MÆDICA - a Journal of Clinical Medicine

CASE REPORT

MAEDICA – a Journal of Clinical Medicine
2023; 18(1): 148-152
https://doi.org/10.26574/maedica.2023.18.4.148

Differential Diagnosis of Cervical Lymph Nodes with Ultrasound and Virtual Touch Imaging Quantification: a Report of Three Cases

Lentiona BASIARI[a], Maria MICHALI[a], Eleni LITSOU[a], Georgios PSYCHOGIOS[a]

[a]Department of Otorhinolaryngology-Head and Neck Surgery, University General Hospital of Ioannina, Ioannina, Greece

ABSTRACT

Cervical lymphadenopathy is a common clinical presentation, and its differential diagnosis is challenging. In this article we present three cases with enlarged cervical lymph nodes evaluated with combination of ultrasound (US) and virtual touch imaging quantification (VTIQ) performed by the head and neck surgeon G.P. with a 10-year experience in ultrasound elastography (USE). In the first two cases, US and VTIQ evaluation showed predominance of areas with increased stiffness and higher share wave velocities compared with those in the third case. Malignancy was suspected in the first and second cases. The histology report revealed metastatic squamous cell carcinoma in the first two cases and chronic non-specific lymphadenopathy in the third case. The development of VTIQ share wave elastography has improved the diagnostic accuracy of ultrasonography and can guide clinical decision when dealing with cervical lymphadenopathy.

Keywords: cervical, lymph node, ultrasonography, elastography, share wave.

INTRODUCTION

Lymph nodes of the head and neck region account for 40% of the lymph nodes in the human body (1). A variety of conditions, including bacterial or viral infections, inflammation, immune related disorders, and malignancy can cause enlargement of cervical lymph nodes (2). Imaging tools like B-mode ultrasound and Doppler sonography are the first choice in the evaluation of enlarged cervical lymph nodes in everyday clinical practice. They are very helpful in determining the location of abnormal lymph nodes as well as their number, size, shape, border, hilum, extranodal extension and intranodal vascular distribution (3).

Address for correspondence:
Lentiona Basiari, PhD, Academic Fellow
Department of Otorhinolaryngology-Head and Neck Surgery, University Hospital of Ioannina, Ioannina, Greece
Postal address: Stavros Niarchos Avenue, 45500, Ioannina, Greece
Tel.: 00306973184508; email: ledi_poli@hotmail.com

Article received on the 30th of January 2023 and accepted for publication on the 15th of March 2023

Share wave elastography (SWE) is a more recently developed technique that measures tissue stiffness under the application of an acoustic radiation force impulse (ARFI) that generates share waves that travel faster in harder tissues. This technique presents higher reproducibility and lower operator dependency because it uses automated tissue compression (4). Virtual Touch Imaging Quantification (VTIQ) is based on ARFI technology and uses share waves to measure tissue elasticity and stiffness quantitatively and qualitatively. The VTIQ image is a two-dimensional color-coded map presented as an overlay in a B-mode ultrasound image. It displays share wave velocities within multiple regions of interest (ROI) selected by the user (5, 6).

In this article, we aim to present the utility of VTIQ in the differential diagnoses of benign and malignant cervical lymph nodes through the presentation of three clinical cases. Siemens Acuson Redwood Ultrasound System with a linear 10 MHz transducer was used. ❑

CASE REPORT

Case 1

A 70-year-old woman presented with odynophagia and an enlarged left cervical mass. Endoscopic evaluation revealed a lesion of the left part of epiglottis and aryepiglottic fold. Ultrasound (US) was performed by the head and neck surgeon G.P. B-mode ultrasound showed an enlarged lymph node localized in the left level IIA with round shape (short axis /long axis ratio of 0.79), absence of hilum and heterogeneous hypoechoic structure (Figure 1A). Doppler ultrasonography showed a peripheral perfusion pattern (Fig. 1B). Virtual touch imaging quantification elastography showed areas with high share wave velocity (SWV) inside the lymph node with a maximum of 10 m/s indicating increased stiffness (Figure 1C). Core needle biopsy (CNB) of the lymph node was performed under US guidance and the result was metastatic squamous cell carcinoma. Biopsy of the epiglottis lesion showed squamous cell carcinoma.

Case 2

A 75-year-old male with HPV+ oropharyngeal squamous cell carcinoma presented with an enlarged right cervical lymph node. B-mode ultrasonography showed a round shape (S/L ratio 0.89) heterogeneous lymph node, with the presence of intralesional hypoechoic areas indicating necrosis with regular border and diffuse pattern of perfusion (Figure 2A, 2B). Virtual touch imaging quantification elastography showed intralesional maximum SWV 10 m/s and minimum SWV 2.31 m/s with predominance of areas with increased SWV (Figure 2C). We also observed the presence of cystic necrosis inside the lesion, where share wave velocity cannot be measured. Preoperative evaluation with B-mode, Doppler and VTIQ elastography was also performed in this patient in ipsilateral and contralateral neck to detect any additional suspicious lymph nodes. The patient underwent right ipsilateral modified radical neck dissection and histology revealed one metastatic lymph node from 20 resected.

FIGURE 1. (A) A 70-year-old woman with SCC of hyperglottic larynx and lymph node metastases; B-mode ultrasonography image showing an enlarged lymph node localized in the left level IIa with round shape. Short and long axis diameters are measured. ACI: internal carotid artery. (B) Doppler ultrasonography of the same lymph node showing peripheral perfusion pattern. (C) VTIQ elastography measurements. Region 1 indicates the measurement of share wave velocity outside the lesion, and regions 2, 3, 4 intralesional measurements of SWV. Low SWV is marked with blue color and maximum SWV with red color.

FIGURE 2. (A) A 75-year-old male patient with HPV+ oropharyngeal squamous cell carcinoma and an enlarged left cervical lymph node. B-mode ultrasonography. (B) Doppler image from the same patient indicating a diffuse pattern. (C) VTIQ elastography image showing predominance of stiff areas with SWV> 6 m/s (red areas) and the presence of cystic necrosis.

Case 3

A 20-year-old man presented with a history of an enlarged right submandibular lymph node during the last three months. Sonographic evaluation was performed more than once during this period of time in order to detect any morphological changes of the lymph node. B-mode and Doppler ultrasound showed an oval shape lymph node with S/L ratio 0.4, regular border and the presence of hilum with hilar perfusion (Figure 3A, 3B). Virtual touch imaging quantification elastography showed maximum intralesional SWV 5.31 m/s and minimum intralesional SWV 2.13 m/s with a predominance of areas with low SWV values (Figure 3C). There were no significant changes between sonographic evaluations during the last three months. Fine needle aspiration (FNA) was not diagnostic. We decided to perform an open biopsy in order to make a diagnosis. Biopsy showed a chronic non-specific lymphadenopathy without malignancy with fibrous areas. ❑

DISCUSSION

A differential diagnosis between benign and malignant cervical lymph nodes is a challenge for the head and neck clinician. High-resolution US and color Doppler US are the first imaging techniques used to assess and evaluate pathologically enlarged lymph nodes of the head and neck region. Many studies have described gray scale and Doppler sonographic criteria such as shape, margins, presence of a hilar sign, homogeneity and perfusion pattern that are used to distinguish between benign and malignant lymph nodes (7). Benign reactive lymph nodes are characterized by an oval shape (short axis/long axis S/L<0.5), a homogenous structure, well defined margins, a hyperechoic hilum, and a hilar vascular perfusion pattern. On the other hand, the presence of hypoechoic and heterogeneous texture, the absence of a hilar sign, the round shape (S/L>0.5), the ill-defined margins and the peripheral, diffuse or mixed pattern of vascular

FIGURE 3. (A) A 20-year-old male with a chronic lymphadenopathy of the right submandibular area; B-mode ultrasound indicating an oval shape lymph node with a hilar sign. (B) Doppler image of the same lymph node showing hilar perfusion pattern. (C) VTIQ elastography from the same lymph node and SWV measurements showing a soft tissue with the presence of some areas with moderate stiffness.

perfusion are considered signs of malignancy (8, 9).

Despite all these, no absolute criteria have been defined and sonographic differentiation remains a challenge due to the false positive and false negative aspects encountered in normal and pathological lymph nodes (10). The development of elastography, especially VTIQ, in the last years added supplementary data for the lymph node characterization and improved the diagnostic accuracy of ultrasonography in cervical lymphadenopathy (9). According to Azizi *et al*, the positive and negative predictive values can reach 52.44% and 94.15%, respectively depending on the cutoff of the maximum share wave velocity within a lymph node (5). In 2017, Suh *et al* conducted a meta-analysis of eight studies and concluded that malignant lymph nodes were stiffer than benign ones and share wave velocity had a sensitivity of 81% and a specificity of 85% for correctly diagnosing malignant lymph nodes (10). A recently published study by Rüger *et al* showed that multimodal ultrasonography with VTIQ could reveal significant differences between benign and malignant cervical lymph nodes; according to their study, there is a high probability of malignancy in the presence of intralesional areas with SWV ≤ 3.5 m/s of 0-29% and 30%-69%; also, the authors showed that there was no benign lymph node with an intralesional area with SWV ≥ 6 m/s of 70%-100% (6).

In the first two cases, B-mode and Doppler sonographic characteristics raised suspicion of a malignant lymph node with a round shape, well defined margins, a hypoechoic heterogeneous structure with absence of hilar sign and a peripheral pattern of vascularization. With the addition of VTIQ elastography, which showed the presence of stiff tissue with predominance of intralesional areas with high SWV, we were more certain that we were dealing with a metastatic lymph node in the first two cases. In case 1, we immediately performed a US guided CNB and scheduled the patient for a biopsy from the primary lesion under general anesthesia, and in case 2 the patient was scheduled for a modified radical neck dissection in addition with resection of the primary tumor. In the first case, histology of the lymph node confirmed our initial diagnosis and biopsy of the primary tumor showed a squamous cell carcinoma of the larynx. In the second case, histopathology confirmed the presence of metastasis only in the suspicious lymph node. Through this case we can see the impact of multimodal US, and especially VTIQ elastography, in the preoperative evaluation of a patient with head and neck squamous cell carcinoma and in preoperative decision making. In the third case, clinical history and repeated US examination of the patient did not raise any malignancy suspicion. Virtual touch imaging quantification elastography measurements indicated the predominance of areas with low SWV and a maximum SWV of 5.31 m/s in a limited area of the lymph node. Fine needle aspiration was not diagnostic, and we performed an excisional biopsy that confirmed our diagnosis of a benign chronic non-specific lymphadenopathy with fibrous changes. In this case, we can see how helpful US and VTIQ elastography can be in the continuous evaluation of a pathological lymph node to detect any suspicious changes in morphology and tissue stiffness.

In conclusion, through the presentation of these cases report we can see how useful and valuable can ultrasound and especially VTIQ elastography be in the evaluation of cervical lymph nodes and how can guide our decision about treatment planning. ❑

CONCLUSIONS

Ultrasound with VTIQ elastography is a very important imaging tool in the evaluation and differential diagnosis of benign and malignant cervical lymph nodes. Virtual Touch Imaging Quantification elastography is characterized by increased SWV values in malignant lymph nodes that are often reaching maximum values of 10 m/s, while in benign lymph nodes, even when fibrous changes occur, maximum SWV can never reach such high values. ❑

Conflicts of interest: none declared.
Financial support: none declared.
Ethical statement: The study was approved by the Institutional Review Board (1072/14-12-2022).

References

1. **Wagner JM, Alleman AM.** Ultrasonography of Cervical Lymph Nodes. *Radiol Clin North Am* 2019;57:485-500. doi: 10.1016/j.rcl.2019.01.005.
2. **Agarwal M, Nabavizadeh SA, Mohan S.** Chapter 6 Non-Squamous Cell Causes of Cervical Lymphadenopathy. *Semin Ultrasound CT MR* 2017;38:516-530. doi: 10.1053/j.sult.2017.05.006.
3. **Ahuja A, Ying M.** An overview of neck node sonography. *Invest Radiol* 2002;37:333-342. doi: 10.1097/00004424-200206000-00005.
4. **Fujiwara T, Tomokuni J, Iwanaga K, et al.** Acoustic radiation force impulse imaging for reactive and malignant/metastatic cervical lymph nodes. *Ultrasound Med Biol* 2013;39:1178-1183. doi: 10.1016/j.ultrasmedbio.2013.02.001.
5. **Azizi G, Piper K, Keller JM, et al.** Shear wave elastography and parathyroid adenoma: A new tool for diagnosing parathyroid adenomas. *Eur J Radiol* 2016;85:1586-1593. doi: 10.1016/j.ejrad.2016.06.009.
6. **Rüger H, Psychogios G, Jering M, Zenk J.** Multimodal Ultrasound Including Virtual Touch Imaging Quantification for Differentiating Cervical Lymph Nodes. *Ultrasound Med Biol* 2020;46:2677-2682. doi: 10.1016/j.ultrasmedbio.2020.06.005.
7. **Turgut E, Celenk C, Tanrivermis Sayit A, et al.** Efficiency of B-mode ultrasound and strain elastography in differentiating between benign and malignant cervical lymph nodes. *Ultrasound Quarterly* 2017;33:201-207. doi: 10.1097/ruq.0000000000000302.
8. **Gupta A, Rahman K, Shahid M, et al.** Sonographic assessment of cervical lymphadenopathy: role of high-resolution and color Doppler imaging. *Head Neck* 2011;33:297-302. doi: 10.1002/hed.21448.
9. **Dudea SM, Lenghel M, Botar-Jid C, et al.** Ultrasonography of superficial lymph nodes: benign vs. malignant. *Med Ultrason* 2012;14:294-306. PMID: 23243643.
10. **Suh CH, Choi YJ, Baek JH, Lee JH.** The diagnostic performance of shear wave elastography for malignant cervical lymph nodes: A systematic review and meta-analysis. *Eur Radiol* 2017;27:222-230. doi: 10.1007/s00330-016-4378-3