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Lymph node fine needle cytology in the diagnosis of infectious diseases and instrumental guides: ultrasound and computed tomography

Citologia per ago sottile dei linfonodi nella diagnosi delle malattie infettive con guida strumentale: ecografia e tomografia computerizzata

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Imaging techniques, such as ultrasound imaging (US), computed tomography (CT), positron emission tomography-CT (PET-CT) or PET-magnetic resonance imaging (MRI), are highly accurate procedure in the lymph node enlargement detection, but none of them has the same sensitivity in the biological definition and the cause of enlargement.
In particular, in recent years, enhanced PET-CT has gained an increasing relevant role in the evaluation of a lymphadenomegalies mainly for the determination of lymph node (N) status. These technologies have a variable specificity and a rate of false positive may occur. Indeed, infectious, autoimmune and neoplastic diseases may lead to lymph node enlargement. Therefore, in cancer staging and in different clinical contexts a direct evaluation of the detected lymph-nodes is requested [1].
Fine Needle Cytology (FNC) combined to different procedures of imaging guide is widely used to obtain cells and tissues fragments from deep located masses from different regions and organs including lymph nodes. The management of these cases depends on the cytological diagnosis, with the identification of the disease that causes the increase in size of lymph nodes and the differentiation between a benign or malignant process [2, 3]. Imaging provide useful information in assessing lymph nodal status, both in identifying a possible unrecognized lymphadenopathy and in defining a set of parameters (size, morphology and vascularization) which contribute in characterizing a suspicious lymph node swelling.
Therefore, FNC of superficial and deep lymphoadenopathies conveniently fit with ultrasound and CT scan, and has been used to diagnose almost any kind of tumors in different organs [4-27].
Diagnoses, clinical decisions and therapies are often established in different organs such as thyroid, breast, lung or haematological diseases [16-21]. In the presence of infectious disease of unknown aetiology, cytological evaluation of enlarged lymph-nodes (US or CT guided) contributes to the definition of the nature of the process, mainly when biomarkers are inconclusive, allowing the application of specific therapeutic procedures.
Even in the presence of clinically palpable lymph nodes, FNC benefits the US guide in order to reach the most significant areas of the lymph node at the imaging avoiding, for example, necrotic - colliquative areas, or hilus, in order to obtain adequate samples and preserving the vascular structures along the needle track to avoid bleedings or other complications. US-

guided FNC offers other advantages too, such as the possibility to follow the tip of the needle in real time (Figure 1), and more in general, low costs, absence of ionising radiations and not least the portability of the equipment at the patient's bed. FNC employs thin needles of small sizes (from 22 to 27G), as opposed to cutting needles used for histological samples, are borderless or with sharp corners [28, 29]. US allows, in superficial enlarged lymph nodes, the evaluation of their internal architecture including the hilus and the parenchymal echo-structure. Some authors have shown that power-Doppler integrated US methods, in assessing the status of enlarged lymph nodes, allow to determine which of these are the most suspicious, leading to a more accurate target selection. Power-Doppler is less dependent on ultrasound beam direction, speed of blood flow and carries a higher sensitivity.

A recent study compared 2 populations of patients suffering from lymphoma and submitted to FNC [30]. In one of the two groups, the power-Doppler as lymph node guide for FNC was used being the colour-Doppler the control. Data analysis showed a sensitivity of 100% with no false negatives in the first group vs. a sensitivity of 76% in the control group [30].

Beyond the sonographical approach for deep lymph-nodal stations, other widely diffused techniques are endoscopic ultrasound FNC (EUS) (Figure 2) and trans-bronchial ultrasound FNC (EBUS) that have completely changed the approach to mediastinal and abdominal lymph node approach. In different series these procedures have shown highest values of sensitivity and specificity.

An example can be provided with endoscopic ultrasound fine needle aspiration on lymphoadenopathies of posterior mediastinum; according to some authors, this method shows a sensitivity of 96%, specificity of 89% and efficiency of 95% [31].

As for the technical procedure choice, in the United States of America, CT is generally considered to be the method of choice to perform biopsies of deep masses, even for lesions smaller than 2-3 cm in diameter whereas US is usually reserved to superficial tissues. However, in Asia and Europe, US is preferred to CT for deep located targets according to the size of biopting mass [32]. For deep located lymph nodes in the abdominal and pelvic stations, the US role is more limited, especially in obese patients, because the attenuation of ultrasonic beam by the superficial soft tissue makes it difficult to display deep lesions. In addition, the ultrasound guide has a limited application in patients with dressings or surgical wound drainage. In these cases an important contribution is made by the use of CT and MRI. The CT also combines the advantages of high spatial resolution (common to both methods) the possibility of an interventional approach to a dubious injury.

Moreover, CT allows an exact three-dimensional localization of the target lymph nodes, even in patients with surgical wounds, bandages and cutaneous anastomosis. In addition, the anatomic detail given by CT, enables precise planning of access, different angles of approach and potential paths to needle percutaneous biopsy with an exact location of the latter within the lesion to be studied. As for the precautions to be taken before performing US or CT

Figure 1 - Ultrasound guided FNC on a lymph node: the needle is addressed in center of a hypoechoic roundish lymph node. Note the smaller reactive lymph node on the left.

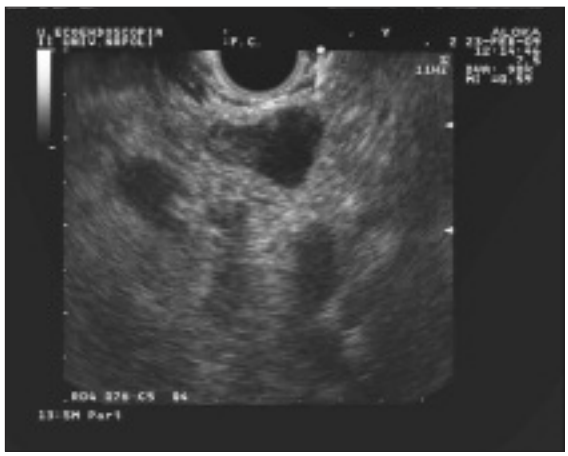

Figure 2 - Hypoechoic lymph node as appears at the endoscopic ultrasound FNC (EUS): A guide will address a thin needle within the lymph node.

guided FNC, the only required routine laboratory data before the procedure are the prothrombin time (PT), partial thromboplastin time (PTT) and platelet count.
CT scan is also used to determine the patient's position (decubitus, supine or prone) depending on the location of the target tissue. The path of the needle is chosen to minimize the chance of crossing for vascular structures, intestinal loops or even non-pathological tissue that could invalidate the diagnosis.
When pre-biopsy planning is finished, it is important to invite the patient to keep a constant respiratory phase in order to avoid complications and to keep the landmarks identified by CT during the preparation phase. The FNC CT-guided becomes necessary when the lymph nodal tissue is hardly accessible and especially when its size is <1 cm (10).
In a prospective study on 1000 CT-guided biopsies, a sensitivity of 91.8% and a specificity of 98.9% was obtained, with a positive predictive value of 99.7%, an extremely low percentage of complications 1% [4]. As for the US-guided FNC of deep located lymph nodes in the abdomen, pelvis and retroperitoneum, a recent study obtained adequate material in 88% without false negatives [28]. In conclusion, imaging techniques have become an indispensable support for FNC enhancing its diagnostic performances.

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Keywords: lymph node, fine needle cytology, ultrasound, computed tomography, magnetic resonance.

SUMMARY

Imaging techniques, such as ultrasound imaging (US), computed tomography (CT), positron emission tomography-CT (PET-CT) or PET-magnetic resonance imaging (MRI), are highly accurate procedure in the lymph node enlargement detection, but none of them has the same sensitivity in the biological definition and in the cause of enlargement identification. Therefore, a direct evaluation of corresponding lymph nodes is necessary in much of the cases and Fine Needle Cytology (FNC) is one of the most frequently used technique for this purpose. The same imaging procedures are often used to perform targeted biopsies including FNC. This study discusses procedures, indications, advantages and limitations of imaging techniques as a support to FNC.

RIASSUNTO

Le tecniche di imaging quali ecografia, (US), tomografia computerizzata (CT), tomografia ad emissione di positroni (PET-CT) e la risonanza magnetica (RM) sono procedure diagnostiche molto accurate nella identificazione di linfonodi ingranditi ma non sono altrettanto specifiche nell'identificazione delle corrispondenti patologie. Pertanto, l'esame diretto di linfonodi ingranditi è spesso necessario e la citologia per ago sottile (FNC) è frequentemente utilizzata per questa finalità. Le stesse tecniche di imaging sono spesso utilizzate per eseguire FNC di linfonodi superficiali e profondi. In questo studio sono descritte e discusse procedure, indicazioni, vantaggi e limiti di ciascuna metodica utilizzata per FNC-guidati.

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