

Ultrasound Neck Node Reporting and Data System (UNN-RADS) for lymphadenopathy: A structured report

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ABSTRACT

Introduction: There is no structured ultrasound scoring system to predict malignant neck lymphadenopathy that assesses findings suspicious for malignancy. In this study, we aimed to develop a weighted score system for ultrasound findings suspicious for malignancy in neck lymphadenopathy with cytopathology confirmed diagnosis and define a classification system for standardized structured reporting based on the prediction of malignant neck lymphadenopathy. **Material and Methods:** This study included a cohort of patients with neck lymphadenopathy evaluated by grayscale ultrasound, color Doppler, and ultrasound-guided biopsy. The findings suspicious for malignancy were: a round or lobulated shape, noncircumscribed margin, hyperechogenicity, an echogenic hilum < 25% or absent, cystic degeneration, presence of calcifications, and a nonhilar vascular pattern. **Results:** Seventy-three patients were included. Three points were assigned to ultrasound findings suspicious of malignancy observed with a frequency $\geq 70\%$ in cases with cytopathology confirmed malignant lymphadenopathy, two points with a frequency of 50% to 69%, and one point with a frequency of 30% to 49%. Five categories were defined based on the weighted score: category 1, benign (≤ 3 points); category 2, probably benign (4 to 5 points); category 3, mildly suspicious for malignancy (6 to 8 points); category 4, moderately suspicious for malignancy (9 to 11 points); and category 5, highly suspicious for malignancy (12 or more points). Categories 1 and 2 included 12 (35.3%) of 34 patients with cytopathology-confirmed benign lymphadenopathy. None of the cases with malignant lymphadenopathy were classified in these categories. Malignant lymphadenopathy was found in categories 3, 4, and 5, with the proportion increasing in direct relation to the category (48.6%, 86.7%, and 88.9%, respectively). **Conclusion:** We propose the Ultrasound Neck Node Reporting and Data System (UNN-RADS) with a standardized 5-category classification and a structured report of ultrasound findings in neck lymphadenopathy suspicious for malignancy and a recommendation for follow-up or biopsy.

Keywords: Malignant lymphadenopathy. Benign lymphadenopathy. Neck ultrasound. Ultrasound-guided fine needle aspiration biopsy. Structured report.

INTRODUCTION

Neck lymphadenopathy is a common indication for imaging examination. There are approximately 800 lymph nodes in the human body, and 40% (over 300 nodes) are located in the head and neck¹. Ultrasound is the primary

diagnostic procedure for evaluating and characterizing neck nodes², and it guides biopsies³. The sensitivity (96.8%) and specificity (88%) of neck ultrasound for identifying lymphadenopathy are high⁴ compared to computed tomography (CT) (95 and 47% for nodes of 10 mm)⁵, DWI magnetic resonance imaging (MRI)

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(96% and 94%)⁶, and positron emission tomography (PET)/CT (81% and 68%)^{4,7}. On the other hand, ultrasound identifies small nodes (< 5 mm) with greater sensitivity than cross-sectional imaging⁸. An oval shape, smooth and well-defined margins, a long axis to short axis ratio (L/S) > 2, an echogenic fatty hilum, and hilar vascularity are ultrasonographic features of a normal lymph node³.

The diagnosis of malignant neck lymphadenopathy is critical for preoperative staging and to determine therapy for primary or metastatic head and neck neoplasms⁹. Ultrasonographic neck lymph node features, such as size¹⁰, shape^{11,12}, margin¹³, hilar echogenicity¹⁴, and vascular pattern^{6,7,12,15}, have been individually associated with malignancy. None of these findings alone is useful for predicting malignant lymphadenopathy^{3,6,7,12}. Ryu et al.⁴ proposed the Cervical Lymph Node Imaging Reporting and Data System (CLN-RADS), which includes five categories to predict malignancy of neck nodes according to the number of suspicious features based on ultrasound, such as round shape, noncircumscribed margin, hyperechogenicity, absence of echogenic hilum, presence of gross necrosis, presence of calcification, peripheral or mixed vascular pattern, and real-time elastographic findings. We hypothesized that a scoring system combining ultrasonographic features suspicious for malignancy might increase the predictability of malignant neck lymphadenopathy. The aims of this study were to (1) develop a weighted score system of ultrasonographic findings suspicious for malignancy in neck lymphadenopathy with cytopathology confirmed diagnosis, and (2) define a classification system for standardized structured reporting based on the prediction of malignant neck lymphadenopathy.

MATERIAL AND METHODS

This retrospective cohort study was conducted from June 2019 to March 2021 at the Centro de Diagnostico Especializado por Imagen in Zapopan, Jalisco, Mexico. Patients referred with a clinical suspicion of neck lymphadenopathy or for diagnostic workup of a known primary carcinoma were included. Patients with an inadequate cytopathology specimen for diagnosis were excluded. Informed consent was not required for this retrospective study of information collected during routine clinical care. The institutional ethics and research committees approved the study protocol.

Study population

We selected lymph node biopsy results from the institution's data registry of patients who underwent grayscale ultrasound and color Doppler. The indication for lymph node biopsy was made by the referring physicians based on suspicion of lymph node pathology from physical examination and/or neck ultrasound. Biopsies were performed by US-guided fine-needle aspiration biopsy (FNAB) or core-needle biopsy (CNB)¹⁶ (hereafter, only the term cytopathology is used to describe both biopsies). Age, sex, and cytopathology diagnosis of the neck lymph node were recorded.

Image acquisition and analysis protocol

Grayscale ultrasound and color Doppler were performed with a Logic S7™ (General Electric Inc., Norwalk, CN, USA) with a 9–15 MHz linear transducer. Images were stored in the Picture Archive and Communication System (PACS). A head and neck radiologist with 30 years of experience (ESI) performed all FNAB and ultrasound examinations.

Ultrasonography was performed in an orderly and systematic manner with a review of the seven-lymph node levels¹⁷. Patients were examined in the supine position with the neck completely exposed, and started in the submental region with a transverse approach, then proceeded to the left side at level 2 and considered the submandibular gland as a reference, which was identified as slightly hyperechogenic above the carotid bifurcation. Transverse tracings were performed in the cephalocaudal direction, medial to the carotid artery. Levels 3 and 4 were examined up to the supraclavicular region in the same direction. Levels 2, 3, and 4 were then examined with a longitudinal approach parallel to the carotid axis. Level 5 was examined first transversely and then longitudinally, using the retroauricular region behind the posterior border of the sternocleidomastoid muscle as a reference. The same protocol was performed on the right side of the neck.

Level 6 was assessed with the thyroid gland as a reference in the direction of the suprasternal recess, where the transducer was tilted in a transverse or longitudinal direction, depending on the patient's anatomy. Finally, level 7 was assessed in the anterosuperior mediastinum behind the sternum with the transducer in a perpendicular oblique direction with the neck hyperextended.

Table 1. Seven ultrasonographic descriptors suspicious for malignancy in neck lymphadenopathy described by Ryu et al.⁴ with modifications proposed in the current study

Ryu et al. ⁴	Current study (Sarda-Inman et al.)
Round shape	Round or lobulated shape ^a
Noncircumscribed margin	Noncircumscribed margin
Hyperechogenicity	Hyperechogenicity
Absence of echogenic hilum	Echogenic hilum < 25% or absent ^a
Presence of gross necrosis	Cystic degeneration ^a
Presence of calcification	Presence of calcification
Peripheral or mixed vascular pattern	Nonhilar vascular pattern ^a

^aProposed modifications in the current study.

After a complete neck examination and in cases where the referring physician ordered a biopsy, a target lymph node was selected based on the identification of suspicious findings of malignancy or the largest lymph node on the US grayscale. Then, as previously described, a US-guided FNAB or CNB was performed⁴. Usually, one needle-pass in the neck node was enough to obtain sufficient material for cytologic evaluation with the technique that combines aspiration and capillarity according to the author's experience. The US examination and the FNAB were performed by the same radiologist using the previously described standardized procedures⁴.

Definition of ultrasonographic descriptors

The findings suggestive of malignancy proposed by Ryu⁴ were modified based on the 30-years of experience of the author (ESI) for the evaluation of neck lymphadenopathy (Table 1)

1. *Shape (oval, round, or lobulated)*. Shape was determined by the ratio between the shortest and the longest axis in the longitudinal section of the lymph node. Lobulated was defined as having three or more undulations. We consider round or lobulated shapes as suspicious features for malignancy.
2. *Margin (circumscribed or noncircumscribed)*. The margin was determined by the sharpness of the lymph node edge.
3. *Echogenicity (hypoechoic or hyperechoic)*. We considered only these two categories. Lymph node echogenicity was determined by comparison with adjacent muscles.

4. *Echogenic hilum (present \geq 25%, present < 25%, or absent)*. In addition to the absence of the hilum, we included thinning of the echogenic hilum (< 25%) as a feature associated with malignancy. The percentage was determined using the maximum diameter of the short axis of the lymph node in relation to hilum thickness.
5. *Cystic degeneration (present or absent)*. This term replaces gross necrosis⁴ and is defined as irregular prominent anechoic areas.
6. *Calcification (present or absent)*. Punctate hyperechoic foci with or without posterior acoustic shadows were considered calcifications.
7. *Intranodal vascular pattern (hilar and nonhilar)*. Hilar vascularity was defined as central flow signals or flow signals branching radially from the hilar structure⁴. A nonhilar intranodal vascular pattern may have peripheral vascularity, defined as flow signals along the periphery, or capsular portion of the lymph node^{4,17,18}.

These features were also evaluated:

8. *Matting (present or absent)*. Defined as clumping of multiple lymph nodes with abnormal features or perinodal hypoechoic lesions with disruption of the nodal border.
9. Echogenic changes in adjacent tissues (present or absent).

Statistical analysis

Quantitative variables are presented as means, standard deviations, and range; qualitative variables are presented as frequencies and percentages. Data were analyzed using ExcelTM version 18.0 (Microsoft Corp., Seattle, WA, USA).

RESULTS

Seventy-six patients were eligible. One case was excluded because of insufficient sample, and two because of the absence of a cytopathology report (Figure 1). Seventy-three patients were included, 29 men and 44 women, with a mean age of 50.51 ± 18.67 years (range, 9 to 87) and 44.50 ± 18.80 years (range, 15 to 80), respectively. Figure 1 shows the specific diagnoses in patients with benign lymphadenopathy ($n = 34$, 46.6%) or malignant lymphadenopathy ($n = 39$, 53.4%) with cytopathological confirmation.

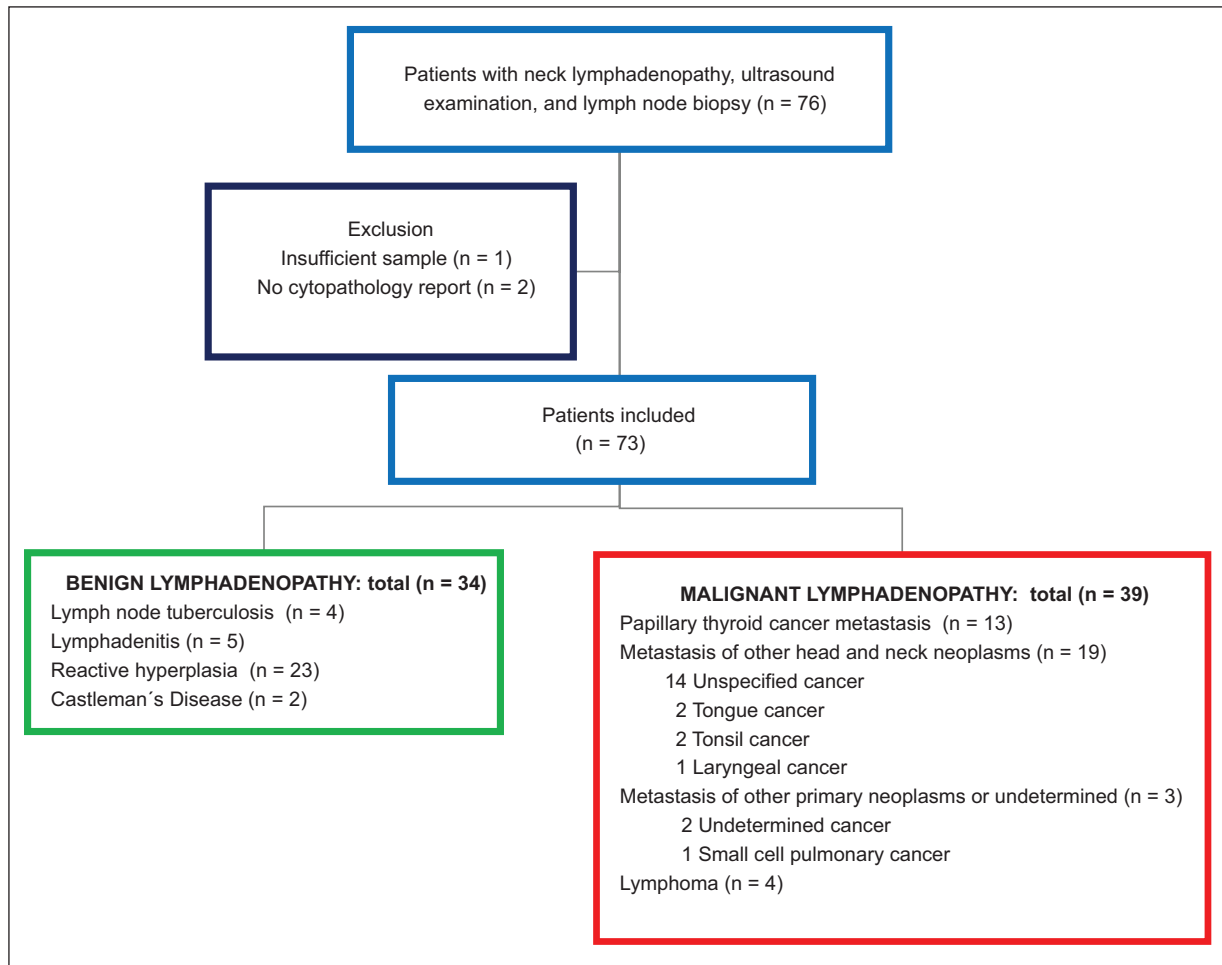


Figure 1. Flowchart of included patients with neck lymphadenopathy, ultrasonography, and lymph node biopsy. Diagnosis of benign or malignant lymphadenopathy was confirmed by cytopathological examination.

Ultrasonographic findings

A total of nine ultrasonographic features were analyzed (Supplementary Tables 1 and 2). The frequency of the seven ultrasonographic findings suspicious for malignancy in 39 patients with malignant lymphadenopathy is shown in Table 2. The comparison of the frequency of ultrasonographic descriptors suspicious of malignancy in patients with benign or malignant lymphadenopathy is shown in Table 3. Of 39 patients with malignant lymphadenopathy, cystic degeneration was observed in 31 (79.4%), echogenic hilum < 25% or absent in 28 (71.8%), hyperechogenicity in 23 (59.0%), round or lobulated shape in 23 (59.0%), a nonhilar vascular pattern in 21 (53.9%), the presence of calcification in 13 (33.3%), and a noncircumscribed margin in 14 (35.9%).

The scoring of ultrasonographic findings suspicious of malignancy was based on their frequency in cases

with malignant lymphadenopathy confirmed by cytopathology (Table 4). Three points were assigned for an echogenic hilum < 25% or absent, and cystic degeneration; 2 points for a round and lobulated shape, hyperechogenicity, and a nonhilar vascular pattern; and 1 point for an uncircumscribed margin and the presence of calcification. Ultrasonographic features of lymph nodes with cytopathology confirmation of the diagnosis are shown as shape and hilum (Figure 2), echogenic features (Figure 3), margin (Figure 4), and vascular findings (Figure 5).

Categories of ultrasonographic descriptors

Five categories were defined (Table 5) based on the weighted score of ultrasonographic descriptors suspicious for malignancy: category 1 – benign with a score of 3 or less; category 2 – probably benign with 4 to

Table 2. Frequency of the seven ultrasonographic descriptors suspicious for malignancy in patients with diagnosis of malignant lymphadenopathy with cytopathological confirmation^a

Description	Metastasis of papillary thyroid carcinoma n = 13 (33.3%)	Metastasis of other head and neck neoplasms ^b n = 19 (48.7%)	Metastasis from distant or indeterminate primary ^c n = 3 (7.7%)	Lymphoma n = 4 (10.3%)	Total n = 39 (100%)
Shape					
Ovoid	6 (46.1)	8 (42.1)	0	2 (50.0)	16 (41.0)
Lobular or round	7 (53.9)	11 (57.9)	3 (100)	2 (50.0)	23 (59.0)
Margin					
Circumscribed	9 (69.3)	12 (63.1)	1 (33.3)	3 (75.0)	25 (64.1)
Noncircumscribed	4 (30.7)	7 (36.9)	2 (66.7)	1 (25.0)	14 (35.9)
Ecogenicity					
Hyperechogenic	9 (69.3)	9 (47.3)	2 (66.7)	3 (75.0)	23 (59.0)
Hypoechoic	4 (30.7)	10 (52.7)	1 (33.3)	1 (25.0)	16 (41.0)
Echogenic Hilum					
Present ($\geq 25\%$)	2 (15.3)	6 (31.6)	0	3 (75.0)	11 (28.2)
Present ($< 25\%$) or absent	11 (84.7)	13 (68.4)	3 (100)	1 (25.0)	28 (71.8)
Cystic Degeneration					
Present	10 (77.0)	16 (84.2)	1 (33.3)	4 (100)	31 (79.4)
Absent	3 (23.0)	3 (15.8)	2 (66.7)	0	8 (20.6)
Calcification					
Present	9 (69.2)	3 (15.8)	1 (33.3)	0	13 (33.3)
Absent	4 (30.8)	16 (84.2)	2 (66.7)	4 (100)	26 (66.7)
Intranodal Vascular Pattern					
Hilar	4 (30.8)	9 (47.3)	1 (66.7)	4 (100)	18 (46.1)
Nonhilar	9 (69.2)	10 (52.7)	2 (33.3)	0	21 (53.9)

^aFNAB (n = 37) and Tru-cut (n = 2); ^bEpidermoid carcinoma (n = 19): Tongue Carcinoma (n = 2), Larynx carcinoma (n = 1), Tonsil carcinoma (n = 2), Unspecified carcinoma (n = 14); ^cEpithelial carcinoma (n = 3): small cell lung cancer (1), undeterminate cancer (2).

Table 3. Comparison of the frequency of the seven ultrasonographic descriptors suspicious for malignancy in patients with benign or malignant lymphadenopathy with cytopathological confirmation

Description	Cystic degeneration	Echogenic hilum $< 25\%$ or absent	Hyperechogenicity	Round and lobulated shape	Nonhilar vascular pattern	Noncircumscribed margin	Presence of calcification
Benign lymphadenopathy, n (%)	18 (53.0)	20 (58.9)	9 (26.4)	15 (44.1)	9 (26.4)	8 (23.5)	11 (32.3)
Malignant lymphadenopathy, n (%)	31 (79.4)	28 (71.8)	23 (59.0)	23 (59.0)	21 (53.9)	14 (35.9)	13 (33.3)

5 points; category 3 – mildly suspicious for malignancy with 6 to 8 points; category 4 – moderately suspicious for malignancy with 9 to 11 points, and category

5 – highly suspicious for malignancy with 12 or more points. The score defining each category was established arbitrarily by the authors. The likelihood of benign

Table 4. Scoring assigned to ultrasonographic findings based on the highest frequency observed in cases with malignant lymphadenopathy^a

Ultrasonographic findings	Score
Echogenic hilum < 25% or absent	3
Cystic degeneration	3
Round and lobulated shape	2
Hyperechogenicity	2
Nonhilar vascular pattern	2
Noncircumscribed margin	1
Presence of calcification	1

^aWe assigned 3 points for ultrasound findings with a frequency of $\geq 70\%$ in patients with malignant lymphadenopathy; 2 points for findings with a frequency of 50% to 69%; and 1 point for findings with a frequency of 30% to 49%. The points used to define each characteristic were arbitrarily determined by the authors.

or malignant lymphadenopathy was based on the total score. Categories 1 and 2 included 12 (35.3%) of 34 patients with cytopathology confirmed benign lymphadenopathy. None of the cases with malignant lymphadenopathy were classified in either of these categories. Malignant lymphadenopathy was found in categories 3, 4, and 5, with the proportion increasing in direct relation to the category (48.6%, 86.7%, and 88.9%, respectively).

Ultrasound Neck Node Reporting and Data System (UNN-RADS)

The UNN-RADS with five categories was developed for standardized structured reporting of ultrasound

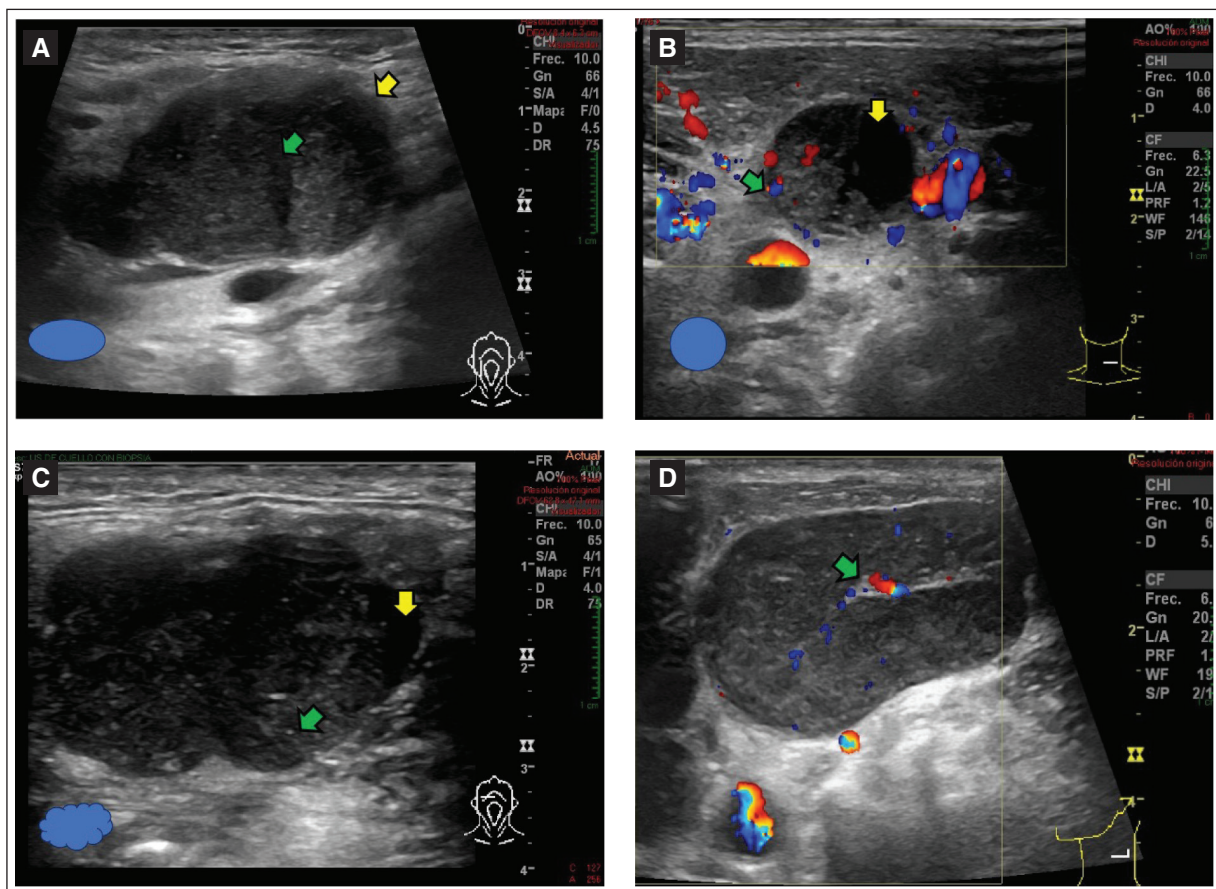


Figure 2. Grayscale and color Doppler ultrasound show the different shapes and hilum features of lymph nodes with cytopathology confirmation of the diagnosis. **A:** a 69-year-old man, with ovoid lymph node, poorly defined margins (yellow arrow), absent fatty hilum with central hypoechoic areas (green arrow). Diagnosis of metastasis of squamous cell carcinoma of undetermined primary. **B:** a 65-year-old man with round shaped lymph node, areas of cystic degeneration (yellow arrow) and disorganized vascularity (green arrow). Diagnosis of squamous cell carcinoma with metastases. **C:** a 58-year-old man with lobulated lymph node, areas of cystic degeneration (yellow arrow), and punctate echogenic foci (green arrow). Diagnosis of non-Hodgkin’s lymphoma. **D:** a 62-year-old man with ovoid lymph node, with thinned hilum < 25% (green arrow) and hilar vascularity. Diagnosis of Castleman’s disease.

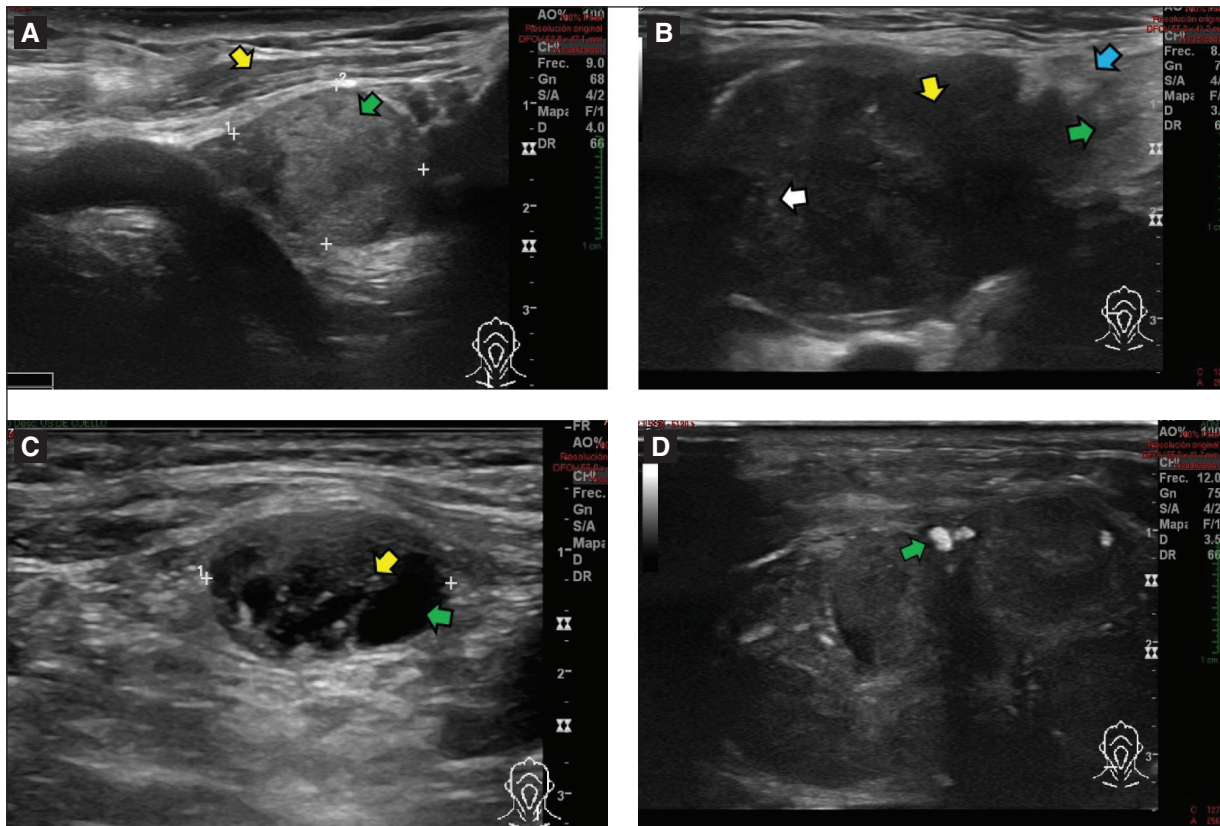


Figure 3. Grayscale and color Doppler ultrasound show the **echogenic features** of the lymph node with cytopathologic confirmation of the diagnosis. **A:** a 56-year-old man with ovoid, hyperechogenic lymph node (green arrow) in relation to adjacent muscle tissue (yellow arrow). Diagnosis of metastatic papillary thyroid carcinoma. **B:** a 40-year-old man with lobulated node, poorly defined borders (green arrow), hypoechogenic (yellow arrow), in relation to adjacent tissue (blue arrow) with punctate echogenic images (white arrow), and fatty hilum absent. Diagnosis of metastatic squamous cell carcinoma of the tongue. **C:** a 48-year-old woman with ovoid lymph node with punctate echogenic images (yellow arrow) and anechoic areas of cystic degeneration (green arrow). Diagnosis of papillary thyroid carcinoma. **D:** a 66-year-old woman with heterogeneous lymph node conglomerate, an absent fatty hilum, and echogenic calcification that projects posterior acoustic shadow (green arrow). Diagnosis of lymph node tuberculosis.

findings of suspected malignancy in patients with neck lymphadenopathy (Figure 6). The upper part of the figure shows the score assigned to each characteristic. The sum of the scores determines the UNN-RADS category according to the total score of the ultrasonographic descriptors. In category 1 or 2, a clinical follow-up is recommended, while in category 3, the referring physician should evaluate the history and clinical picture to define the recommendation, yes or not to perform FNAB, or a follow-up in 3 months with a new US and evaluate the interval changes and clinical manifestations to define the recommendation for biopsy. If the referring physician's suspicion or US features suggest lymphoma, a core biopsy should be performed. In category 4 (moderately suspicious for malignancy) or category 5 (highly suspicious for malignancy), a biopsy is recommended. The definitions of the ultrasonographic descriptors are in the

lower part of the figure. The final diagnosis for each of the 73 patients included in this study is shown in Supplementary Table 3 in relation to the score obtained and the UNN-RADS category. Figure 7 shows grayscale US and Doppler color of the features in benign or malignant lymphadenopathy with confirmation by cytopathology and the total score of the ultrasonographic descriptors suspicious for malignancy and UNN-RADS categories.

DISCUSSION

We propose the UNN-RADS classification of 5 categories based on the weighted score of the seven ultrasound findings suspicious for malignancy in patients with neck lymphadenopathy: round or lobulated shape, noncircumscribed margin, hyperechogenicity, echogenic hilum < 25% or absent, cystic

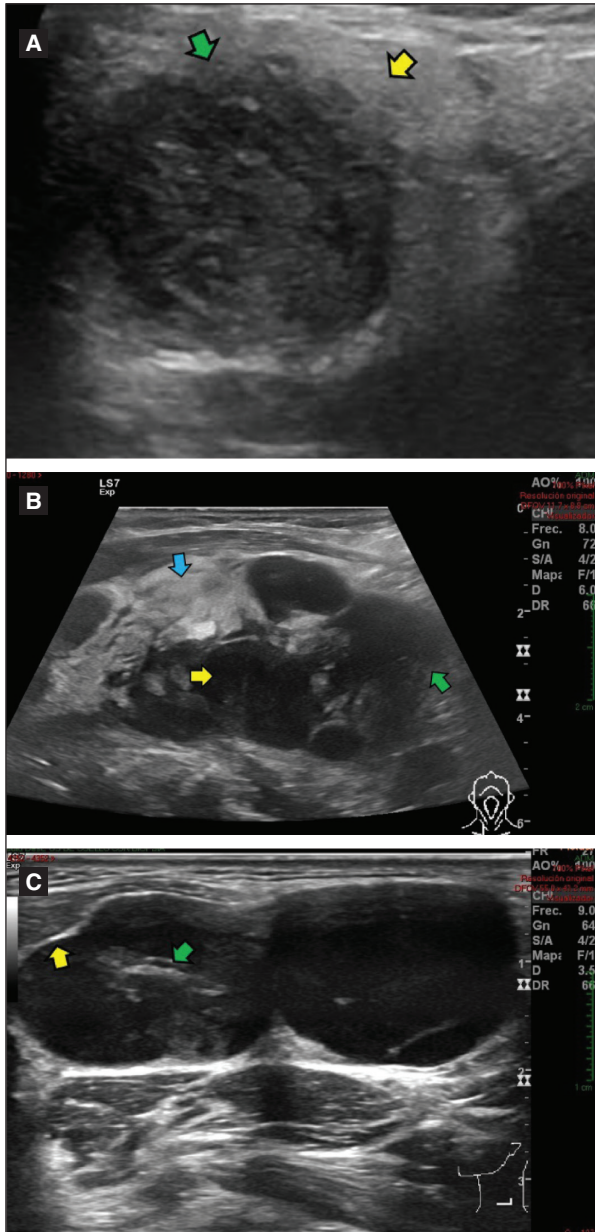


Figure 4. Grayscale ultrasound shows the characteristics of the margin with cytopathology confirmation of the diagnosis. **A:** 69-year-old man with round shaped lymph node, poorly defined margins (green arrow), echogenic changes in adjacent tissue (yellow arrow). Diagnosis of squamous cell carcinoma of the larynx. **B:** 67-year-old woman with matting, poorly defined margins (green arrow), anechoic areas of cystic degeneration (yellow arrow), and increased echogenicity of adjacent tissue (blue arrow). Diagnosis of lymphoma. **C:** a 18-year-old woman with matting, defined margins (yellow arrow) and thinned fatty hilum < 25% (green arrow). Diagnosis of lymphadenitis.

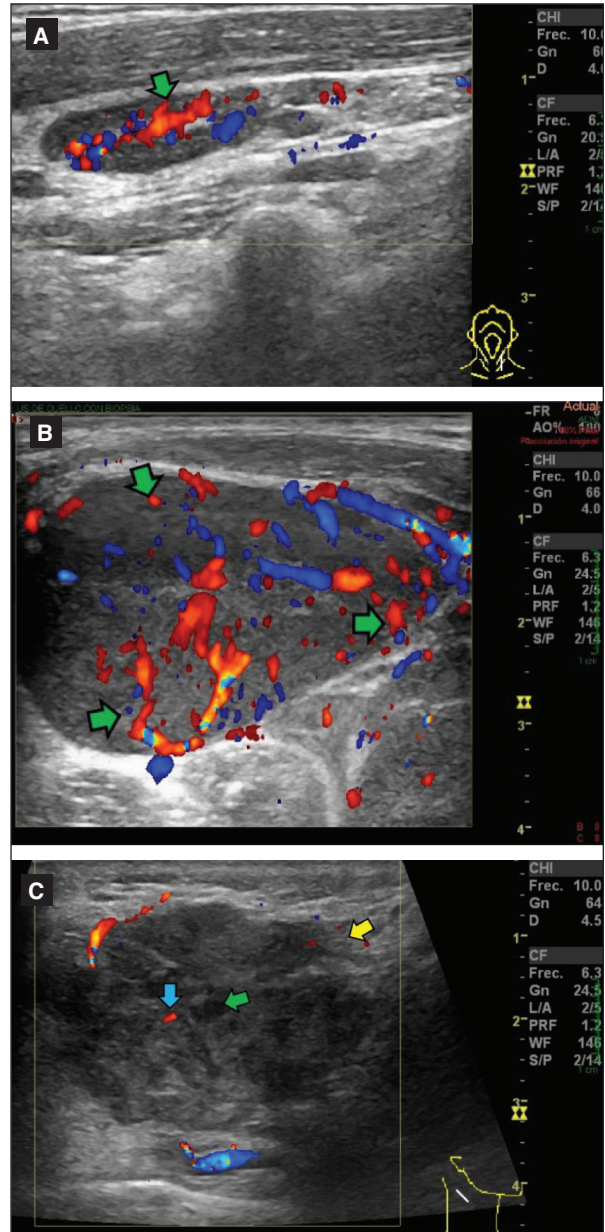


Figure 5. Grayscale ultrasound and color Doppler show vascular lymph node features with cytopathology confirmation of the diagnosis. **A:** a 18-year-old man with ovoid lymph node, echogenic fatty hilum > 25% and hilar vascularity (green arrow). Diagnosis of lymphadenitis. **B:** a 22-year-old man with ovoid lymph node, mixed vascularity (nonhilar) (green arrows). Diagnosis of lymphoma. **C:** a 81-year-old man with lobulated lymph node, poorly defined margin (yellow arrow), absent fatty hilum, anechoic areas of cystic degeneration (green arrow), and sparse nonhilar vascularity (blue arrow). Diagnosis of metastasis of squamous cell carcinoma.

degeneration, presence of calcification, and nonhilar vascular pattern. To our knowledge, this is the first time a structured system based on ultrasound findings for predicting malignancy in neck lymphadenopathy is defined and a recommendation is established for follow-up or lymph node biopsy.

A scoring system that weights ultrasound findings with suspected malignancy may be more accurate than a single feature in predicting malignant lymphadenopathy^{6,7,12}. In a previous study, Ryu et al.⁴ proposed a 5-point scale CLN-RADS to determine the risk stratification of malignant lymphadenopathy

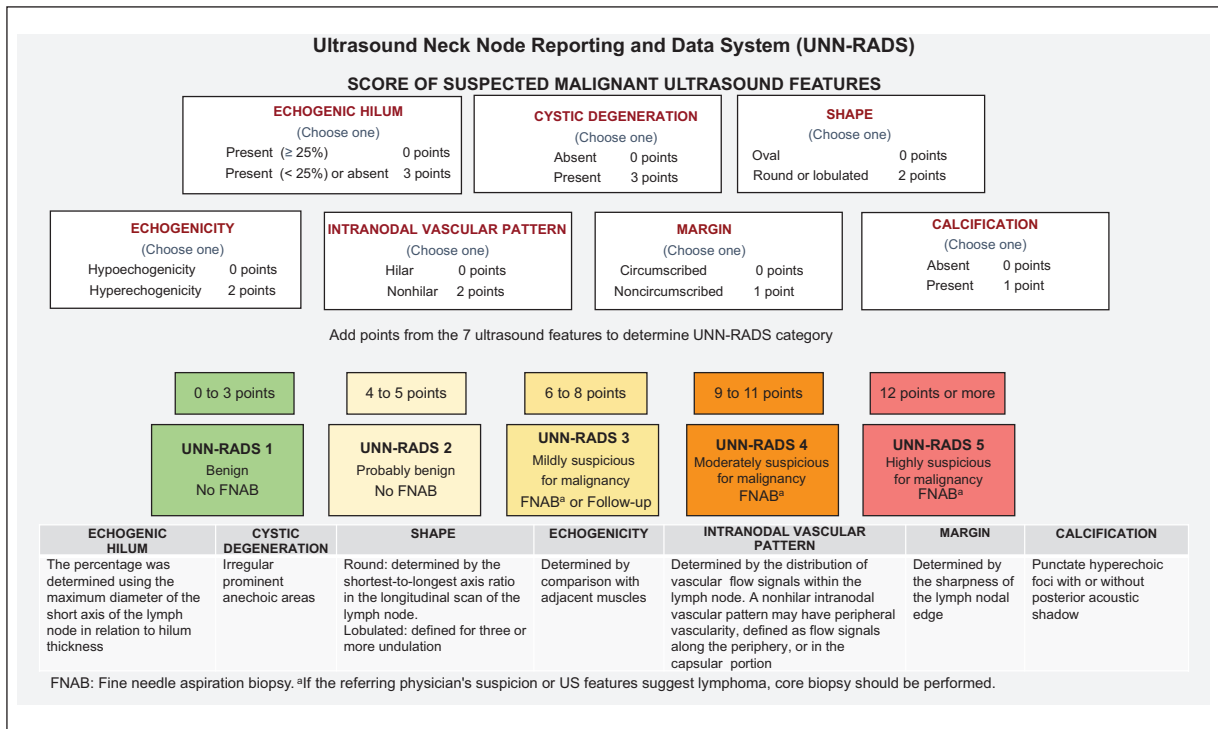


Figure 6. UNN-RADS classification shows the 5 categories based on the weighted score of the seven ultrasonographic descriptors with suspicion of malignancy for the prediction of malignant neck lymphadenopathy and recommendation for biopsy or follow-up. Explanations are provided at the bottom.

UNN- RADS: Ultrasound Neck Node Reporting and Data System.

Table 5. UNN-RADS categories based on the score^a of the seven ultrasonographic descriptors suspicious for malignancy and their relationship with benign or malignant lymphadenopathy with cytopathologic confirmation

Categories	1		2		3		4		5	
	Benign	Probably benign	Mildly suspicious for malignancy	Moderately suspicious for malignancy	Highly suspicious for malignancy					
Score	≤ 3		4–5		6–8		9–11		≥ 12	
Benign lymphadenopathy, (n = 34)	2 (100%)	10 (100%)	19 (51.4%)	2 (13.3%)	1 (11.1%)					
Malignant lymphadenopathy, (n = 39)	0	0	18 (48.6%)	13 (86.7%)	8 (88.9%)					
Total (n = 73)	2	10	37	15	9					

UNN-RADS: Ultrasound Neck Node Reporting and Data System; ^aThe score defining each category was arbitrarily determinate by the authors.

according to the number of suspicious features based on the combination of US and elastography. In contrast, UNN-RADS classification established a 1-, 2-, or 3-point scale to categorize ultrasound findings suspicious for malignancy. In UNN-RADS categories 4 and 5, the number of benign cases decreased and the malignant cases increased. There are several fundamental differences between the CLN-RADS⁴ and UNN-RADS classifications. In the former classification, ultrasonographic descriptors suspicious for malignancy have equal weight and the sum of these predicting malignancy. In contrast, in our proposed UNN-RADS

classification, a 5-category system was constructed in which the score was weighted based on the frequency of the seven ultrasonographic descriptors suspicious for malignancy.

Prediction of malignant lymphadenopathy based on ultrasound findings suggestive of malignancy may be clinically useful. In our study, benign lymphadenopathy was confirmed in 34 (46.6%) and malignant lymphadenopathy in 39 (53.4%) of 73 patients. The prediction of malignant lymphadenopathy with the classification UNN-RADS was 0% in categories 1 and 2, whereas malignant lymphadenopathy was found in categories 3,

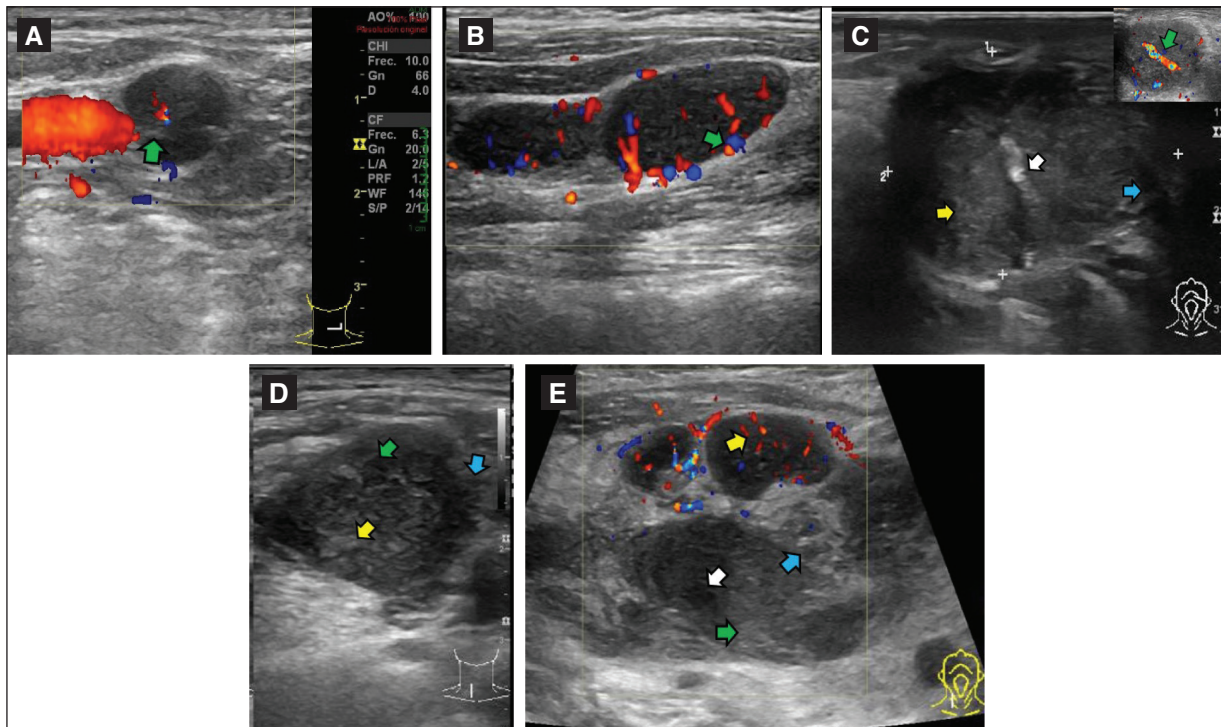


Figure 7. Grayscale and color Doppler ultrasound according to each category of **UNN-RADS classification** with cytopathologic confirmation of the diagnosis. **A:** a 22-year-old woman with hilum present, thinned < 25% (3 points) (green arrow) lymph node. UNN-RADS category 1. Diagnosis of reactive hyperplasia. **B:** a 49-year-old man with absent fatty hilum (3 points), nonhilar vascularity (2 points) (green arrows) lymph node. UNN-RADS category 2 (total 5 points). Diagnosis of reactive hyperplasia. **C:** a 29-year-old woman with a thinned fatty hilum < 25% (3 points) (white arrow), hyperechogenic (2 points) (yellow arrow), round shape (2 points), noncircumscribed margin (1 point) (blue arrow), hilar vascularity (0 points) (green arrow). UNN-RADS category 3 (total 8 points). Diagnosis of lymphadenitis. **D:** a 59-year-old woman with absent fatty hilum (3 points), anechoic areas of cystic degeneration (2 points) (green arrow), hyperechogenicity (2 points) (yellow arrow), noncircumscribed margin (1 point) (blue arrow), lobulated shape (2 points). UNN-RADS category 4 (total 10 points). Diagnosis of distant metastases from small cell carcinoma of the lung. **E:** a 67-year-old woman with matting, anechoic areas of cyst degeneration (3 points) (white arrow), lobulated shape (2 points), absent fatty hilum (3 points), hyperechogenicity (2 points) (green arrow), nonhilar vascularity (2 points) (yellow arrow), noncircumscribed margin (1 point) (blue arrow). UNN-RADS category 5 (total 13 points). Diagnosis of lymphoma.

UNN-RADS: Ultrasound Neck Node Reporting and Data System.

4, and 5 with an increasing proportion directly related to the category, 48.6%, 86.7%, and 88.9%, respectively. In comparison, in the study by Ryu et al.⁴ which included 291 patients, the diagnosis of benign lymphadenopathy was confirmed in 182 (62.6%) and malignant lymphadenopathy in 109 (37.4%). According to the CLN-RADS categories, the risk of malignant lymphadenopathy was category 1, 3.3%; category 2, 10.9%; category 3, 26.7%; category 4, 51.8%–74.4%; and category 5, 90.6%–98.8%. The clinical usefulness of UNN-RADS for predicting malignancy appears to be superior to CLN-RADS because no cases of malignant lymphadenopathy were diagnosed in categories 1 (benign) and 2 (probably benign), whereas the increased likelihood of malignancy was related with categories 3, 4, and 5 with an increase in the score of the UNN-RADS classification.

Ultrasound-guided biopsy is the gold standard for confirming the diagnosis of neck lymphadenopathy. Liao et al.¹² proposed a scoring system based on age and ultrasound findings of the lymph node, such as round shape, echogenicity, and vascular pattern to recommend performing FNAB with real-time information directly from PACS. Based on ROC analysis, they proposed a cut-off point of 7 to define low or high risk of malignant lymphadenopathy and recommended performing biopsy in cases with a score of 7 or more. The authors did not define the likelihood of malignancy. In contrast, the UNN-RADS classification recommends performing FNAB in categories 4 and 5 because of the high likelihood of malignant lymphadenopathy.

The first structured reporting system in radiology was BI-RADS, developed in 1993 for the assessment of breast lesions on mammography¹⁹. Subsequently,

Table 6. ULTRASOUND NECK NODE REPORTING AND DATA SYSTEM (UNN-RADS): Standardized structured reporting format for ultrasonographic descriptors suspicious for malignancy in patients with neck lymphadenopathy

Ultrasound Descriptor	Features and Puntaction		Scoring of observed findings
SHAPE	Oval	0	
	Round	2	
	Lobulated	2	
MARGIN	Circumscribed	0	
	Noncircumscribed	1	
ECHOGENICITY	Hypoechoogenicity	0	
	Hyperechoogenicity	2	
ECHOGENIC HILUM	Present	0	
	Present < 25%	3	
	Absent	3	
CYSTIC DEGENERATION	Absent	0	
	Present	3	
CALCIFICATION	Absent	0	
	Present	1	
INTRANODAL VASCULAR PATTERN	Hilar	0	
	Nonhilar	2	

TOTAL SCORE

UNN-RADS CATEGORY

RECOMMENDATION FOR BIOPSY

Definitions and recommendations:

UNN-RADS Category 1. Benign with 0–3 points.

Recommendation: clinical and/or imaging (US) follow-up is recommended.

UNN-RADS Category 2. Probably benign with 4–5 points.

Recommendation: clinical and/or imaging (US) follow-up is recommended.

UNN-RADS Category 3. Mildly suspicious of malignancy with 6–8 points.

Recommendation: the referring physician should evaluate the history and clinical picture to define if YES or NO to perform FNAB^a or follow-up in 3 months to assess a new US and evaluate interval changes and clinical manifestations and/or by US indicate biopsy^a.

UNN-RADS Category 4. Moderately suspicious for malignancy with 9–11points.

Recommendation: FNAB biopsy^a.

UNN-RADS Category 5. Highly suspicious for malignancy with 12 or more points.

Recommendation: FNAB biopsy^a.

^aIf the referring physician's suspicion or US features suggest lymphoma, core biopsy should be performed.

FNAB: Fine needle aspiration biopsy; US: Ultrasound; UNN-RADS: Ultrasound Neck Node Reporting and Data System.

ultrasound-based risk stratification and reporting systems have been proposed to identify nodules that warrant biopsy or follow-up in different anatomic regions (e.g., TI-RADS)²⁰. We propose a structured, standardized template to systematize the identification

and reporting of ultrasound findings of neck lymphadenopathy using the seven descriptors for suspected malignancy (Table 6). The total sum of findings defines the UNN-RADS category and the recommendation for clinical follow-up or biopsy. Structured, standardized

reporting of neck lymphadenopathy allows comparison and follow-up of ultrasound findings on subsequent examinations of the same patient and can be used for research and educational purposes.

The strengths of this study are the patient population, which included the most common causes of benign and malignant lymphadenopathy, and the fact that lymph node biopsy and cytopathology, which are the reference standard, were performed in all cases. Furthermore, the characteristics of the ultrasound-based descriptors suspicious for malignancy, which were evaluated to develop UNN-RADS classification, were supported in a previous study⁴. Limitations of the study include it retrospective, single-center design and small sample size. On the other hand, ultrasonography was evaluated by only one experienced head and neck radiologist. Interobserver agreement of the UNN-RADS classification were not determined. The UNN-RADS classification does not involve complementary evaluation with other imaging modalities and is not recommended for staging or treatment planning. Most structured reporting systems of imaging of different organs have been established through the deliberation of consensus committees in established professional organizations⁴. UNN-RADS is not ready to be widely applied to practice.

CONCLUSION

We propose the UNN-RADS classification with a standardized 5-category and a structured report of ultrasound findings in neck lymphadenopathy suspicious for malignancy and a recommendation for follow-up or biopsy. It is recommended, according to the UNN-RADS categories, that patients with neck lymphadenopathy undergo lymph node biopsy or follow-up based on the weighted score of ultrasound findings. Ultrasound findings in suspected malignancy of the neck lymph nodes and their standardized reporting are critical for effective communication between radiologists and referring clinicians, who can rely on the complete, and systematic evaluation of neck nodes. There is a need to validate the clinical application of the UNN-RADS classification in studies in an independent cohort with more patients and established by professional organizations. The UNN-RADS classification will allow radiologists to fully and accurately define ultrasonographic features and clearly and easily report findings and recommendations for biopsy or follow-up in neck lymphadenopathy.

Supplementary material

Supplementary data are available at *Journal of the Mexican Federation of Radiology and Imaging* online (DOI: 10.24875/JMEXFRI.M22000020). These data are provided by the corresponding author and published online for the benefit of the reader. The contents of supplementary data are the sole responsibility of the authors.

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Conflicts of interest

The authors declare that they have no conflicts of interest.

Ethical disclosures

Protection of individuals. This study was conducted in compliance with the Declaration of Helsinki (1964) and its subsequent amendments.

Confidentiality of data. The authors declare that they followed their center's protocol for sharing patient data.

Right to privacy and informed consent. Informed consent was not required for this retrospective observational study of information collected during routine clinical care.

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