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ULTRASOUND EXAMINATION OF LYMPHADENOPATHY IN THE B-MODE AND USING DOPPLEROGRAPHY OF THE VESSELS OF THE LYMPH NODES

Abstract: *The possibilities of ultrasound in the diagnosis of lymphadenopathy of various etiologies are examined. Ultrasound criteria in B-mode and using dopplerography of the vessels of the lymph nodes are characterized, which allow differentiating different types of lymphadenopathies, especially malignant and benign lesions of the lymph nodes.*

Key words: *B-mode, dopplerography, lymphadenopathy, vessels of the lymph nodes, ultrasound diagnostics*

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Introduction

An urgent and rather complex differential diagnostic problem for doctors of various specialties is lymphadenopathy (LAP) - a condition manifested by an increase in lymph nodes (LN) of any nature, while the term is exclusively generalizing. The term lymphadenopathy is used when discussing a differential diagnosis, to indicate cases when the diagnosis has not been established for various reasons [1]. In clinical practice, the term lymphadenopathy, as a rule, acts as a preliminary diagnosis, or the leading syndrome of diseases of various etiologies, but this pathology is not always given serious enough attention, despite the fact that it can often be a clinical manifestation of serious and even fatal nosology's [2, 3, 4]. The problem of differential diagnosis of lymphadenopathy is currently very relevant, but still far from resolved. The relevance of this research topic is due to the variety of nosological forms accompanied by lymphoproliferative syndrome, as well as the complexity of the differential diagnosis of benign and malignant lymphadenopathies [5, 6]. If the etiology of (LAP) is not clear, then doctors are often inclined to complex additional studies, and sometimes

unnecessary invasive procedures, such as excision biopsy [7].

One of the leading methods for detecting pathology of the lymph nodes is ultrasound (ultrasound). The accuracy of ultrasound in detecting lymph nodes is different, it largely depends on the location of the lymph nodes, the quality of the equipment, as well as the experience of the researcher. The specificity of ultrasound in the detection and differential diagnosis of lymph node lesions is from 30 to 100% [8].

Standard ultrasound examination in seroscale mode (or B-mode) on modern equipment remains the leading method of ultrasound examination of peripheral lymph nodes, it has high accuracy and sensitivity [9]. This is a fairly simple diagnostic method with low cost and without radiation, which is widely used for the diagnosis of pathology of superficial lymph nodes. With standard ultrasound, standard criteria are assessed: localization of LN; The size of the lymph nodes with the determination of the ratio of longitudinal and anteroposterior diameters (L/A-L/S) (Solbiati index);

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The number of increased LN; their shape; contours; the presence of differentiation of lymph nodes in the cortex and gate; echogenicity; echostructure of the lymph nodes; condition of surrounding organs and tissues [10].

The following parameters are considered ultrasonic criteria for the normal (unchanged) state of the lymph nodes: the shape is mainly oval, elongated; the borders are clear, the contours are even; L/A ratio (L/S) > 2.0; size along the long axis - not more than 1.5 cm; the presence of differentiation into the cortex and gate (normally, the hypoechoic part — the cortex, and the central part — the hyperechoic part — the gate) are located on the periphery of the LN [11, 8, 12].

Materials And Methods

Ultrasound is a valuable addition in the diagnosis of metastatic lesions LN [13, 12, 14]. So ultrasound is widely used in diagnostics, especially at an early stage of examination of patients with likely involvement of retroperitoneal lymph nodes in the tumor process [15]. The method allows you to evaluate both the localization and size of the lymph nodes, and their structure [16]. In case of neck tumors, the sensitivity of this method for detecting metastatic lymph nodes is quite large and ranges from 78% to 96% [17].

As signs of a possible metastatic lesion of the lymph nodes, consider the size, round shape of the node, heterogeneous echostructure, pronounced vascularization with the distribution of blood flow mainly along the periphery of the lymph node [18, 14]. Unfortunately, the absolute criterion has not yet been determined due to false positive and false negative aspects encountered in normal and pathological lymph nodes [19, 20].

Dopplerographic research has several varieties: color mapping, energy and spectral modes. By dopplerographic study of blood vessels, one can investigate the qualitative signs of blood vessels, that is, the geometry of the blood vessels (direction, course, whether there is tortuosity, patency, narrowing and stenosis, etc.). Quantitative traits can also be determined: max. and min., blood flow velocity, averaged blood flow velocity, pulsation index and resistance index. Qualitative signs are studied by color and energy doppler, while quantitative ones are studied by spectral mode. At the stage of formation of the color Doppler mapping technique, the determination of blood flow in the lymph nodes was not given much importance. Later, as criteria for metastatic lesion, it was proposed to note avascular zones corresponding to areas of necrosis and identification of peripheral vessels, in particular, the chaotic distribution of vessels inside the node [21].

In normal and reactive lymph nodes during ultrasound, blood flow, as a rule, does not register or visualize blood vessels in the gate area. Metastatically changed nodes usually exhibit peripheral or mixed

blood flow, and in lymphomas the blood flow is mainly mixed [22]. The presence of peripheral blood vessels is suspicious of malignant changes in the lymph node [23, 22]. Against this background, with small sizes, the metastatic lesion is often visualized as a round, hypoechoic, avascular zone. In this case, deformation or even amputation of blood vessels adjacent to the metastasis in the structure of the lymph node is possible. However, on echograms, increased blood flow, including along the periphery of the lymph node, can also be observed with non-tumor processes. For example, with severe inflammatory changes or tuberculosis, the nodes have a different vascular pattern [16].

This can imitate both benign and malignant conditions [22]. In addition, displacement of blood vessels and hypoechoic, avascular zones are often found in the lymph nodes with the development of cystic necrosis. The role of quantitative blood flow indicators for the differentiation of benign and malignant processes in the lymph nodes is controversial. Some studies have shown that arteries of metastatic nodes have higher resistance index (RI) and pulsation index (PI) than reactive ones [22]. According to G.P. Sinyukova et al. (2007) visualize blood flow in metastatically changed lymph nodes in color Doppler mapping in 93% of cases [24]. However, according to other sources, there is no significant difference in the values of RI and PI between benign and malignant nodes. Nevertheless, the features of the vascular pattern complement the ultrasound picture of the lymph nodes in the gray scale mode, increasing the accuracy of the method in the differentiation of metastatic and reactive changes [23]. At the same time, some authors believe that the criterion for malignancy is an increase in the resistance index of more than 0.9, while other researchers for metastatically affected lymph nodes give resistance index numbers of more than 0.73. However, what values are considered threshold at the moment are not clearly defined [25, 26].

Results And Discussion

In the modes of color and energy Doppler mapping, the nature of the blood flow in the lymph nodes is evaluated and five types of blood flow are distinguished by the nature of vascularization [27]: 1) avascular, 2) with vascularization at the periphery of the lymph node (peripheral type), 3) with vascularization inside the lymph node (central type), 4) with vascularization at the periphery and inside the lymph node (mixed type), 5) treelike blood flow inside the lymph node. According to the literature, in the presence of malignant changes in the lymph nodes, a mixed type of blood flow is most often recorded [5, 11, 8].

Normal and reactive lymph nodes tend to have a pronounced vasculature or look like avascular. However, metastatic lymph nodes usually have

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peripheral or mixed (central and peripheral) vascularization [28]. A. Gupta et al. (2011) found that 93.5% of reactive lymph nodes had a chylar (central) vasculature and 91.7% of metastatic lymph nodes had a peripheral vasculature [29]. The number and location of the vascular legs of the LN, as well as the distribution of the vessels, deserve close attention, since with benign LN usually one vascular pedicle that flows into the gates is revealed, while in the malignant process, multiple legs entering the cortex of the LN are revealed. In benign LN, the correct radial distribution of blood vessels is usually revealed, starting from the gate; in malignant nodes, the distribution of blood vessels is chaotic [30]. In tuberculosis and inflammatory processes in the tibial region, LN vessels can be displaced as a result of necrosis, creating a chaotic picture [31].

Conclusion

Depending on the histological structure of the primary tumor, a different pattern of blood flow in the lymph nodes was noted. So, for squamous cell carcinoma (tumors of the oral cavity, pharynx, larynx, tongue, etc.), the following symptoms are characteristic: the presence of blood flow along the periphery of the lymph node, and visualization of blood vessels in an amount of 2 or more. In case of papillary thyroid cancer, blood flow in the metastatic lymph nodes was characterized by diffuse distribution of blood vessels ("flaming" lymph nodes).

Melanoma metastases were characterized by reduced echogenicity and local increased blood flow in one or another part of the lymph node [32]. The use of Doppler mapping makes it possible to assess the degree of vascularization of the LN, but is not very effective for differential diagnosis in determining the nature of the lesion of the LN [13].

Thus, with ultrasound, it is necessary to clarify the number and location of the changed lymph nodes. It is also necessary to find out the following lymph node data: size, shape, border, contour, structure, echogenicity and vascularization. It is necessary to evaluate the relationship of the lymph nodes with adjacent organs and tissues. Ultrasound signs of altered lymph nodes must be considered comprehensively, but the final conclusion cannot serve as a criterion for the benign or malignant process of the lymph nodes. At the final diagnosis, it is necessary to take into account the clinical symptoms of the disease, as well as data from other diagnostic methods. If there is a suspicion of a malignant process in the lymph nodes, a fine-needle aspiration biopsy of the node should be performed under the supervision of an ultrasound scan and, if necessary, an excision biopsy [16]. The final diagnosis of the revealed pathology of the lymph nodes should be based on a comprehensive analysis of clinical data and the results of instrumental and laboratory studies. At the same time, ultrasound is a highly informative and non-invasive method that plays an important role in the differential diagnosis of lymphadenopathy.

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