Original Article

Role of Ultrasound and computed tomography in assessment of abdominal lymphadenopathy and splenomegally in lymphomas

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Abstract:

Background: lymph nodes involvement is the most common presentation of abdominal lymphoma; their diagnosis is based on variety of imaging modalities, histopathology of different areas of involvement and stage of the disease.

Objective: to compare the value of abdominal ultrasound (US) and computed tomography (CT) scan in already diagnosed cases of lymphoma and evaluation of lymph nodes and splenic involvement in patients with proved lymphoma.

Patients and methods: thirty patients with lymphoma were gathered from hematological unit in Baghdad teaching hospital retrospectively depending on their histopathology that revealed either Hodgkin lymphoma (HL) or non-Hodgkin lymphoma (NHL) and they were examined by ultrasound and CT scan of the abdomen, then were categorized according to the lymph nodes regions involvement.

Results: the results showed that both ultrasound and CT are nearly equal in detecting upper abdominal adenopathy and splenic involvement, while CT is better than ultrasound in assessment of lower abdominal, mesenteric and para-iliac lymph nodes groups.

Conclusion: our results are comparable to the earlier series and show improved detection of lymph nodes by new modality CT.

Key words: ultrasound, computed tomography, lymphadenopathy, lymphoma.

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Introduction:

Lymphoma is a cancer in the lymphatic cells of the immune system (1). Typically, lymphomas present as a solid tumor of lymphoid cells (2). Treatment might involve chemotherapy and in some cases radiotherapy and/or bone marrow transplantation, and can be curable depending on the histology, type, and stage of the disease (3,4). There are many types of lymphomas, and in turn, lymphomas are part of broad group of diseases called hematological neoplasms (5). CT scan is the most commonly used imaging modality for the detection, staging, and follow-up of lymphoma (6,8), while the ultrasound examination able to characterize the abnormal shape, appearance and abnormal power Doppler signal of lymph node and had limited role in follow up (7,8). Ultrasound features of abdominal lymphadenopathy in adult patients with lymphoma include multiple, non-necrotic hypoechoic enlarged round sharp border nodes with lack of normal echogenic hilum in (72-73%) and posterior enhancement. Calcification is rare, if present is usually after treatment and cystic necrosis is uncommon. Color Doppler imaging reveals mixed vascularity with prominent hilar vessels and peripheral vascularity alone is rare in lymphoma. Sonographic patterns of splenic involvement correspond to three macroscopic forms; diffuse/infiltrative, miliary/nodular, focal hypoechoic/cyst-like (without posterior acoustic enhancement) or indistinct boundary echo pattern. (6, 7, 9) CT scan is the most commonly used imaging modality for the detection, staging, and follow-up of lymphoma. (6, 8)

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Patients and methods

This is a retrospective study in which 30 cases of proved lymphomas were radiologically analyzed in the period from the 1st of October 2010 to the 1st of September 2011 in radiological departments in medical city complex.

All the patients included in this study had a biopsy and proved to be lymphoma and were referred for CT and Ultrasound for staging. The Ultrasound and CT were done in all the cases, eighteen of them are males and twelve are females, their age range from 20-70 years, all of them were admitted in the hematological unit in Baghdad teaching hospital. Examination was excluded from consideration in thirteen cases which show either one or combination of the following: (the imaging studies were not adequate to apply the diagnostic criteria for example patients allergic to contrast media are excluded. Patient with primary visceral lymphoma, because the study was confined to lymphadenopathy and spleen. Patients with

lymphoma complicating other hematological disease).

Ultrasound was performed with a Philips HD11XE using a 3.5 MHz transducer (has good penetration) for splenic and retroperitoneal assessment and an additional examination by 5 MHz transducer (for superficial purposes) for assessment of mesenteric lymph nodes.

The Patients were examined in the supine position from the epigastric region to the pelvis. Assessment of adenopathy was then done for each of the following anatomic regions: splenic hilum, mesenteric, para-aortic and iliac regions.

A lymph node considered significant in above mention regions if their transverse dimension exceeded 10 mm, anechoic, hypoechoic or producing mass effect which could not be due to normal structure. Splenic size and texture were evaluated. The spleen was considered abnormal if it was enlarged, heterogeneous structure, or if both features were present. The upper limits of normal spleen size were 13 cm. In a normal size spleen, any focal or diffuse areas of decreased echogencity were considered to be suspicious.

Power Doppler Ultrasound procedure: Patients underwent power Doppler US of all enlarged or suspicious lymph nodes and considered as abnormal if they were showing single vascular pole, with large branches or the presence of peripheral vessels arranged into single pole with multiple irregular and tortuous centrally directed branches.

The CT examinations were done by Toshiba Aquilion 64 Multidetector CT scanner, with a slice collimation of 0.6 mm, a reconstruction interval of 5 mm, kilo voltage of 140, and milliamp of 200-250. Scanning was performed from the lower chest to the pubis without and then with intravenous administration of 100 mL of nonionic iodinated contrast material, iohexol 300mg Iodine/mL which administered at a rate of 3 mL/sec using injector via a 20-gauge cannula in the cubital vein. Imaging was performed during the portal venous phase after delay of 65 seconds in all cases. In our department, the patients were not given oral contrast media. Then images are reviewed and the presence of any para-aortic and mesenteric lymph nodes greater than 10 mm and 6mm in retrocrural region in the short-axis diameter were included. Lymph nodes were identified as well-defined round or oval structure of soft-tissue density, separated from blood vessels and nearby bowel. We recorded the presence of the lymph nodes and their location in one of following sites: splenic hilum, para-aortic, para-iliac and mesenteric root.

Data recorded include the patient name, age, sex, histopathology, Para-aortic lymph nodes, Para-iliac lymph nodes, mesenteric lymph nodes, splenic involvement, size and pressure effects (hydronephrosis, vascular involvement) applied for both Ultrasound and CT.

While in addition, lymph nodes consistency, calcification and Ureteric displacement is applied for CT scan and for ultrasound we additionally applied the Echogensity, shape, hilum, outline and vascularity by power Doppler.

Results:

Thirty patients proved lymphoma (18) males and (12) females, referred to radiology department for ultrasound and CT scanning.

The mean age of the patients was (39.25+/-13.4) years for HL and was (45.68+/-7.9) years for NHL, the patients were referred for staging of their newly diagnosed disease.

Eight patients had HL and twenty two had NHL.

Abdominal Lymph Nodes results:

Details about the lymph nodes in different regions and by CT and ultrasound are given in Tables 1 and 2 respectively, while the details about ultrasound and CT features of lymph nodes are explained in table 5 and 6.

Additional features as pressure effect on nearby organs that were seen by ultrasound and CT are discussed in table 7

The detecting ability of ultrasound and CT for abdominal lymph nodes was as follow:

In the upper abdomen, lymph nodes at the splenic hilum were detected in equal percentage by CT and ultrasound in 14 patients (50% in HL and 71% for NHL).

Ultrasound identified the lymph nodes in para-aortic region as involved in 10 patients (25% for HL and 36.4% for NHL) whereas the CT identify them in 13 patients (37.5% for HL and 45.5% for NHL).

Iliac lymph nodes were involved in 1patient by ultrasound and in 2 patients by CT, this represent 4.5% for US and 9.1% for CT ,while the mesenteric lymph nodes were detected in 13 patients (0% for HL and 59% for NHL) by CT, whereas the ultrasound identify them in 6 patients (0% for HL and 27.3% for NHL) in both of these regions the P value is 0.001 which is significant advantage for CT over the US in detection of lymph nodes in these areas.

CT is better than ultrasound in detection smaller size lymph nodes in different regions in generals with p value of 0.0128 (table 4)

Spleen:

Splenic involvement was identified in equal percent by ultrasound and CT which was 16 cases (62.5% for HL and 50% for NHL), Focal masses within spleen were identified in by ultrasound in 1 patient while they are not seen in this patient by CT prior to contrast injection and revealed clearly after contrast injection (table 3).

Table 1: lymph nodes by CT versus histopathology

Lymph nodes group CT	Histopathology HL		NHL	
Para-iliac	0%	(0/8)	9.1%	(2/22)
Para-aortic	37.5%	(3/8)	45.5%	(10/22)
Splenic hilum	50%	(4/8)	45.5%	(10/22)
Mesenteric	0%	(0/8)	59%	(13/22)

Table 2: lymph nodes by US versus histopathology

Lymph nodes groups US	Histopathology HL		NHL	
Para-aortic	25%	(2/8)	36.4%	(8/22)
Para-iliac	0%	(0/8)	4.5%	(1/22)
Splenic hilum	50%	(4/8)	45.5%	(10/22)
*Mesenteric	0%	(0/8)	27.3%	(6/22)

*P value is 0.004 which is significant differentiating feature between HL and NHL.

Table 3: Splenic involvement by CT and US versus histopathology

	HL		NHL	
Splenic involvement by CT and US	62.5%	(5/8)	50%	(11/22)

Table 4: lymph nodes size versus modalities

*Lymph nodes size <2cm	%
CT	100% (21/21)
US	66.66%(14/21)

*Two-sided P-valve: 0.0128

Table 5: US features of Lymph nodes.

Us features of LN	HL	NHL
Echogenicity		
Homogenous	100% (8/8)	90.9% (20/22)
Heterogeneous	0% (0/8)	9.1% (2/22)
Outline		
Sharp	100% (8/8)	100%(8/8)
Ill-defined	0%	0%
Power Doppler		
Central	100% (8/8)	77.3% (17/22)
Central and Peripheral	0% (0/8)	22.7% (5/22)
Shape		
Rounded	100% (8/8)	81.8% (18/22)
irregular	0% (0/8)	18.2% (4/22)
LN hilum		
Displaced	12.5% (1/8)	22.7% (5/22)
lost	87.5% (7/8)	77.3% (17/22)

Table 6: CT features of Lymph nodes

CT features of LN	HL	NHL
Density		
Homogenous	100%(8/8)	90.9% (20/22)
Heterogeneous	0% (0/8)	9.1% (2/22)
Calcification	0%	4.5% (1/22)

Table 7: associated features detected by US and CT

Associated features	US HL	NHL	CT HL	NHL
Hydronephrosis	0%(0/8)	9.1%(2/22)	0%(0/8)	9.1%(2/22)
Ureteric displacement	Not seen	Not seen	0%(0/8)	9.1%(2/22)
Vascular				
Narrowing	0%(0/8)	0%(0/22)	0%(0/8)	0% (0/22)
Displacement	12.5%(1/8)	4.5%(1/22)	12.5%(1/8)	22.7%(5/22)
Bowels narrowing or obstruction	0%(0/8)	0% (0/22)	0%(0/8)	0% (0/22)

Discussion

Ultrasound had approximately the same diagnostic value as CT in assessment of the upper abdominal adenopathy which represent 25% in HL and 36.4% in NHL versus 37.5% in HL 45.5% for NHL respectively and adenopathy in splenic hilum 50% in HL and 45.5% in NHL for both, but not in the mid (including the mesenteric) which represent 27.3% in NHL versus 59% for NHL respectively and in lower abdominal(including the para-iliac) adenopathy which represent 4.5% in NHL versus 9.1% for NHL respectively. The lower sensitivity of ultrasound for detecting these lymph nodes regions is explained by the interference of mesenteric fat and abdominal gas, in addition to that the previously mentioned factors and low resolution of ultrasound making CT of superior valve in detection of smaller size lymph nodes (< 2 cm in our study) than that in ultrasound which represent 100% versus 66.6% respectively with P value of 0.0128. However ultrasound still of special value in thin patients and when guided needle biopsy is required. Because of technical advances, the use of multidetector CT has much improved the detection capability of para-aortic lymph nodes and this attributed to thin slices and high resolution multiplanar reconstruction properties in comparison to old CT scanner . For example, we report here a value of 83% compared with 65% in the study published by Castellino et al(10). A decade however, the value for the detection of splenic disease by CT is also improved (62.5% in HL and50% for NHL in our series). The

essential advantage of ultrasound is in the detection of splenic disease or splenic infiltrates that was measured as small as 3 mm is better than native CT that missed the infiltrates; this raised the mandatory requirement for intravenous contrast in delineation of focal lesions that were not seen in native study. Our data show an improved value of ultrasound for detecting splenic involvement and thereby confirm the results of a smaller Scandinavian study indicating a 54% for the detection of splenic disease (62.5% in HL and50% for NHL in our study), but the former study did not indicate other abdominal findings and did not include a comparison with CT(11). Splenic size is in most cases equally well estimated by CT and ultrasound. Ultrasound requires experience and special training; it does not entail radiation exposure and can be repeated at ease in case of unclear findings and from a practical point of view, patients with lymphoma first should undergo CT scan, and in case of negative findings then should be referred for ultrasound focusing on the spleen and liver (8). Calcified Lymph nodes seen in one patient with NHL by CT scan which was coarse, central within heterogeneous texture lymph node, the patient had received chemotherapy. Associated features seen more clearly by CT scan which include hydronephrosis, lateral Ureteric displacement and anterior vascular displacement of aorta, inferior vena cava and superior mesenteric artery, but no vascular occlusion could be noted after contrast administration.

Conclusion

These results indicate that ultrasound and computed tomography should be combined together, if possible, as ultrasound is the fast and not invasive method and has particular efficiency for detecting splenic involvement and splenic hilum adenopathy, whereas computed tomography is more accurate in detecting the involvement of mid para-aortic, mesenteric or iliac lymph nodes, ultrasound is more sensitive in detection of focal splenic lesion, finally we recommended CT abdomen with IV contrast as staging modality for each patient with lymphoma.

Authors contributions:

Khaleel Ibraheem Mohson: Auther make substantial contribution to conception and design, acquisition of data, analysis and interpretation of data.

Mohammad Alhilli: supervisior

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