Original Article

Diagnostic Efficiency of Ultrasound Imaging in Assessing the Extent of Lymphoma

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Abstract:

Summary: The article presents the results of evaluating the diagnostic efficiency of ultrasound (US) in determining the extent of pathological processes in lymphoma patients. The study included 48 patients with Hodgkin's and non-Hodgkin's lymphoma who were hospitalized at the National Scientific Oncology Center from 2021 to 2024. All participants underwent comprehensive ultrasound of the abdominal parenchymal organs and lymph nodes using B-mode and Doppler imaging. The obtained data indicate high sensitivity and specificity of US in detecting liver, spleen, and abdominal lymph node involvement. Characteristic echographic signs of lymphatic conglomerates and associated complications such as ascites and exudative pleuritis were noted. Given the availability and safety of the method, US can be considered a key tool for primary diagnosis and lymphoma monitoring in clinical practice.

The purpose of the study: To evaluate the diagnostic efficiency of ultrasound (US) in assessing the extent of the disease in lymphoma.

Methods: A retrospective analysis of 48 medical records of patients with confirmed diagnoses of Hodgkin's lymphoma (HL) and non-Hodgkin's malignant lymphoma (NHL) who were treated at the National Scientific Oncology Center between 2021 and 2024. All patients underwent comprehensive abdominal ultrasound, pleural ultrasound, and lymph node imaging with Doppler.

Results: Pathological changes in lymph nodes, spleen, liver, and pleura were detected in all patients. In 60% of cases, the lymph node conglomerates appeared echonegative, while 5% showed signs of aggressive progression (undefined capsules, liquefaction). Typical echographic signs of diffuse and focal organ changes were observed.

Keywords: Lymphoma; Ultrasound; Extent; Diagnosis; Imaging

Introduction

Lymphomas are malignant neoplasms of the lymphatic system that include Hodgkin lymphoma and non-Hodgkin lymphomas. Accurate staging is critical for treatment selection and prognosis. Computed tomography (CT) and positron emission tomography with CT (PET-CT) are established modalities for assessing disease extent; however, they are associated with high cost and exposure to ionizing radiation. Ultrasound (US) remains an accessible, noninvasive, radiation-free technique. The present study aims to evaluate the diagnostic value of US in determining the extent of lymphoma involvement. Lymphomas constitute a complex group of lymphoid tumors occurring across all age groups, and the probability of disease increases with age [1].

Lymphomas are primary neoplasms of lymphoid tissue, belong to tumors of the immune system, and typically arise from lymph nodes. They are divided into two major categories: Hodgkin disease (Hodgkin lymphoma) and malignant non-Hodgkin lymphomas. Among all lymphomas, Hodgkin disease accounts for 25–30% of cases [3].

Non-Hodgkin lymphomas frequently (15.0%–35.0%) present with involvement of lymph nodes, lungs, pleura, pericardium, and other thoracic organs. A variety of high-information imaging methods—CT and magnetic resonance imaging (MRI)—are used for their evaluation; however, owing to cost and limited availability, ultrasonography is often the most practical option.

Relevance

Lymphomas represent a heterogeneous group of malignant disorders of the lymphatic system that require precise diagnosis and staging to guide optimal management. Ultrasonography is a noninvasive, accessible, and highly informative imaging modality that can play a key role in assessing the extent of lymphoma involvement. This article examines the diagnostic performance of US compared with other imaging techniques (CT, MRI, PET-CT) in lymphoma, with particular attention to the potential of ultrasound elastography and Doppler assessment in the differential diagnosis of lymphadenopathy.

Materials and Methods

A retrospective analysis was conducted of 48 medical records of inpatients with diagnoses of Hodgkin malignant lymphoma (HL) and non-Hodgkin malignant lymphoma (NHL) treated at the National Research Oncology Center (JSC "NROC") during 2021–2024. Patient age ranged from 16 to 69 years. All patients underwent ultrasonography (US) of the liver, spleen, pancreas, kidneys, and adrenal glands with assessment of organ size and echotexture. The retroperitoneal space was carefully examined to identify enlarged lymph nodes, and the chest was assessed to verify exudative pleuritis (exudative pleural effusion).

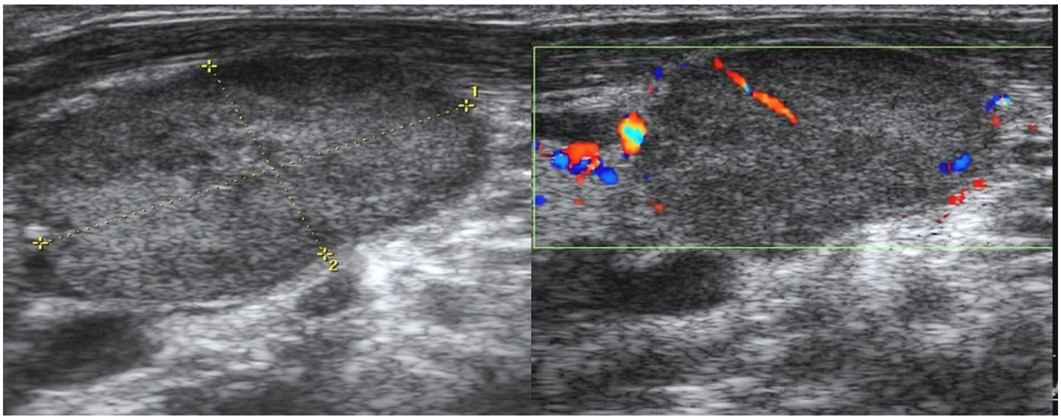
The following US criteria were used to characterize abdominal lymph node involvement: location, number, size, margins, and degree of echogenicity. Using Doppler ultrasonography, qualitative hemodynamic features were evaluated in affected lymph nodes, including flow pattern (central, peripheral, or mixed) and flow intensity, determined by the number of color Doppler signal foci (intense, low-intensity, or moderately intense).

Results

Hepatomegaly was identified in all patients (100%). Based on hepatic echotexture, diffuse changes were observed in 20 cases (41.6%), focal changes in 8 cases (16.8%), and combined diffuse–focal changes in 20 cases (41.6%). Diffuse changes were characterized on sonograms by homogeneous darkening of the organ with blurring of the hepatic architecture. Focal changes appeared as solitary and scattered hypoechoic foci without well-defined margins; hyperechoic foci were interpreted as fibrotic areas, and anechoic zones as areas of liquefaction. Combined diffuse–focal changes presented as alternating hyper- and hypoechoic foci against a background of diffusely reduced echogenicity.

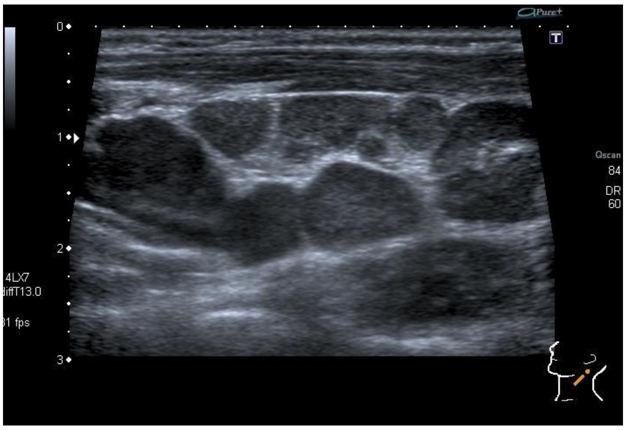
All patients also demonstrated enlargement of intra-abdominal lymph nodes (100%). Nodes were arranged in groups along major vessels (aorta, inferior vena cava, and iliac vessels), often forming "packs" or large conglomerates, and clustered at the hepatic, splenic, and renal hila. On sonograms, lymph nodes appeared as oval or round structures of reduced echogenicity. In 60% of cases they presented as echonegative (hypoechoic) with smooth, well-defined margins. The nodal capsule was visualized as an echogenic line, which was not always sharply delineated.

Figure 1. Hypoechoic heterogeneous structure of a lymph node.



In some patients (5%), lymph nodes were in very close apposition to one another. Large conglomerates exhibited heterogeneous echotexture. An echogenic capsule could be traced along the outer contour of the conglomerate and between individual nodes; in some large conglomerates the capsule was only partially visible or entirely absent. The conglomerate appeared as a tumor-like mass with a lobulated surface or with areas of liquefaction.

Figure 2. Conglomerate of lymph nodes in the submandibular region.



Differentiating individual nodes within such a conglomerate was not always feasible. Large conglomerates in which separate lymph nodes and their capsules cannot be clearly delineated typically indicate an aggressive disease course with spread to adjacent structures, consistent with published data [5].

Large conglomerates led to noticeable displacement and compression of abdominal vessels, the stomach, intestines, and urinary bladder. Edema of the limb was observed on the side of pronounced lymphadenopathy located in the iliac region and the lesser pelvis. In lymphomas, involvement of other organs and tissues—either primary or secondary—is not uncommon, particularly of the gastrointestinal tract, lungs and pleura, pericardium, kidneys, and mammary glands. Our observations corroborate reports that malignant lymphomas of the stomach and intestine account for 0.5% of all gastrointestinal malignancies [2,4].

In our data set, sonography most clearly enabled verification of intestinal tumor involvement. On echograms, intestinal lymphoma appeared as a heterogeneous mass of varying size with ill-defined margins, characterized by a hypoechoic periphery and an echogenic center.

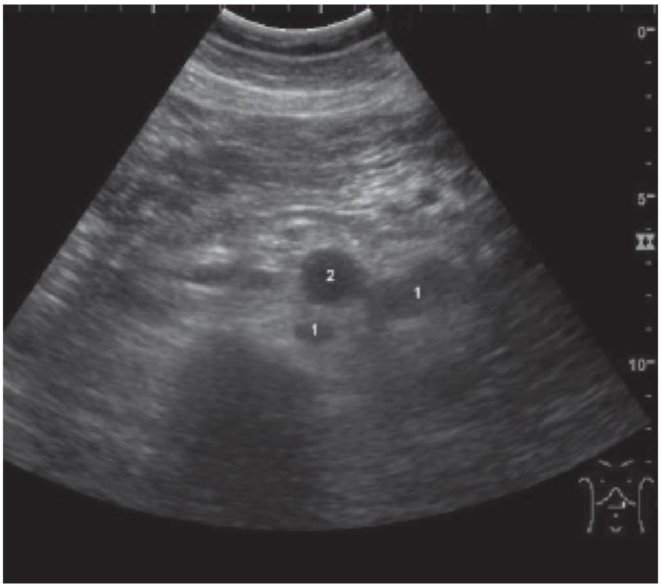
Ultrasound of the pancreas revealed no specific changes; only an age-related increase in echogenicity was noted. No specific renal parenchymal involvement was identified, although kidney size was increased. The parenchyma of solid organs was sonographically characterized by reduced echogenicity. In patients with renal involvement, enlarged lymph nodes were often recorded adjacent to the organs.

In both NHL and HL, the pleura may be involved in the tumor process. Primary pleural involvement is rare; however, with disease generalization or relapse, the probability increases [1,5]. In view of this, we performed 91 ultrasound examinations of the pleural cavities. A characteristic finding was fluid accumulation within the pleural spaces. Sonography reliably detects pleural effusion; the sonographic hallmark is an anechoic space surrounding the lung parenchyma, either bilaterally or unilaterally.

Occasionally, abdominal ultrasound revealed ascitic fluid, which appears on the monitor as an anechoic structure. We observed three patients with free intraperitoneal fluid.

Discussion

In summary, ultrasonography is a valuable diagnostic modality for HL and NHL. Its high informativeness supports recommending it as one of the principal methods for establishing involvement of abdominal lymph nodes and parenchymal organs in lymphoma. When lymphadenopathy is detected, a systematic assessment of the liver, spleen, and other organs is essential. Affected lymph nodes are most commonly situated along major vessels (para-aortic, paracaval, along the iliac vessels) and at organ hila (liver, spleen, kidneys). At stages III and IV, enlargement of abdominal and retroperitoneal lymph nodes was consistently observed.



Hepatic and splenic involvement is quite common in both NHL and HL. In diffuse lesions of the spleen and liver, overall echogenicity is reduced. The sonographic appearance of focal lesions in the liver and spleen is similar: foci with depleted internal echoes. Small foci are more often hypoechoic, whereas larger ones are heterogeneous with areas of liquefaction or calcification.

Ultrasonography also provides important diagnostic information for other extranodal sites, including the gastrointestinal tract, pleura, kidneys, and adrenal glands. Involvement of these organs is observed less frequently and more often in the setting of prolonged disease, biologic aggressiveness, or relapse. Detection by US of splenomegaly and enlarged abdominal lymph nodes may indicate the need to continue chemotherapy and, not infrequently, support consideration of additional local radiotherapy to the involved nodal regions.

Conclusion

This study demonstrated the high diagnostic effectiveness of ultrasonography (US) for assessing the extent of disease in lymphoma. US performed well in detecting involvement of lymph nodes, liver, spleen, and other parenchymal organs, as well as in identifying characteristic sonographic signs of complications such as ascites and exudative pleural effusion. The method shows high sensitivity and specificity, making it a valuable tool for initial diagnosis and monitoring of lymphomas—particularly where access to more expensive, resource-intensive modalities such as CT and MRI is limited.

In addition, the combined use of B-mode and Doppler ultrasonography substantially improves diagnostic accuracy, enabling not only assessment of nodal involvement but also evaluation of vascular invasion, which is critical for therapeutic decision-making. Given its accessibility, safety, and noninvasiveness, ultrasonography can be recommended for broad application in clinical practice, especially in resource-constrained settings.

Thus, ultrasound imaging is an important component of the diagnostic and follow-up toolkit for patients with lymphoma, facilitating earlier detection and timely intervention.

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Author Contributions: Orazbayeva D. was responsible for data collection. Nurbek Zh. was responsible for statistical data processing. Isa G. was responsible for the article concept.

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