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Magnetic Resonance Imaging Findings in Childhood Period Nasopharynx Cancer

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Summary

Background: Nasopharyngeal carcinoma is a rarely seen tumor in childhood. It is mostly detected late as the clinical features are similar to other childhood tumors which affect the nasopharynx and adenoidal hypertrophy. Therefore, the radiological features of childhood tumors of the nasopharynx must be well known. The aim of this study was to investigate the contribution of MR imaging features of childhood nasopharynx cancer.

Material/Methods: The study included 10 nasopharyngeal carcinoma patients under the age of 18 years who presented at hospital between February 2008 and March 2014 and who had tissue diagnosis and MRI of the nasopharynx region. The MRI scans were evaluated by two radiologists. Loco-regional spread, asymmetry, signal intensity of the tumors, and lymph nodes were evaluated.

Results: In all the patients there was a mass which narrowed the nasopharynx. In all cases, unilateral mastoid opacification was observed. In 9 cases (90%), parapharyngeal extension was found. In 8 cases (80%), the mass showed an extension into the nasal cavity or oropharynx. In 5 cases (50%), there was an involvement of the skull base. In 3 patients (30%), an extension to the masticator space and pterygopalatine fossa was found. There were enlarged cervical lymph nodes bilaterally in 10 cases (100%). In 4 cases (40%), a lateral retropharyngeal lymph node was detected.

Conclusions: Childhood nasopharyngeal cancers are often diagnosed at an advanced stage. MR imaging can be helpful in diagnosis and differential diagnosis of childhood nasopharynx cancer from other diseases of the nasopharynx.

MeSH Keywords: Magnetic Resonance Imaging • Nasopharyngeal Neoplasms • Nasopharynx

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Background

Nasopharyngeal carcinoma (NPC) accounts for approximately 1–3% of all malignant tumors and 20–50% of all primary nasopharyngeal malignant tumors in the pediatric age group [1–3]. The most common benign pathologies seen in the nasopharynx in childhood are adenoidal hypertrophy and angiofibroma, and malignant tumors are lymphoma and rabdomyosarcoma. Of all the childhood tumors, lymphoma is seen at a frequency of 10–15%, and rabdomyosarcoma at 8% [1,2]. The frequency of NPC varies extensively with age, ethnic and geographical origin. There is a high risk of NPC in far Eastern countries. Turkey has an intermediate risk factor for NPC. Two peaks of incidence have been observed in Turkey. The first one between 10 and 20 years of age and the second one between 40 and 60 years [1,2]. Childhood NPC is different from the adult type as the former one is more frequently associated with Ebstein-Barr virus infection. Nasopharyngeal carcinoma in pediatric patients usually presents as an undifferentiated type and is most often associated with loco-regionally advanced disease and more frequent distant metastases than in the adult type [1]. The childhood variant is highly responsive to chemotherapy and radiotherapy, although there is a higher rate of loco-regional and distant metastases [3]. The 5-year disease-free survival rate is between

Table 1. The presenting symptoms and disease stages of our patients during their application are shown.

Patient	Age	Sex	Presenting symptoms	T stage	N stage-location	M	Stage	EBV
1	17	M	Inability to open the mouth	4	2(VA)	1	4	NA
2	17	Fm	Nasal congestion	2a	2(IIB, VA)	0	3	+
3	18	Fm	Neck swelling, hemoptysis	2	2(IIB, VA)	0	3	+
4	18	M	Neck swelling	1	2(IIB, VA)	0	3	NA
5	17	M	Hearing loss	3	2(IIB, VA)	1	4	NA
6	15	M	Neck swelling	4	2(IIB, VA)	0	4	NA
7	15	Fm	Neck swelling	2b	2(IIB,VA)	0	3	NA
8	15	Fm	Neck swelling	4	3(IIA,IIB,III,VA)	1	4	+
9	13	M	Neck swelling	2	2(IIB, VA)	0	3	NA
10	7	M	Neck swelling	4	2(IIA,IIB, VA)	0	4	+

30 and 60% and is no different from the one in adults [3]. The occurrence of this tumor in children is very rare; only about 3% of all NPCs occur in patients younger than 18 years [4]. Children and adolescents with NPC were at a higher risk of getting second cancer than adults [5]. In total, 28% of the survivors had serious long-term treatment-related morbidities [6].

In this study it was attempted to determine decisive findings on MRI that may help in the diagnostics and staging of childhood nasopharyngeal carcinoma (NPC) as NPC is rarely seen in childhood and shows different clinical characteristics compared to adults.

Material and Methods

Approval for the study was granted by the training-planning board of Ankara Oncology Education and Research Hospital. Files of patients under the age of 18 years who had been diagnosed histopathologically with nasopharyngeal cancer between February 2008 and March 2014 were analysed. Ten patients under the age of 18 years, with a pre-treatment MRI examination were included in the evaluation. The presenting symptoms and demographic characteristics of the patients were recorded and MR examinations were re-evaluated. Of the 10 patients included in the study, 4 were female and 6 were male, with a mean age of 15.2 years (range, 7–18 years). The presenting symptoms and disease stages of the patients on presentation are shown in Table 1. In 1 case, a sister under the age of 18 years had a history of nasopharynx cancer and another case had familial history of Mediterranean fever. Four patients had Ebstein-Barr virus infection positivity.

MR examinations were applied with a 1.5 Tesla MR device. Axial-coronal T1-, T2-weighted images and sagittal-coronal STIR sequence and axial, coronal and sagittal post-contrast T1 sequences were evaluated.

The extension of lesions to surrounding tissues and the state of the lymph nodes were evaluated on MRIs. Tumor asymmetry and signal intensity of tumors were evaluated. Size, shape, location and signal intensity of lymph nodes were assessed. Ten patient had thorax CT for detection of metastases, two patient had brain MRI because of their headache complains, and two patient had extremity MRI because of leg pain.

Staging was made according to the American Joint Cancer Commission (AJCC) classification 2010.

One pathologist who experienced head and neck pathology reevaluated specimens. Pathological types were classified according to the World Health Organization (WHO) classification.

Results

All the patients had masses that narrowed the nasopharyngeal air column. Unilateral mastoid opacification was observed in all cases (Figure 1A, 1B). In 6 cases (80%), the mass extended into the nasal cavity and 2 cases of the mass extended into both the nasal cavity and the oropharyngeal posterior wall (Figure 2B). In 9 cases (90%), there was an parapharyngeal extension (Figures 1C, 2A). In 5 cases (50%), there was an involvement of the skull base (Figure 3A, 3B). In 3 patients (30%), there was an extension into the masticator space (Figure 1A, 2A) and the pterygopalatine fossa (Figure 1B). In 2 cases (20%), there was cavernous sinus invasion and carotid encasement (Figure 3A, 3B). In 5 cases (50%), there was sphenoid sinus invasion and clivus involvement (Figure 1D, 2B). In 10 cases (100%), there was bilateral cervical lymph node enlargement (Figure 1E). In 4 cases (40%), lateral retropharyngeal lymph node was detected. Only one case had cervical lymphadenopathy which was 7 cm in greatest dimension. The others were smaller than 6 cm in greatest dimension. The supraclavicular lymph node was not detected. All of the cases had level

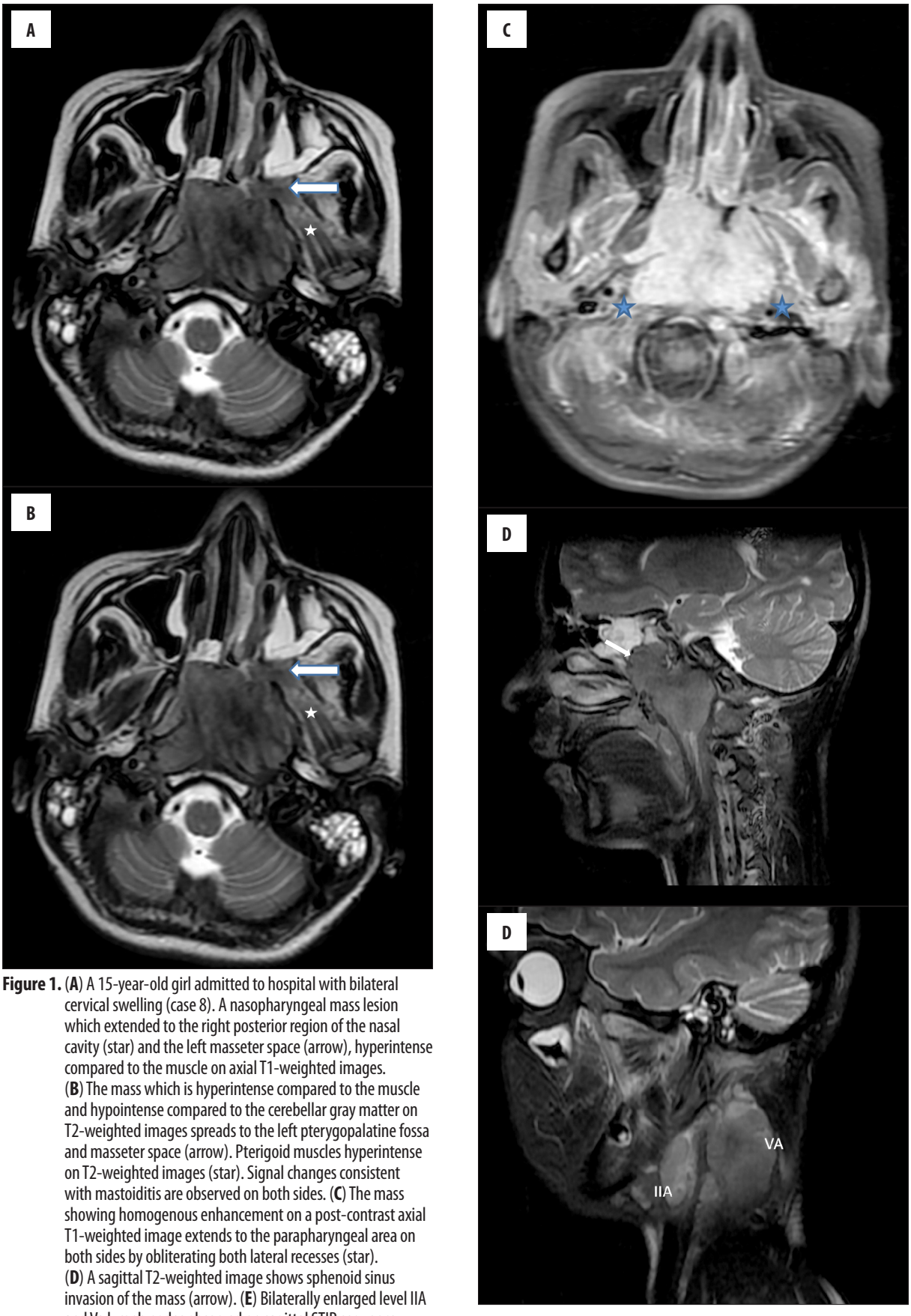

Figure 1. (**A**) A 15-year-old girl admitted to hospital with bilateral cervical swelling (case 8). A nasopharyngeal mass lesion which extended to the right posterior region of the nasal cavity (star) and the left masseter space (arrow), hyperintense compared to the muscle on axial T1-weighted images. (**B**) The mass which is hyperintense compared to the muscle and hypointense compared to the cerebellar gray matter on T2-weighted images spreads to the left pterygopalatine fossa and masseter space (arrow). Pterigoid muscles hyperintense on T2-weighted images (star). Signal changes consistent with mastoiditis are observed on both sides. (**C**) The mass showing homogenous enhancement on a post-contrast axial T1-weighted image extends to the parapharyngeal area on both sides by obliterating both lateral recesses (star). (**D**) A sagittal T2-weighted image shows sphenoid sinus invasion of the mass (arrow). (**E**) Bilaterally enlarged level IIA and Va lymph nodes observed on sagittal STIR sequence.

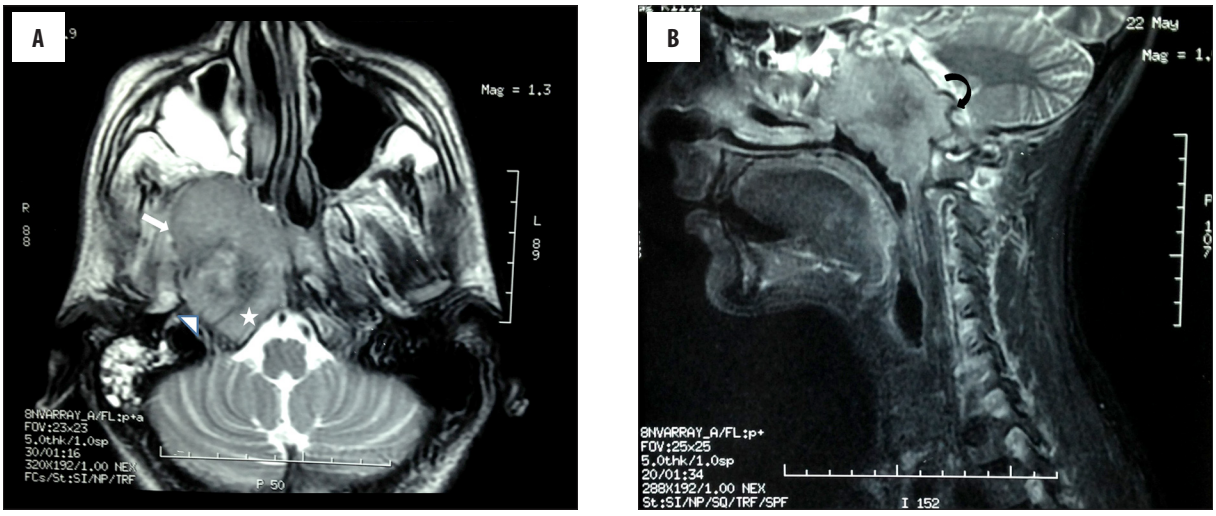

Figure 2. (**A**) A 17-year-old boy with an asymmetric nasopharynx mass which extends to the right parapharyngeal (arrow head) and masticator area (arrow) and which involves the right half of the clivus (star) (case 1) and which is monitored in the hyperintense signal characteristics on T2-weighted images compared to the muscle. (**B**) Extension of the mass to the nasal cavity and oropharynx posterior wall in sagittal T2-weighted images with clivus destruction is (arrow).

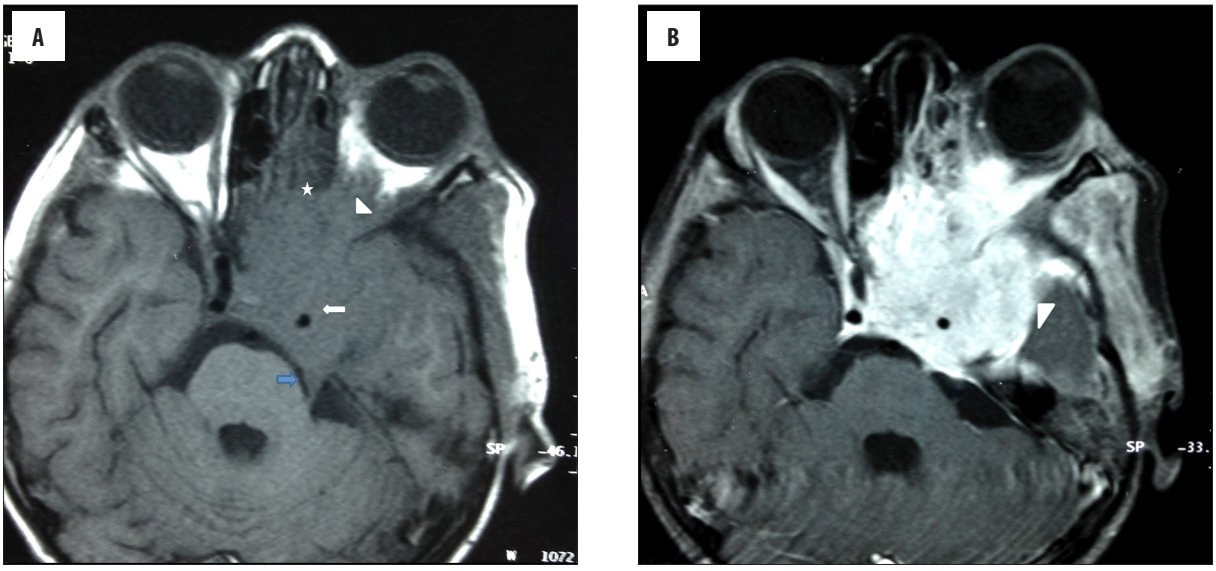

Figure 3. A 7-year-old boy with a huge nasopharyngeal mass (case 10) extending to the sphenoid/ethmoid sinus (star) on the anterior side, to the left orbit (arrow head) and prepontine cystern (blue arrow) on the posterior side, cavernous sinus, and the middle fossa (arrow head) on the lateral side. Carotid encasement is also seen (white arrow). The mass is slight hyperintense compared to the muscle on T1-weighted images (**A**) and showing intense homogenous enhancement after contrast administration (**B**).

VA lymph node, nine of them had level IIB lymp node, two of them had level IIA (case 8 and 10) and one of them had level III lymph node (case 8).

The histological sub-type of 9 of the current cases was consistent with non-keratinizing -undifferentiated carcinoma. Only one of them was poorly differentiated kreatinizing squamous cell carcinoma (case 6).

Three patient had distant metastases. While there was bone metastasis in 3 cases (30%), 1 patient had lung metastasis (10%) (case 5). One patient had tibia and right ileum metastases (case 5), one patient had lumbar vertebra and ileum metastases (case8), one patient had humerus and femur metastases. Bone metastases were lytic metastases in T1-hypointense, T2-hyperintense and post-contrast images and showed minimal enhancement (Figure 4A, 4B). In 1 patient, there was a solid parenchymal nodule in the lung (case5).

Discussion

Radiological imaging methods play an important role in diagnostics and differential diagnosis of childhood nasopharyngeal masses. While nasopharynx cancer is seen more around the age of 13 years in early adolescence, rhabdomyosarcoma is often seen at the age of 2–5 years. Lymphoma may be seen in all age groups in children [7]. The average age of the cases in the current study was 15.2 years. Lymphoma and childhood nasopharyngeal cancer

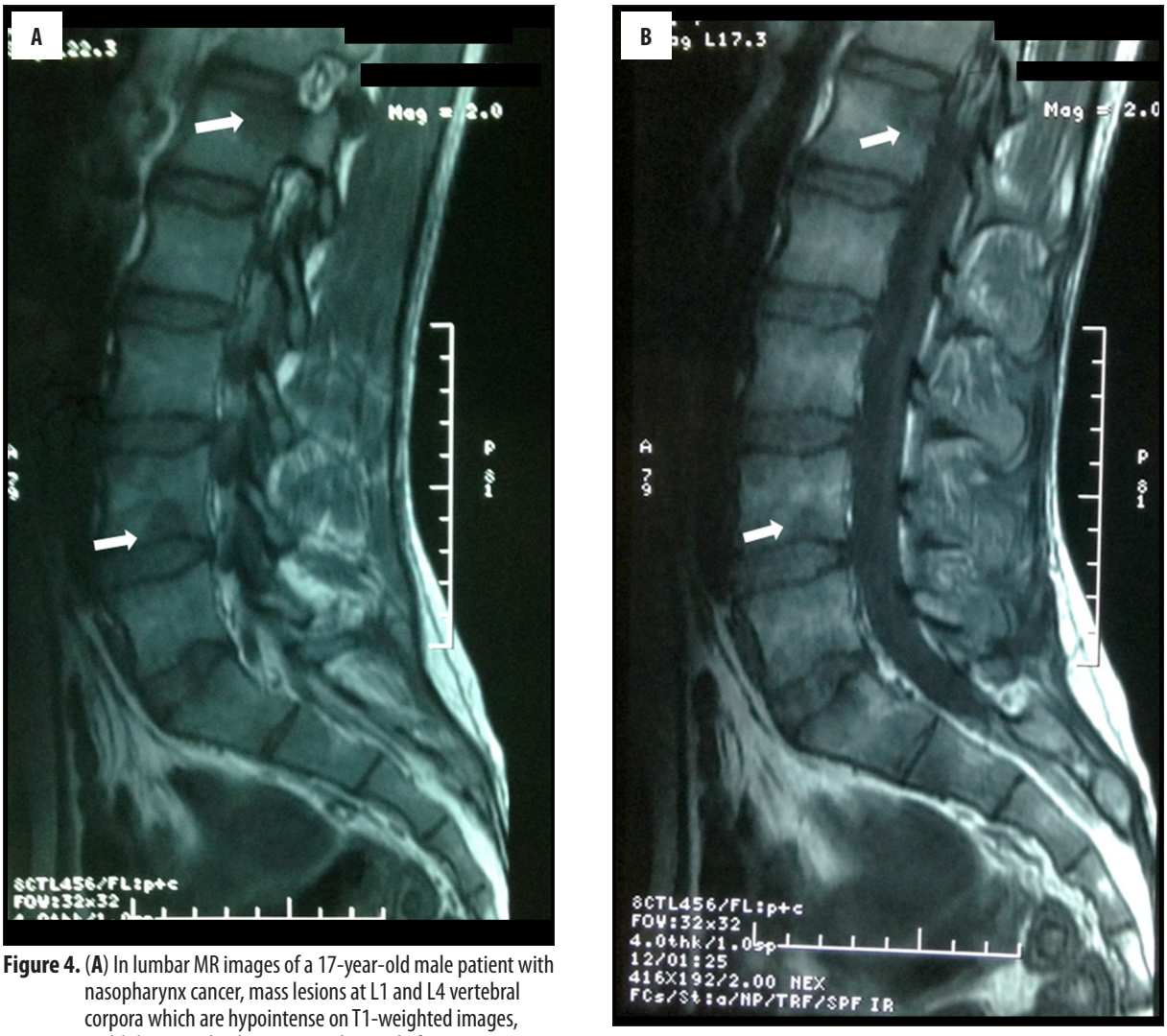

Figure 4. (**A**) In lumbar MR images of a 17-year-old male patient with nasopharynx cancer, mass lesions at L1 and L4 vertebral corpora which are hypointense on T1-weighted images, and (**B**) minimal enhancement observed after contrast administration.

often present with a mass on the neck. Local symptoms are nonspecific in nasopharynx cancer and they evolve due to the tumor obliterating the eustachian tube and the nasal cavity. Cranial nerve involvement is commonly seen. Often, II, IV, V, and VI or IX, X, XI, and XIIth nerves are involved. The weakest points in cranium invasion of nasopharynx tumors are the foramen lacerum and foramen ovale [7,8]. Extension to the cervical lymph nodes is often seen and it appears in the early stages [7]. The most common lymph nodes involved are high level II, and level VA. In the current study, level IIB and level VA lymph nodes were the most commonly observed. In childhood nasopharynx cancers, distant metastases have been reported in 5–11% of cases at the time of presentation at rates of 67% in bones, 20% in lungs, 30% in the liver, and 23% in the bone marrow. Only 15% of NPCs are caught at the early stage during the time of diagnosis [8,9]. Five of the cases in the current study had stage 4 tumors, the other five cases had stage 3 tumors. While there was bone metastasis in 3 cases (30%), 1 patient had lung metastasis (10%). NPC histological type in childhood is often a nonkeratizing undifferentiated carcinoma, and the NPC sub-type in adulthood is squamous cell carcinoma [3–9]. Nonkeratinizing NPC is strongly associated with prior EBV infection. EBV DNA is found in tumor cells and premalignant lesions.

Endoscopic assessment of the nasopharynx is generally difficult in children due to the lack of co-operation during the assessment and a small size of evaluated areas. Approximately 6% of NPCs cannot be seen through endoscopy so CT and MR imaging are used for observation of nasopharynx cancers which cannot be seen through endoscopy, and in the evaluation of the invasion of nasopharynx cancer to deeper areas. It has been reported that 82% of NPC in CT is located in the posterolateral region of the pharynx and 12% has a midline localization [8–10].

CT is successful in showing bone destruction caused by the mass. MR imaging is superior to CT due to multiplanar imaging capability and superior soft tissue contrast. It is also a method which should be preferred in childhood as there is no radiation exposure. A total of 75% of childhood NPCs are isointense on T1-weighted images compared to muscles or at high signal intensity compared to muscles and low signal intensity compared to cerebellar gray matter on T2-weighted images. Childhood NPCs may

occasionally display extension to the calvarium, dura, suprasellar region and the brain stem. Brain stem invasion is indicative of poor prognosis of the disease. In cases undergoing radiotherapy, carotid sheath invasion and pseudoaneurysms may be seen [8,9].

In pediatric NPC, FDG PET-CT tends to yield lower stage than MRI. It is also less sensitive in detecting bilateral cervical and retropharyngeal LN metastases based on size criteria of MRI. However, it is valuable in detecting distant metastasis and clarifying ambiguous findings on MRI. FDG PET-CT is also sensitive and specific for follow-up and enables earlier detection of disease clearance and simpler monitoring [11].

In differential diagnosis, benign diseases such as adenoiditis and juvenile angiofibroma, and childhood head-neck malignant tumors such as lymphoma and rhabdomyosarcoma should be considered. Often, adenoidal hypertrophy can be accompanied by lateral retropharyngeal and cervical lymphadenopathies. However, extension outside the nasopharynx is not observed. In adenoidal hypertrophy, symmetrical expansion in the nasopharynx is seen, whereas NPC has an asymmetrical appearance [7–10,12].

Juvenile angiofibroma is observed in MR characteristically as a mass that includes flow void foci and that shows intense enhancement after gadolinium administration. Parameningeal rhabdomyosarcomas frequently involve the nasopharynx and nasal cavity, and cranial extensions are frequently observed. MR signal characteristics of rhabdomyosarcomas is similar to NPC but its enhancement is more heterogenous. Rhabdomyosarcomas can be accompanied by hemorrhage and lymph node metastasis is seen less often. Lymphoma generally appears with cervical lymphadenopathy. However, supraclavicular lymph node and posterior triangle involvement points to lymphoma. The detection of Waldeyer's ring involvement is significant in the differential diagnosis. It is more hypointense on T1-weighted images compared to the muscle in lymphoma. T2 signal characteristics of lymphoma is similar to NPC [7–10].

Conclusions

Childhood nasopharynx cancers are generally diagnosed at an advanced stage as they display non-specific symptoms. An asymmetric mass in the nasopharynx, cranial extension of the mass, cervical and lateral retropharyngeal lymph node growth, and bilateral mastoid accompanying the process should primarily bring to mind nasopharynx cancer. Using radiological methods in the early stages enables early diagnosis of the disease and improves treatment success.

Statement

There is no financial disclosure or conflict of interest statements.

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