CT AND MRI FINDINGS OF VARIOUS ORGAN LYMPHOMAS: AS A PICTORIAL REVIEW

Original Article

ÇEŞİTLİ ORGAN LENFOMALARINDA CT VE MRI BULGULARI İNCELEME

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PURPOSE

Lymphoma is the malignant neoplasm of the lymphoid system. CT and MRI appearances can be diverse, and almost all organ systems can be involved. The diagnosis of extranodal lymphoma is challenging, since almost all other pathologic conditions including neoplasms can mimic this disease. We aimed to illustrate CT and MRI findings of lymphoma in various extranodal sites.

ÖZET

Lenfoma lenfoid sistemi tümörüdür. CT ve MRI bulguları farklıdır ve tüm organ sistemleri karışabilir. Esktranodal lenfoma tanısı zordur. Diğer patolojik durumlar ve tümörler bu hastalığı taklit edebilir. Çalışmada çeşitli ekstranodal bölgeleri CT ve MRI bulguları göstermeyi amaçlandı.

MATERIAL AND METHOD

CT and MRI examination findings were presented to illustrate the diversity of the radiological appearances and organs involved.

RESULTS

Among all lymphoma subjects, extranodal disease accounts for 15% of patients. We aimed to demonstrate some special clues for each system to help the differential diagnosis of extranodal lymphoma. **GIS**: Intestinal mural thickening with adjacent lymph node enlargement without obstructive symptoms, and with possible additional aneurysmatic dilatation. **Genitourinary**: Patchy hypodense or hypointense areas through the parenchyma, bilaterally. **Thoracic**: uniformly but nonsegmental thickening of the vascular, and/or cardiac wall. Pulmonary parenchymal involvement may present with any configuration such as ground-glass appearance, infiltration, mass, nodule etc. **Central nervous system**: Atypically presented a nonmass-like lesion with minimal contrast enhancement. **Bone, muscle and soft**

tissues: Homogenous mass lesion with minimal or relative large area of necrosis and permeative growth without obvious destruction.

CONCLUSION

Lymphoma is a common malignancy, accurate diagnosis is crucial for the treatment strategy. This pictorial review will make radiologists familiar with the imaging findings of lymphomas affecting various extranodal sites.

INTRODUCTION

Lymphoma is the malignant neoplasm of the lymphoid system. It is well known that almost any organ system in the body can be involved. Radiological findings may show different patterns for each organ system. The differential diagnosis of lymphoma has always been a challange from the radiologist's point of view, since imaging characters of many other entities may mimic this disease. In this article, we aimed to review imaging findings of extranodal lymphoma and to highlight some clues for the diagnosis of the extranodal lymphoma with CT and/or MRI in various organs .

MATERIAL AND METHOD

From the radiology archieves of two centers in digital system, the CT and MRI examinations of 33 patients (male:19, female:14, mean age:43 years) with the diagnosis of extranodal lymphoma were rewieved. CT and MRI findings were rewieved in terms of the diversity of radiological appearances. CT and MRI is used to illustrate the diversity of the radiological appearances and organs involved in a general way. All the diagnoses have been proved by cytohistopathological examinations.

In this multicentric review, all the cross-sectional images were re-evaluated retrospectively (CT:11, MRI:16, CT+MRI:5) and this evaluation was performed comparing with the literature data, on a case by case basis. Among all the reviewed 227 patients, which had been reported as lymphoma, between May 2007 and June 2009, 34 patients with extranodal lymphoma were included. The imaging findings, characteristic and distinguishing features of extranodal lymphoma are emphasized and discussed with related figures.

RESULTS

The patient groups and their classification according to the location of the extranodal lymphoma is shown in detail in **Table 1**.

Table 1. *Case groups and classification according to the primary involved sites.*

Abdominal-gastrointestinal-genitourinary system (n=14)	Gastric (n=4), ileum (n=2), appendix (n=1), caecum (n=1), pancreatic (n=1), Spleen (n=1), surrenal (n=1), renal (n=2), testiscular (n=1)
Thoracic-pulmonary (n=5)	Thymic (n=1), primary parenchymal (n=2), Thoracic wall (n=1), cadiac (n=1)
Central nervous system (n=4)	Neurohypophysis (n=1), spinal cord (n=1), neural parenchymal (n=2)
Skeletal system (n=5)	Spinal column (n=2), femur (n=1), diffuse axial skeleton (n=1), Calf muscles (n=1)
Maxillofacial-Burrkitt (n=3)	Sinonasal (n=1), mandibular (n=1), orbital (n=1)
Peripheral nervous system (n=2)	Brachial plexus (n=1), lumbary plexus (n=1)

Review of the archieves have shown that, among all patients which had the final diagnosis of "lymphoma", 15% of them have been determined as extranodal lymphoma.

Patients with gastrointestinal intestinal system (GIS) lymphoma had relatively mild symptoms which were primarily related with the malignancy rather than intestinal obstruction. In our cases, although the existence of obvious mural thickening and mesenteric

lymphadenopathies, there was no sign of intestinal obstruction. And additionally, aneurysmatic intestinal dilatation that accompany mural thickening has been shown in two patients **(Figure 1**).

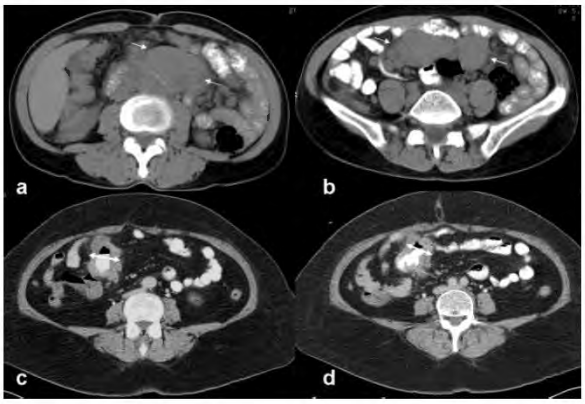

Figure 1. *Axial contrast enhanced CT sections of a patient with intestinal lymphoma. Conglomerated giant lymphadenopathies are seen throughout the caeliac (a) and mesenteric (b) areas (arrows). Thick walled short ileal bowel segment has aneurysmatic ectasia (double headed arrows).*

Both subjects with renal lymphoma presented with patchy hypodense corticomedullary foci throughout the parenchyma **(Figure 2).**

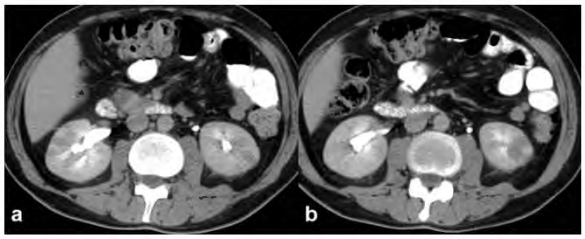

Figure 2. *Contrast enhanced CT sections of a pstient with renal lymphoma. Both of the kidneys showed patchy hypodense, relatively nonenhanced corticomedullary foci.*

One patient had primary testicular lymphoma which presented with gyriform appearance around the contours of affected testis **(Figure 3).**

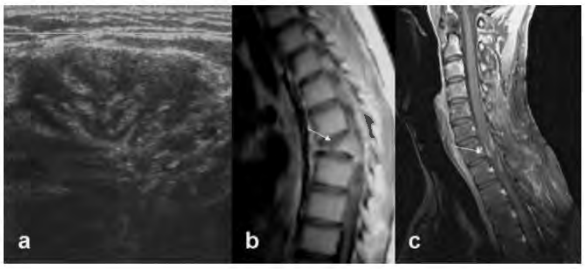

Figure 3. *Testicular lymphoma patient. Testicular structure have a gyriform folded pattern (a), compression fracture of the affected 8'th dorsal vertebra (b) and enhanced dural thickening represent systemic involvement (arrows).*

In subjects with lymphoma originating from the contents of thoracic cage boundaries, regardless of the lesion size, encasement of vascular lumens or invasion of cardiac chambers were seen but there were no necrotic focus in the mass lesion, nor any sign of occlusion of the encased vascular structure. But for all the cases, mediastinal mass lesion boundaries were beyond the intimomedial plates or neighboured bony cortices without destruction, probably by permeative lysis. In spite of these specific paterns of lymphoma originating from the mediastinal contents (vessel, cardiac chambers), all the parenchymal forms showed nonspecific configuration changing from a single nodule to large consolidating or widespread interstitial infiltrative changes **(Figure 4).**

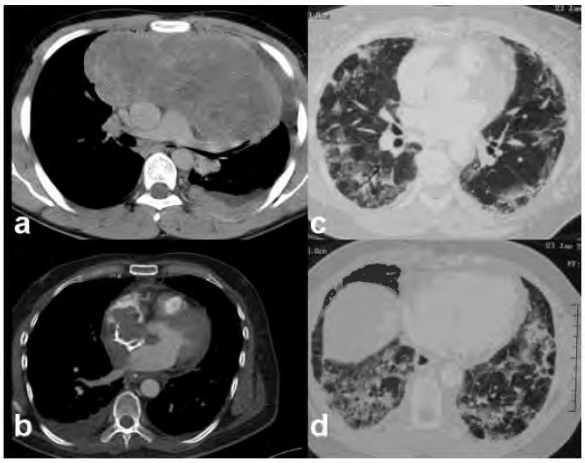

Figure 4. *Mediastinal extranodal lymphoma (a, b); Pulmonary parenchymal lymphoma (c, d) subjects. Anterior mediastinal involvement with a large mass (a) and also accompanying right superior veno-atrial*

junction of the heart (b). In the other patient, (c, d) parenchymal patchy, nonsegmental, non-specific involvement of the lungs represent infiltration of the pulmonary structure by lymphoma.

As far as patients with central nervous system lymphoma are concerned, although there were visible lesions on unenhanced sequences, there were no specific patterns of spread or no specific localization. Although the lesions were relatively large, minimal contrast enhancement after contrast administration was a common radiologic pattern for all patients. In general, in the evaluations of lesions which have not typical radiologic patterns and masses with lower enhancement though to the large volumes, lymphoma must be taken into account firstly. In our cases, another subject with hypothalamo-hypophyseal axis involvement showed infiltration through the cranial nerve courses **(Figure 5).**

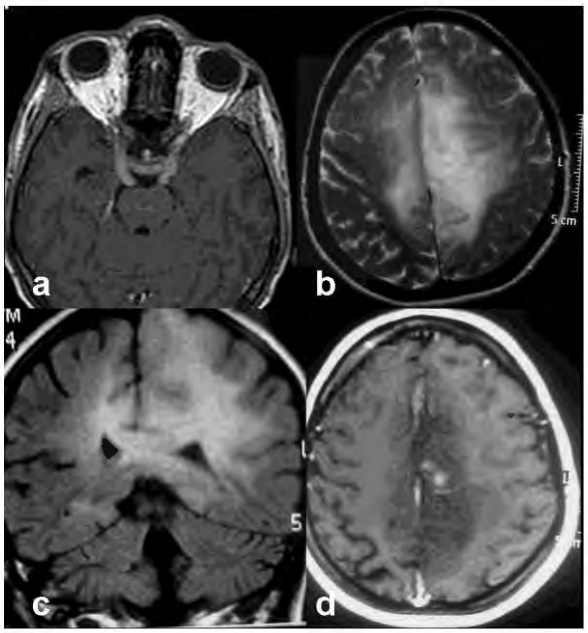

Figure 5. *Cranial lymphoma with bilateral cavernous sinus involvement following the course of the cranial nerve tracts (a). In T2w (b) and FLAIR (c) sequences the mass lesion is seen to proceed to the bihemispheric parenchymal area which crossing the callosal fibers probably from the left side to the right side of the brain.*

Although largely being infiltrative and nonnecrotic in the T2W sequences, no significant contrast enhancement was seen other than left paramedian foci .

Involved neural parenchyma has a special characteristic appearance that although infiltrated by the lymphoproliferative process, there was no obvious break-down which may represent degradation of a landmark. The lesions evolved without interrupting normal parenchmal tissue with permeative infiltration. In case of the bone and soft tissue involvement, fascial planes, fatty planes, skeletal tissue and potential spaces were all obliterated with large but relatively nonnecrotic masses without the loss of anatomical boundaries **(Figure 6**).

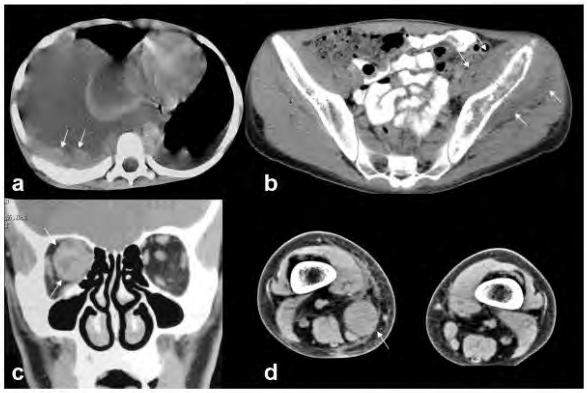

Figure 6. *Dramatic patterns with nondestructive large masses that caused thickening of the normal anatomic structures. a) Nodular pleural thickening, b) Permeative involvement of lef iliac bone and soft tissue, c) Diffusely thickened and enhancing right optic nerve, d) uniformly thickened right gracilis muscle with striation of inflamed perimusculary fatty planes (arrows).*

Regardless of cervical or lumbar sites, in two subjects with plexus involvement, there were enhancing infiltrative thickened nerve roots rather than only enhancement of the plexus fibers diffusely as in inflamatory conditions **(Figure 7).**

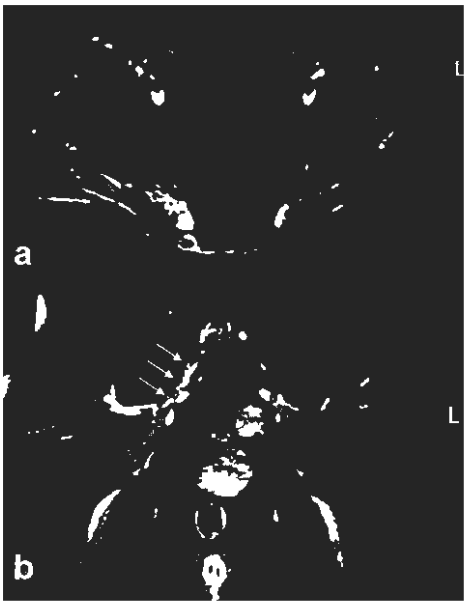

Figure 7. *Axial (a) and coronal fat-saturated (b) T1 weighted post-contrast images show the mass-like thickened and enhanced right lumbosacral plexus fibers, obviously.*

DISCUSSION

Extranodal lymphoma may arise anywhere outside the lymph nodes; from sites with primary lymphoid organs; from organs or non-lymphoid tissues; or from organs with a significant lymphoid tissue component (eg, gastrointestinal tract). Radiologic examination of the affected areas has been shown to be of great value in the staging and follow-up of lymphoma. Clinically important upstaging and/or downstaging is at valuable rates. With this study we aimed to reveal the known patterns of different extranodal radiologic manifestations for increasing the familiarity with this entity.

Lymphoma is the malignant neoplasm of the lymphoid system. CT and MRI appearances can be diverse according to the site involved. The diagnosis of this condition is mostly a challenge to the radiologist, since almost all other conditions including neoplasms can mimic this disease.

Involvement of the lung parenchyma is relatively rare. The lung is more frequently involved in secondary or recurrent disease than in primary disease. Pulmonary involvement may be bilateral and almost in all subjects parenchymal patterns are nonspecific. These radiologic patterns include a mass or consolidation-infiltration and atelectasis of a lobe or segment. In some cases; biopsy may be required to differentiate relapse from infection, radiation pneumonitis or lung tumors-metastasis. CT is the modality of choice in evaluating pulmonary parenchymal abnormalities. Thymus, thoracic walls, heart and great vessels may be affected from the involvement or may be the primary site of the origin.

The spleen is usually considered to be a "nodal organ" in Hodgkin disease and an extranodal organ in non-Hodgkin lymphoma. Staging laparotomy has shown that the spleen is infiltrated in about 30%–40% of patients at presentation. Splenic involvement is typically diffuse, and only minority of subjecs manifest with nodules larger than 1 cm in diameter. The size of the spleen is not very helpful because diffuse infiltration may be present in a normal sized spleen. The primary involvement of the liver and pancreas is very rare and these organs are almost always involved secondarily. Intestinal involvement has a a poorer prognosis than those with other forms of the extranodal disease. The stomach is the most frequent site of malignant lymphoma of the gastrointestinal tract. The infiltrating form is the most common and may be difficult to differentiate from scirrhous carcinoma (especially when associated with fibrosis). Gastric diffuse wall thickening with lobulated outer contour may be a clue for lymphomatous extranodal involvement. Involvement of the intestine may present as a thickened and dilated loop, specifically involving the colon or ileal segment.

Intrinsic involvement of the genitourinary organ systems at presentation is rare. Involvement f the kidneys, ureters, bladder, urethra is extremely rare and findings are

nonspecific. In contrast to the non-Hodgkin lymphoma, renal involvement is extremely rare, and perirenal infiltration is also dominant. This finding may help the discrimination of Hodkgin from non-Hodkgin forms.

Although skeletal involvement is rare as the presenting symptom, it is seen in approximately 20% of affected patients during the course of the disease. Bone marrow involvement is rare at presentation but it is important. Because when tumor infiltration is seen at imaging, clinical stage IV disease is presumed. MR imaging may be more sensitive than all other current imaging modalities in demonstrating bone marrow infiltration. Osseous involvement occurs in 5 %–20 % of patients during the course of Hodgkin disease. Osseous involvement is indicative of widespread, aggressive disease. Primary bone lymphoma is also seen in non-Hodkgin form. In decreasing order of frequency the bone lesions are found in the following locations: dorsolumbar spine, pelvis, ribs femur, and sternum. The radiologic features of bone disease are nonspecific. Lesions may be solitary or involvement may be polyostotic. Bone scintigraphy has an accuracy of 95% in detecting osseous involvement.

Extranodal disease manifests clinically in less than 1% of head and neck cases. Nasopharyngeal involvement, sinonasal destructive masses, maxillomandibulary involvement can be seen and rarely thyroid may be the origin of disease.

Once an extremely rare neoplasm, primary lymphoma of the central nervous system now ranks behind only meningiomas and low-grade astrocytomas in prevalence. Virtually all primary CNS lymphomas are composed of B cells. Primary CNS lymphoma has a distinct affinity for perivascular extension. Overall prognosis for patients with primary CNS lymphorna remains poor. In secondary form, involvement of the central nervous system is generally a late manifestation and constitutes a serious and potentially fatal threat to the patient. Furthermore, this complication may occur in patients who are apparently in remission. Lesions are more frequently intraspinal, than intracranial. Brain involvement by Hodgkin disease is so rare that a space-occupying lesion in the brain of a patient with known Hodgkin disease should prompt a second diagnosis.

CONCLUSION

In this article, we have discussed and illustrated diverse forms of extranodal lymphomas. Also, we have summarized the most striking imaging findings with impulsive figures throughout the discussion section as a pictorial assay.
Because of the numerous therapeutic options at the presentation of the tumors and greater chance for cure when compared with other neoplasias, it is important to differentiate extranodal lymphomatous involvement of other tissues. With the help of some clues that are indicated in this pictorial review, radiologists can be more familiar with the imaging findings of lymphomas affecting various organ systems.

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