. The MR imaging appearance is nonspecific and diagnosis requires histologic confirmation. However, the predilection for T/NK cell lymphoma to cause a diffuse necrotic mass that spreads to the nasopharynx with destruction of the midline structures—the nasal turbinates, nasal septum and palate—are features that in an Asian patient should suggest the diagnosis of nasal T/NK cell lymphoma.

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