

Application of the Ultrasound Research Method in Otorhinolaryngology and Diseases of the Head and Neck Organs

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ABSTRACT: Despite the fact that otorhinolaryngologists have been looking for a solution to the problem of chronic tonsillitis for a very long time, it remains unresolved. The prevalence of chronic tonsillitis is not decreasing, but rather increasing. Diseases of the tonsils are characteristic primarily of the child and adult working population. Chronic tonsillitis attracts attention not only as an independent disease, but also as a cause of frequent local and especially systemic complications, which number more than 100. All these facts indicate the unresolved and urgent problem of chronic disease of the palatine tonsils.

In the diagnosis of diseases of the neck organs, one of the most common methods is ultrasound. It has a number of significant advantages over other methods, such as high sensitivity and specificity, the ability to detect minor changes in organs, non-invasiveness of the study, painlessness, availability, and absence of ionizing radiation.

Ultrasound diagnostics in the neck area is widely used and actively studied in acute inflammatory-purulent pathology (paratonsillar abscesses, phlegmon), in pathology of the larynx and trachea, salivary and thyroid glands, as well as in the metastasis of malignant neoplasms to the lymph nodes.

There are several methods for diagnosing lymph nodes, such as: puncture and excisional biopsy, lymphography, scintigraphy, thermography and ultrasound echography. Despite such a variety of diagnostic methods, ultrasound is the method of choice for imaging cervical lymph nodes.

One of the most modern methods in ultrasound diagnostics is elastography. This method is most informative in cases where changes in tissues are small in size and cannot be detected using standard ultrasound modes.

KEYWORDS: ultrasound, ultrasound, elastography, chronic tonsillitis, palatine tonsils, lymph nodes

INTRODUCTION

Chronic tonsillitis (CT) is one of the most common diseases of the pharynx. Its occurrence, according to various authors, ranges from 5 to 63%. In the structure of ENT pathology, CT occupies one of the leading places and is 13-35%.

It is generally accepted that the diagnosis of CT is based on an assessment of the clinical picture of the disease: complaints, anamnesis, and examination of the pharynx. However, none of the signs of an inflammatory disease of the pharynx is pathogenic for chemotherapy. Various objective methods for the diagnosis of chronic tonsillitis are proposed, but each of them has drawbacks that, in the end, do not make it possible to apply it in the daily practice of an otorhinolaryngologist. In this regard, it is necessary to search for objective criteria for the differential diagnosis of CT.

ULTRASONIC DIAGNOSTIC METHOD

One of the highly informative methods of non-invasive intravital diagnosis of various pathological conditions is ultrasound examination (US), which has a number of advantages:

- high sensitivity and specificity;
- detection of even minor changes in tissues and organs;
- non-invasive research;
- painlessness;
- availability in most health facilities;
- safety due to the absence of ionizing radiation.

The ultrasound research method is widely used to diagnose various pathologies in the neck area.

So, in otorhinolaryngology, ultrasound has found very wide application as a diagnosis of paratonsillar abscess. Knowledge of the sonographic manifestation of the normal structure of the amygdala and various infections of the

peritonsillar tissue can help the otorhinolaryngologist make a correct diagnosis. Percutaneous ultrasound is an ideal diagnostic tool for evaluating tonsils when a paratonsillar abscess is suspected, and can reliably differentiate paratonsillar abscess from other tonsil pathologies. This method is fast, non-invasive, painless, cost effective, and readily available. In addition, it does not possess ionizing radiation and does not require sedation. In many hospitals, percutaneous ultrasound is an integral part of the algorithm for assessing paratonsillar abscess and plays an important role in identifying patients who do not require surgery.

Sonographically, the amygdala is seen as a clearly visualized oval structure of soft tissues with a thin capsule. It is hypoechoic in relation to the adjacent submandibular gland. The parenchyma of the amygdala has a transverse character with alternating linear hyperechoic and hypoechoic stripes. The striped appearance is due to tonsillar crypts. Dense echogenic mobile foci are often visible medially th edge of the tonsil, and they are pockets of air in the pharynx.

According to various studies, ultrasound signs of peritonsillar tissue are as follows:

1. Peritonsillar cellulitis: It is an inflammatory tissue reaction between the tonsil capsule (TM) and the pharyngeal muscles, which is caused by infection, but not associated with accumulation of pus. An alternative term for cellulite is phlegmon. Peritonsillar cellulitis is considered an intermediate condition between uncomplicated tonsillitis and the formed peritonsillar abscess. The sonographic appearance may vary depending on the degree of inflammation. Typically, the tonsils are enlarged with heterogeneous parenchyma and are limited by the surrounding soft tissue edema, which is visualized as increased echogenicity. The parenchyma of the amygdala may show small, indistinct, internal hypoechoic areas that may represent developing foci of edema, hemorrhage, necrosis or pus. Most hypoechoic areas are less than 1 to 1.5 cm in size, and a well-defined abscess is undetectable.
2. Intratonsillar abscess: less common and visualized as a small intratonsillar hypoechoic pocket. This term can be used to describe a well-defined accumulation of fluid in the tonsillar parenchyma.
3. Peritonsillar abscess: is a collection of pus located between the tonsil capsule and the pharyngeal muscles. Peritonsillar abscess is visualized as a well-defined hypoechoic or anechoic fluid-filled cavity with jagged edges, usually along the posterolateral margin of the amygdala.
4. Parapharyngeal abscess of phlegmon is a deep infection of the neck in the parapharyngeal space. It can develop at any age, but is most commonly seen in children and adolescents. Symptoms are initially similar to strep throat or uncomplicated tonsillitis and may progress as inflammation and infection spread. In a patient with a parapharyngeal abscess or phlegmon, the tonsil itself will be identified separately from the abscess, which will usually be in the back of the tonsil and will not be in contact with it. Ultrasound examination is used for acute inflammatory-purulent pathology of the soft tissues of the neck, and the areas of application of ultrasound for visualization of the upper respiratory tract are actively explored:
 - Ultrasound makes it possible to determine in advance the diameter of the lumen of the larynx and trachea for accurate selection of the endotracheal tube;
 - it is possible to use ultrasound as a control of the endotracheal tube entering the trachea directly during the manipulation;
 - to diagnose obstructive sleep apnea during sleep;
 - Provides an opportunity to pre-analyze the area where the tracheostomy is expected to be performed in order to prepare for an emergency;
 - Ultrasound can improve the results of a percutaneous dilated tracheostomy by determining the correct spacing between the tracheal rings (avoiding entering the blood vessels and also determining the distance from the skin to the tracheal wall).

Studies are being conducted on the use of ultrasound to determine the size of BM in the preoperative diagnosis of children with obstructive sleep apnea to predict the results of surgical treatment.

ULTRASONIC DIAGNOSTIC TECHNIQUES

In ultrasound diagnostics, in addition to the widely used traditional imaging and Doppler imaging techniques, the elastography method is being actively studied.

Compression elastography is an ultrasound examination of organs and tissues, which allows you to determine and visualize various degrees of elasticity and stiffness of individual sections of the studied area.

Elastography is most informative in cases where tissue changes are small in size and cannot be detected using standard ultrasound modes. Thus, the elastography method allows obtaining additional data during ultrasound scanning of tissue

(the degree of tissue elasticity, homogeneity of the organ structure), thereby increasing the diagnostic significance of the study.

Compression elastography is also actively used in the pathology of organs located in the neck.

This method is widely used for the differential diagnosis of thyroid nodules, the diagnostic possibilities of detecting tumors of the salivary glands are being actively studied, and is also used to detect metastatic lesions of the lymph nodes (LN).

About 300 of the 800 lymph nodes in the human body are located in the head and neck region.

Studies have revealed certain patterns of lymph outflow in the head and neck area.

Regional lymph nodes are characterized by a reaction to infectious and autoimmune processes occurring in NM in chronic tonsillitis, and determining the state of the lymph nodes in combination with other (anamnestic, pharyngoscopic) signs of a chronic infectious and inflammatory process in NM is important in the diagnosis of chronic tonsillitis. However, the detection and adequate assessment of co standing of lymph nodes by palpation is not possible in all cases. The sensitivity and specificity of palpation of lymph nodes, according to the literature, reaches 50-88%, and it is almost impossible to determine the state of deep lymph nodes during physical examination.

Currently, one of the most informative methods for assessing the state of the lymph nodes is ultrasound examination (US), the accuracy of which is more than twice the results of palpation (73 and 32%, respectively).

The echographic picture of the lymph nodes is normal. Ultrasound examination of the neck region in 68% of cases reveals one or two lymph nodes.

With echography, the normal size of the lymph nodes did not exceed 0.5-1.5 cm. With age, the size of the lymph nodes increases. This is due to increased fatty infiltration of the lymph nodes.

Unchanged LN, as a rule, have an oblong shape, while in pathological processes, lymph nodes are usually large in size, normally have a hypoechoic rim, a hyperechoic core, a homogeneous echo structure, the absence of vessels or single vessels in the gate area, low values of the peripheral resistance indices.

Lymph nodes have fuzzy boundaries and merge with the surrounding tissue. The contour of clinically healthy lymph nodes is often even.

Usually two main components of the node are clearly distinguishable - the cortical and medullary layers, the ratio and echogenicity of which depend on many factors, such as age, localization of the node, anamnesis, etc. The lymph node cortex, which is not stimulated by antigens, is thin and practically does not differentiate on echograms.

The medullary layer of the lymph node on echograms is often hyperechoic, as it contains blood vessels, fat, cords of lymphatic tissue and cerebral sinuses, that is, a large number of surfaces that reflect ultrasound.

Visualization of the lymph node hilum is a normal feature of most nodes.

In a normal lymph node, vascularization should be present only at the hilum, or the node should be avascular.

Echographic picture with lymphadenitis. When studying the echosemiotics of cervical lymphadenitis, the greatest importance is attached to the longitudinal (P) and anteroposterior (PZ) size of the lymph node, its shape, general echogenicity, homogeneity, the area of the cortical sinus and hilus, contours, the state of the perinodular zone. The "roundness index" (P / PZ) and the volume of the lymph node are determined.

With inflammation of the LN increases, the cortical layer expands, its echogenicity decreases (up to anechogenicity), the node becomes more accessible for ultrasound imaging, acquires a spherical shape.

In acute serous inflammation, the lymph node is determined to be enlarged, with smooth and clear contours, reduced echogenicity, while maintaining the differentiation of the structure; there is a marked increase in the vascular pattern in the projection of the gate.

In the stage of periadenitis, the shape of the lymph node is revealed to be round, the contours are indistinct, around the hypoechoic "rim" of the infiltrate associated with the appearance of perifocal edema. Echogenicity remains reduced, the internal structure is visualized indistinct or absent.

Echographic picture with metastatic lesions of the lymph nodes. The main echographic criteria for metastatic lesions of lymph nodes: rounded (in which the ratio of the long and short axis approaches 1.0) and irregular shape, heterogeneous structure, reduced echogenicity, diffuse type of blood supply, uneven distribution of vessels in the peripheral zone, heterogeneity of the size of the lymph nodes, abnormal vascularization of the lymph node capsule with Doppler

ultrasound, necrosis (late sign) and calcification, sharp borders of the lymph node, lack of visualization of the hilum, edema of surrounding tissues.

Due to diffuse replacement of lymphoid tissue by tumor, hyperechoic central part is completely absent or sharply thinned. For the same reason, it is impossible to differentiate the cortical substance and sinus in the affected nodes.

The blood supply to the lymph nodes in metastatic lesions deserves special attention. In such nodes, vascularization increases, acquires a diffuse type and has an atypical pattern. In this case, the blood flow on the ultrasound image is recorded in the form of fragments of chaotically directed vessels. Vessels are unevenly distributed, may tend to increase their number in the peripheral regions. The blood flow in the nodes changes so much that deformation of even the vessels adjacent to the node can be observed. For a more detailed study of blood flow, the Doppler ultrasound method is used, which even measures the blood flow velocity.

Despite the fact that the structure of the LN is most often heterogeneous, in most cases, the echogenicity is reduced. The node acquires heterogeneity due to inclusions of increased echogenicity (finely dispersed, linear, lamellar, etc.).

Late sign metastasis is LN necrosis. With the disintegration of lymphoid tissue, anechoic zones of various sizes, shapes and localization are observed.

Individual echographic criteria for metastatic lesions of the LN can vary significantly depending on the histological structure of the tumor itself.

Sharp boundaries of the LN acquires due to a decrease in the amount of adipose tissue and, consequently, an increase in acoustic conductivity in comparison with the surrounding tissues.

According to different authors, the diagnostic efficiency of ultrasound in assessing lymphogenous metastasis of head and neck tumors is:

- sensitivity - 71-96.8%;
- specificity - 74.4-100%;
- accuracy - 77-92.3%.

Palpation of the lymph nodes has a rather low diagnostic sensitivity when assessing the volume of the lymph node, mobility and density. This is especially true of the lymph nodes of the head and neck, which are small in size. Modern devices with transducers with a frequency of 7.5 MHz and more can detect non-palpable altered lymph nodes in the neck.

Ultrasound is the method of choice for imaging cervical lymph nodes.

CONCLUSION

Due to the fact that the sensitivity of ultrasound in the diagnosis of lymph nodes in the neck was more than 90%, its use in the B-mode in determining the presence of pathological changes, differential diagnosis of inflammatory and tumor diseases of the head and neck is reasonable and promising.

In the diagnosis of diseases of the neck organs, one of the most common methods is ultrasound. It has a number of significant advantages over other methods.

Ultrasound diagnostics in the neck area is widely used and actively studied in acute inflammatory-purulent pathology (paratonsillar abscesses, phlegmon), in pathology of the larynx and trachea, salivary and thyroid glands, as well as in the metastasis of malignant neoplasms to the lymph nodes.

All these factors create prerequisites for studying the state of the tissue of NM and regional lymph nodes in various forms of chronic tonsillitis by ultrasound.

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