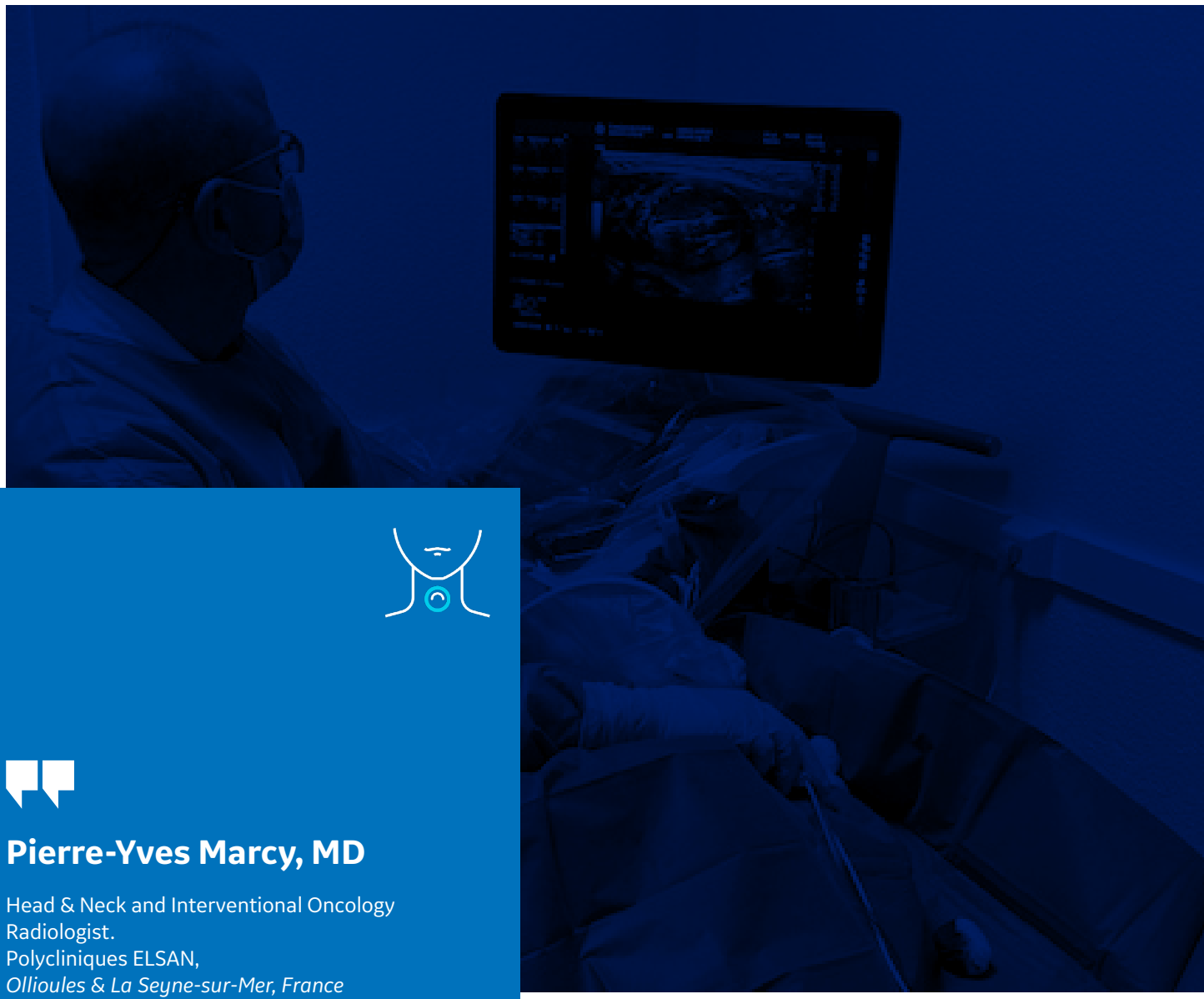

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Latest **Ultrasound Technologies** in the diagnosis of patients with Head and Neck lesions

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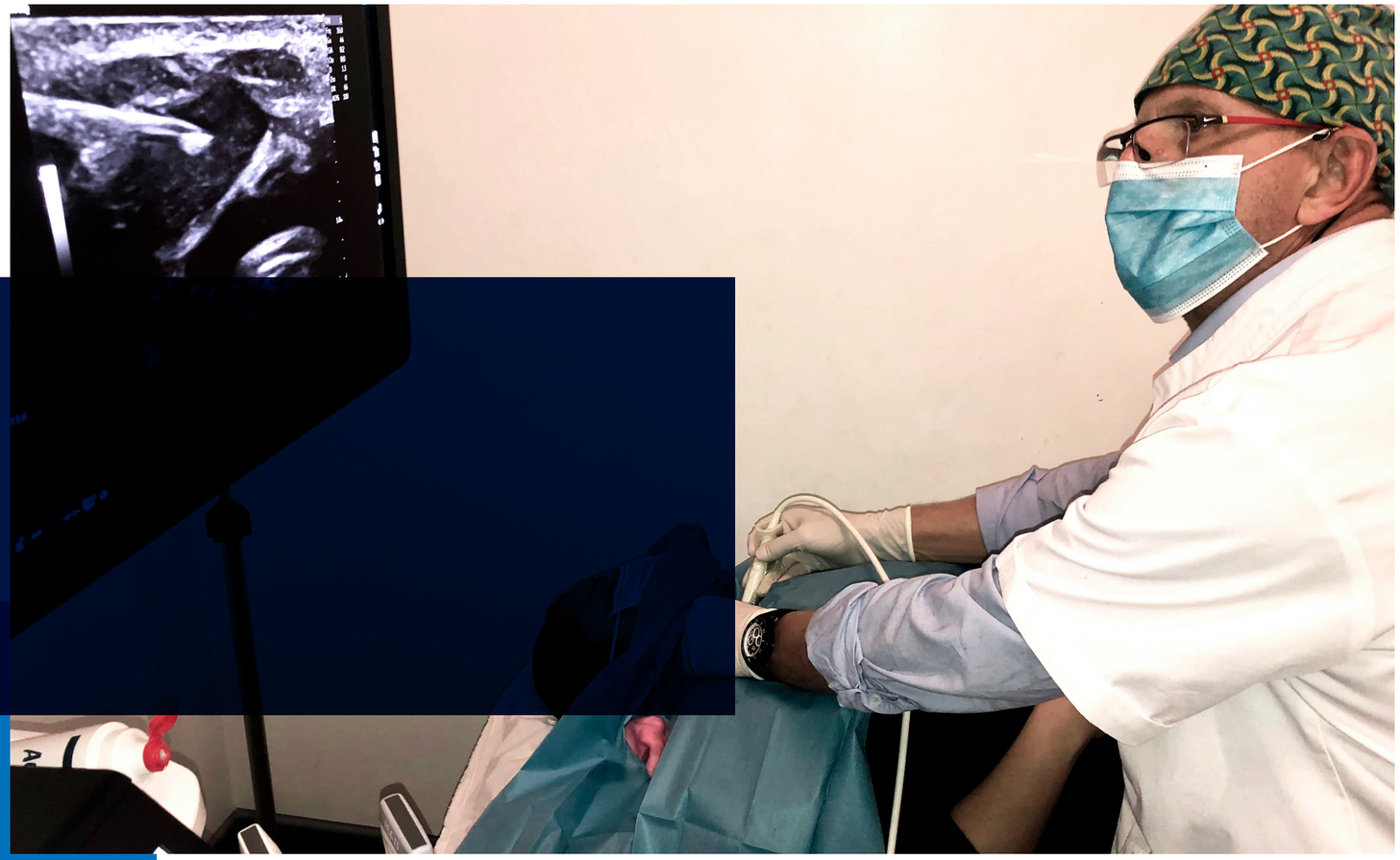
Introduction



CURRENT TRENDS IN H&N ULTRASOUND

Today, neck ultrasound is the first line-imaging tool when facing thyroid pathology, an enlarged neck node, or an indeterminate neck lump in current daily practice.
It supplements physical examination namely when clinical perception is confused by anatomical variants that include shortness of the neck, obesity, great muscularity, distortion by abnormal adjacent structures (lipoma, adenopathy, Zenker's diverticulum, dermoid cyst), tortuous innominate arterial trunk and carotid artery, internal jugular vein thrombosis, prior surgery / radiation therapy related skin sclerosis, or even dyspneic patient.

Thyroid Ultrasound is of utmost importance to differentiate between a goiter and a neck mass of extra thyroid origin, to diagnose thyroid nodules from a homogeneous goiter, to assess the vasculature of the thyroid gland and its kinetic feature, the precise echostructure of neck lymph node, to monitor securely FNAC and / or biopsy a neck mass.

FIVE ITEMS TO REACH THE FINAL DIAGNOSIS

Regarding the thyroid gland, defining five items is mandatory to reach the final diagnosis:

1. **Location and volume** (use a high frequency linear transducer with a wide bandwith);
2. **Echogenicity** (define the musculo thyroid gradient): the echogenicity of thyroid gland should be compared to the patient's parotid or submandibular gland, and to sternocleido-mastoid muscle to define the normal or hypoechogenicity of the patient's thyroid gland;
3. **Echostructure** (purely cystic, solid, predominantly cystic, predominantly solid, presence of micro/macrocalcifications, comet tail echogenic foci);
4. **Quantitative & qualitative vasculature** (Doppler, MVI): the Doppler US allows the assessment of qualitative and quantitative vasculature, and thus defines the hyperkinetic disorders of the thyroid gland that includes thyroiditis, Basedow Graves disease and hyperfunctional thyroid nodule).
5. **Perithyroid environment**; (lymph nodes, carotid jugular bundles, vagus nerve, MCSG).

Some additional points are also important to make the full diagnosis:

- Determine with accuracy the nature and intensity of the echoes within the thyroid gland / thyroid mass and also behind (deep to) the thyroid.
- As the anatomy of the neck is complex, defining the anterior lateral and posterior borders of the thyroid and neck lump.
- Define the anatomical epicenter of the neck lump, to elaborate the various etiologies and assess the displacement of trachea and laryngopharynx from the midline.
- Define the precise location of danger zones (neurovascular bundles, anterior & external jugular veins, oesophagus, trachea, brachial plexus, MCSG, recurrent laryngeal nerve) before planning any image – guided percutaneous procedure in the neck.

New Solutions for H&N Ultrasound investigations

LATEST TECHNICAL IMPROVEMENTS LEAD TO A HIGH LEVEL OF DIAGNOSTIC CONFIDENCE

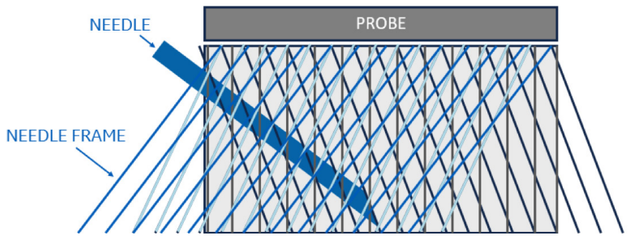
The latest GE improvements in B-mode and the extended capabilities of vascular flow modes increase the accuracy of the Ultrasound diagnosis. The software development will lead to a high level quality of diagnostic confidence, and increase the accuracy of percutaneous FNAC & CNB of neck lump in a meaningful way.

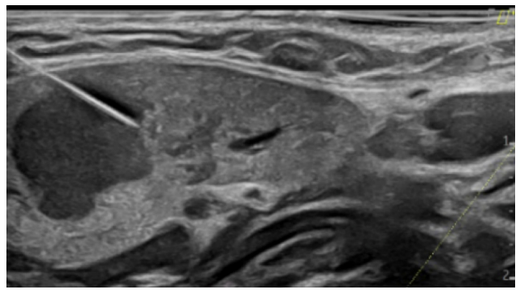
The introduction of the new cSound™ Imageformer combined to the matrix probe technology clearly improve the image's spatial resolution along the thyroid gland, with a focus of each pixel. The new levels of Speckle Reduction Imaging deliver high flexibility into the speckle noise reduction, contributing to an excellent contrast resolution of the image. This helps to better differentiate the isoechoic thyroid nodule within the parenchyma and to better delineate the anterior (superficial) as well as the deep (posterior) borders of the neck lump to be assessed.

In addition, the new Micro Vascular Imaging (MVI) combined with Radiant*flow*™ technology provides for clinicians a high-definition flow mode with a near 3D look. It supports visualization of tiny vessels, helping clinicians to have:

- a clearer definition of the vessels with Radiant*flow*™,
- an easier display of interconnecting smaller vessels; detecting more vascularity than Color Doppler and Power Doppler technologies,
- a better detection of subtle abnormality in traditionally "blind zones", including thyroid capsular tumor involvement or lymph node cortex neoangiogenesis.

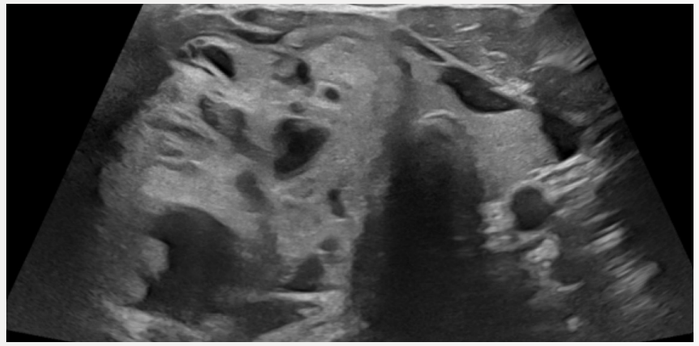
During interventional procedures, the B-Steer+ feature enables the enhanced visualization of the needle structure thus improving the operator's accuracy and confidence.





CHOOSING THE CORRECT PROBE FOR THE RIGHT PATIENT.

The ultrasound image below clearly shows the outlines of a 60ml right thyroid mass, thanks to the appropriate settings of the cSound Imageformer technology.



Note the thyroid nodule's echostructure, which is partly cystic. The global echogenicity of the right thyroid mass is similar to the left thyroid and parotid glands, thus the thyroid mass is scored EU-TIRADS 3.

The tracheal lumen is displaced on the left side. The right CCA and IJV are out of the field of view, and strongly displaced laterally and posteriorly. The Focus setting of the transducer is automatic, note the perfect definition of the anterior as well as the posterior and lateral margins of the right thyroid mass. Note the important tracheal displacement without lumen compression.

Clinical Cases

01

CASE 01

PATIENT'S HISTORY

A 50 years old female patient was diagnosed ten years ago of a Lymphocytic Thyroiditis (LT) and presented with sensitive lobe t hyroid hypoechoic nodule, which was scored EU-TIRADS on thyroid ultrasound (US)(a). Serum thyroid function was normal.

CHALLENGE

Lymphocytic Thyroiditis (LT) is very common in daily clinical practice. However, patients frequently lack informations regarding previous US thyroid gland reports and biological results.

Differential diagnoses of suspicious thyroid nodule in this particular context include papillary thyroid carcinoma and even more rare Non-Hodgkin Malignant Lymphoma (NHML).

Depiction and diagnosis of a thyroid nodule in case of LT are somewhat uneasy due to the global hypoechogenicity of the thyroid gland, the presence of fibrous echogenic bands delineating pseudonodules of thyroid parenchyma, obscuring deep down tissues.

SOLUTION

In our own experience, the value of ultrasonography to predict LT is based upon the quality of :

(a) assessing the decreased echogenicity (to be compared to submandibular / parotid glands) and the micronodular echostructure of the thyroid gland,

(b) diagnosing level VI- reactive adenitis according to Robbins classification (3),

(c) assessing the thyroid gland vasculature and kinetics.

The full diagnosis of LT will be made on the association of the US criteria with the positive TPO antibodies serum level.

A 50 years old female patient presents with sensitive right thyroid hypoechoic nodule, which was scored EU-TIRADS 5 (a). Ultrasound scan depicts a 23 x 8 x 19mm strongly hypoechoic right thyroid nodule; the nodule's outline displays lobulations and patient's thyroid nodule is scored EU-TIRADS 5 according to the EU-TIRADS 5 scoring (1). Interestingly, B-Flow depicts harmonious thyroid lobe tiny vascularization, which does not look to be interrupted by the presence of the nodule. The hypoechoic micronodules within the rest of the thyroid gland parenchyma correspond to the lymphocytic infiltrates (germinative centers).

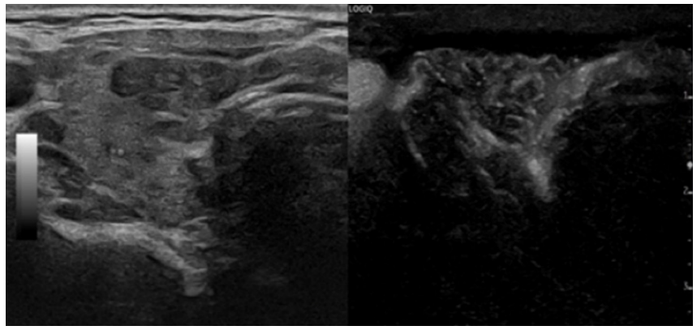


Figure 1a- Gray scale US (left), B-Flow technology (right) imaging of the right thyroid lobe. ML6-15-D probe.

Moreover, strain elastography assesses the presence of similar stiffness pattern values between the thyroid nodule and the adjacent thyroid gland tissue. FNAC made the final diagnosis of "thyroiditis pseudo nodule" (2).

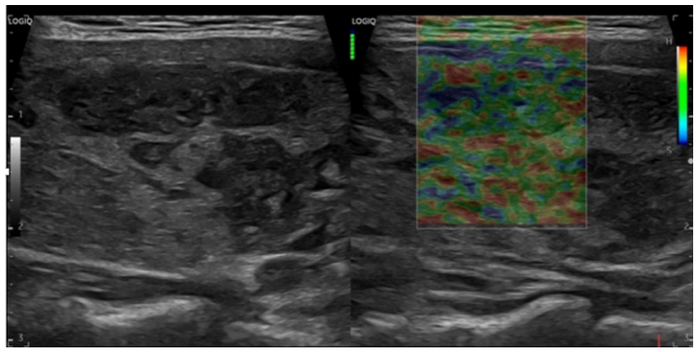


Figure 1b- US features of thyroiditis pseudo nodule without strain elastography (left) and with elastography (right).

Multi probe assessment of the echo-structure of the thyroid gland shows the typical micronodular hypoechoic pattern known as "leopard feature". Looking for reactive adenitis in the Robbins classification level VI, in the vicinity of the ITA is mandatory (3).

Color Doppler displays the inferior thyroid bundle at the posterior inferior aspect of the thyroid lobe, and the reactive adenitis (++). Activated germinative centers are hypoechoic micronodules. Combination of "leopard feature", Robbins level VI reactive adenitis and elevated serum thyroid peroxydase antibodies (TPO) level makes the full diagnosis of autoimmune thyroiditis.

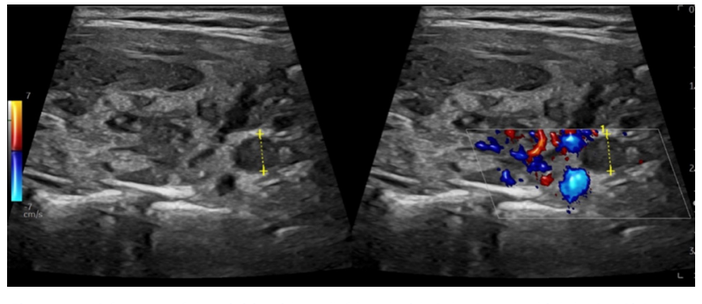


Figure 1c- US features of thyroiditis without (left) and with Color Doppler (right). L8- 18i-D MHz probe.

02

CASE 02

PATIENT'S HISTORY

A 91 years old female patient, with a history of gastric MALToma ten years before, presented with dysphagia, dysphonia and a growing neck mass.

CHALLENGE

During follow up, the challenge is to diagnose emerging malignant PTC and/or malignant lymphoma within the pre-existing Hashimoto thyroid gland tissue. NHML includes two types of features: the nodular and the diffuse ones. In the past, the suspicious nodule was called "pseudocystic" as the malignant mass looked very hypoechoic.

SOLUTION

Thanks to the new Ultrasound performances, the border between malignant lymphoma tissue and non-lymphomatous tissue appears well-defined; the feature is nowadays described as "broccoli-like" or "coastline-like" irregularity due to the "stripe- shape"of the lymphomatous thyroid tumor.

In the diffuse infiltrative type of thyroid lymphoma, the internal echoes are also exceedingly hypoechoic but the border between lymphoma and non-lymphomatous tissues is difficult to assess.

Rapidly enlarging painless thyroid mass, which may cause pressure symptoms of the aerodigestive tract, typical Ultrasound reticulated "broccoli" pattern, presence of ipsilateral "broccoli -like" malignant neck nodes are in favor of the diagnosis of malignant non Hodgkin lymphoma, which should promptly lead to percutaneous core needle biopsy.

Color Doppler with Radiant*flow*™ (left) and B-Flow (right) shows the malignant related neoangiogenesis within the "broccoli-like" or "strip & grid" feature of the thyroid lump. The marked hypoechoic area is interspersed by linear echogenic strands (linear echogenic strands pattern).

Note that high echoes are observed, and echoes behind masses are not attenuated.

Histopathologically, this pattern could be explained on the basis of the expansion of lymphoma cells demarcated by narrow fibrous bands.

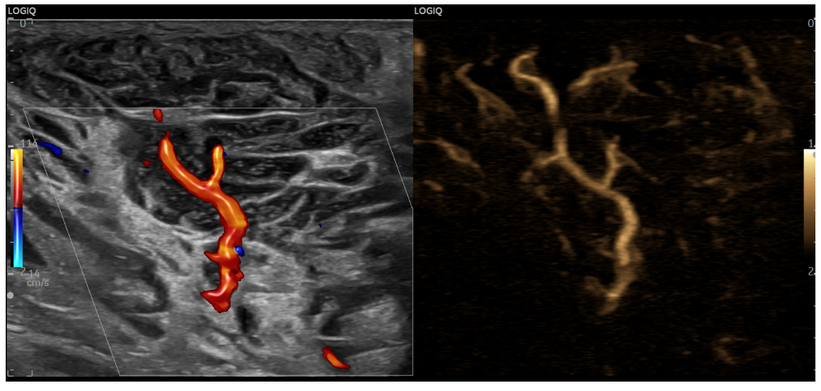


Figure 2a- Color Doppler with Radiant*flow™ (left) and B-Flow (right) show the malignancy-related neoangiogenesis.*

Percutaneous 18G CNB of the neck mass can be performed under Color Doppler US monitoring, to prevent accidental bleeding. Full diagnosis of high-grade malignant lymphoma was made.

Note the relative high degree of stiffness of the malignant lymphomatous mass (predominant red pattern on strain elastography).

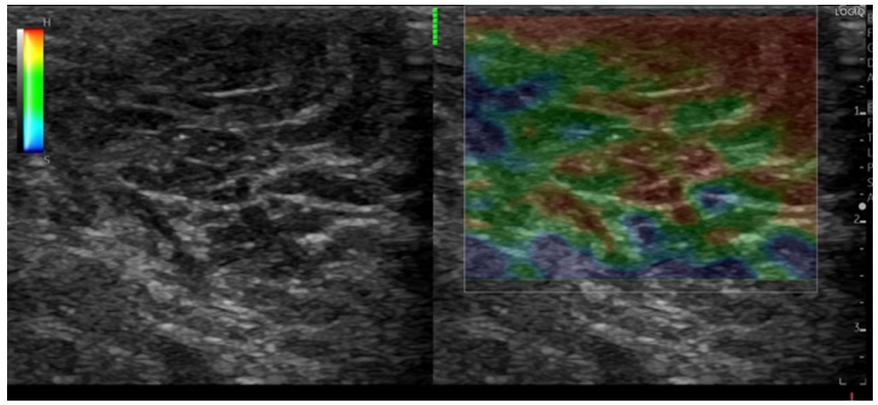


Figure 2b- B-mode without elastography (left) and with strain elastography (right) displays the high stiffness index of the high grade NHML thyroid lump.

Early diagnosis can be established by using modern imaging methods including US, FNAC with immunohistochemistry and flow cytometry, and histology percutaneous specimen technology will lead to accurate and precise diagnosis of malignant thyroid lymphoma without necessitating open thyroid surgical biopsy (4).

A high index of suspicion from the part of the thyroid radiologist is required to achieve early diagnosis and prompt treatment of this potentially curable thyroid malignancy even in elderly patients. Ultrasound monitors the biopsy of suspicious lymphoma lesions and provides accurate information on treatment effects and tumor recurrence for patients presenting with malignant thyroid lymphoma after treatment, especially after chemotherapy (5).

CASE 03

03

PATIENT'S HISTORY

A 71 years old patient with a history of cardiac arrhythmia tachycardia, and recent T12 vertebral body collapse, presented for thyroid US Doppler assessment. Patient's serum TSH level was <0.01IU/l.

CHALLENGE

Subclinical hyperthyroidism is associated with increased risk of coronary heart disease mortality, incident atrial fibrillation, heart failure, fractures and excess mortality in patients with serum TSH level <0.1mIU/l with free thyroid hormone levels within their respective reference intervals. Endogenous subclinical hyperthyroidism can be caused by Graves' disease, autonomously functioning thyroid nodules and multinodular goiter (6). Consultation for this reason is frequent in daily clinical practice. However, patients frequently lack information regarding previous US thyroid gland reports, biological results and personal history.

Depicting thyroid vascular pedicles (STA) and (ITA) is sometimes challenging namely in case of enlarged thyroid, short neck or obesity of the patient. It can be quite difficult to differentiate painless auto immune lymphocytic thyroiditis (LT) from early-stage atypical Graves' disease (GD) and from toxic adenoma (TA) in a multinodular goiter.

SOLUTION

The Doppler examination provides meaningful information on the thyroid gland volume, thyroid echogenicity and echostructure, thyroid gland blood vasculature and flow. Several Doppler US techniques have been used to evaluate the thyroid gland lesion vasculature, including:

- Color Doppler ultrasonography (CDUS) combines the Doppler effect and the real-time US imaging.
- Power Doppler US (PDUS) offers an increased sensitivity for detecting low-velocity flow within small vessels.
- Spectral Doppler Ultrasonography (SDUS) is of utmost importance in the evaluation of thyroid dysfunction disorders. SDUS displays the spectrum of thyroid gland flow velocities represented graphically on the Y-axis against time on the X-axis. The Spectral Doppler mode assesses different blood flow parameters including the peak systolic velocity PSV (cm/s) and STA / ITA output (ml/min) and provides many informations in the differential diagnosis of thyrotoxicosis (7,8).

In addition, two new technologies bring novel clinical informations to the diagnosis :

- Radiant*flow*™ algorithms add a 3D-like appearance to Color Flow and Power Doppler Imaging signals. It provides clearer separation of the signal and background and helps in identifying slow flow in tiny vessels that at times can be hard to detect with traditional visualization techniques.
- B-Flow Imaging is a unique flow mode that directly images blood reflectors and tissue information simultaneously, providing an accurate morphologic display of the intraluminal blood flow throughout the entire field of view.

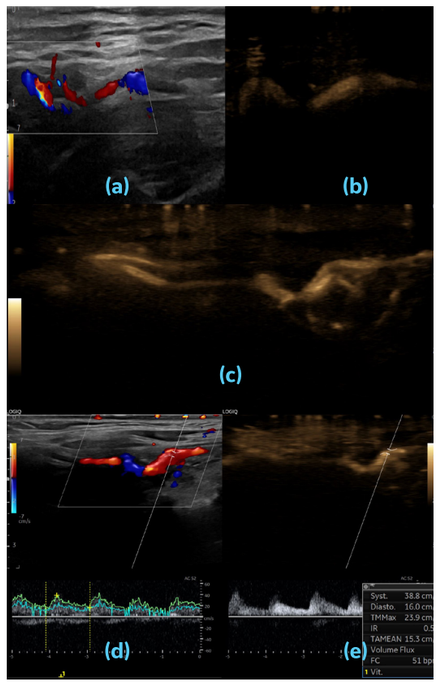


*Figure 3a- Innovative technology depicts in a very easier fashion the STA, a clearer definition of vessels is obtained in combination with Radiant*flow*™ technology (a) and B-Flow technology (b,c). Comparison of both technologies (d,e) shows a better definition of STA Doppler spectrum by using B-Flow technology.*

In this clinical case, Color Doppler and B-Flow technologies depicts in a very easier fashion the two STA & ITA pedicles, a clearer definition of vessels is obtained in combination with Radiant*flow*™ technology, showing ideally the superior thyroid and inferior thyroid pedicles, respectively at the upper and lower part of each thyroid lobe.
The vessel's diameter usually is abnormally high in case of Graves' disease, and otherwise proportionate to the size of a multinodular goiter.

Color flow hot nodules could also be differentiated from cold nodules with more prominent vascular patterns and significantly higher perinodular and intranodular signals PSV values. Doppler sonography (CFDS) can differentiate the untreated GD from the LT, which has similar gray scale findings. Mean peak systolic velocity (PSV) of superior thyroid artery (STA) PSV cutoff point ranges from 45cm/s to 50.5 cm/s to differentiate LT from GD (6-9).

Diagnosis Key: to depict STA, spot the CCA division with new flow modes is very easy namely in case of tiny thyroid vessels; moving the sagittal US probe medial to common carotid artery division and vertically allows to depict the STA either by Radiant*flow*™ or B-Flow technology (a,b,c). Spectral Doppler US can then be assessed by using an angle less than 40° with the vessel grand axis.

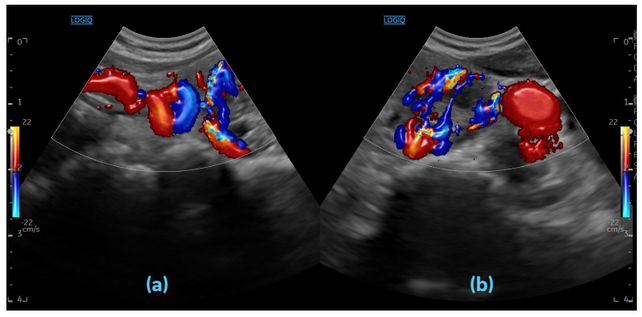
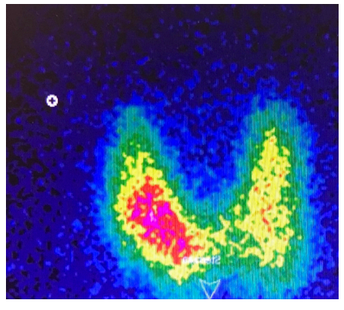


*Figure 3b- The Color Doppler combined with Radiant*flow*™ technology perfectly shows, at the upper right thyroid vicinity, the sinusoidal pathway of the superior thyroid artery (STA) and vein (STV) of the pedicle on the sagittal view (a) and the trifurcation of the STA on the axial view (b).*



Right ITA Spectral Doppler assesses high velocity (> 80cm/s), which are in favor of hyperkinetic lower thyroid autonomous nodule and hyperthyroidism.

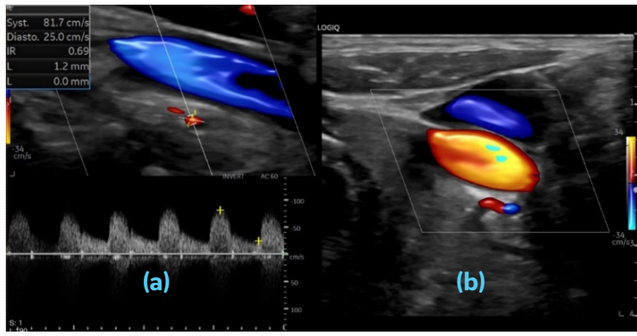


Figure 3c- Sagittal US scanning of CCA. "Dot sign" representing the ITA crossing behind the posterior aspect of the CCA (a). Axial horizontal scanning of CCA. Turning 90° the US probe displays the ITA running horizontal behind the lower thyroid (b).

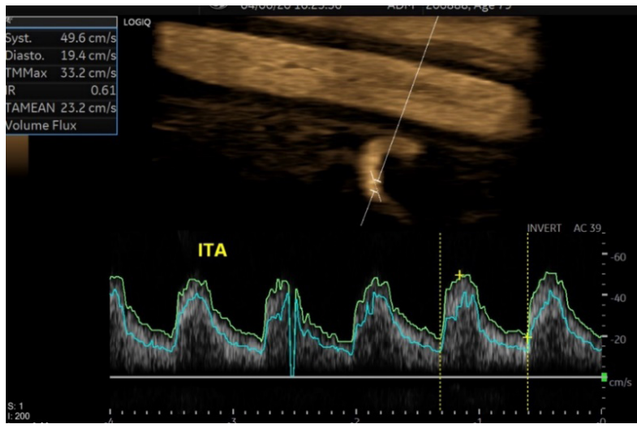


Figure 3d- Left ITA Spectral Doppler assessment with B-Flow Imaging.

Diagnosis Key: to depict the ITA, spot the CCA on a sagittal view on Color Doppler with Radiant*flow*™ technology, as shown as a dot sign behind the CCA, at the lower neck. Move the US probe to depict the typical ITA loop either on sagittal or axial planes. Spectral Doppler waveforms US of ITA can then be assessed by using an angle less than 40°. Comparison of output values between both RITA and LITA is in favor of an autonomous right lower thyroid nodule (81.7cm/s versus 49.6cm/s RITA versus LITA respectively).

Thyroid scintigram confirmed the diagnosis of right autonomous thyroid nodule.

04

CASE 04

PATIENT'S HISTORY

A rapid growing mild hypoechoic 32mm right thyroid TIRADS 4a nodule was depicted on grey scale US in a 56 years old female patient presenting with LT. Peripheral vasculature is shown on CDUS, and even more on B-Flow technology. FNAC of thyroid nodule is mandatory.

CHALLENGE

FNAC of thyroid nodule is frequently challenging due to the characteristics of either the patient (short neck, obesity, agitated and/or dyspnoeic patient), or the neck (strong heterogeneity of the thyroid gland due to auto immune infiltrative and thyroid band fibrosis, coarse calcifications, enlarged thyroid, or extra thyroid mass).

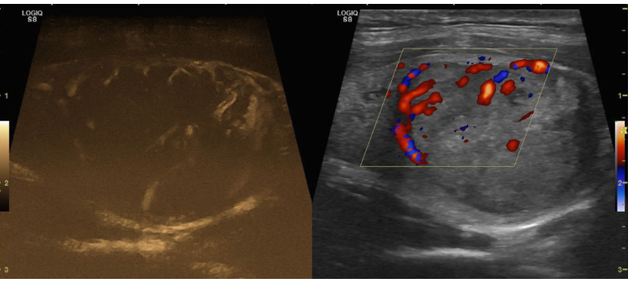


Figure 4a- B-Flow shows tiny vasculature of the thyroid nodule, whose puncture should be avoided (left). CDUS depicts larger vessels than B-Flow in this example (right).

SOLUTION

Multiparameter setting is mandatory. Choose the right probe (low frequency, large probe's footprint) to analyze the exact location, volume, anatomical landmarks and danger zones.

Each pixel of the image is focused thanks to cSound Technology. However, the perfect setting of the field of view (the optimal magnification increases the temporal resolution frame rate) of the target nodule is mandatory as well as obtaining an optimal contrast resolution (we need to decrease the dynamic range to increase the image contrast).

The assessment of the thyroid nodule's vasculature by using CDUS allows to choose the optimal percutaneous FNAC pathway, avoiding the thyroid capsular vessels. Using the MVI technology allows the subtle vessel depiction at the vicinity of the thyroid nodule capsula to prevent subcapsular haemorrhage.

The anterior jugular vein also is easily depicted at the condition the operator applies a light pressure on the US probe. Another tip is first to initiate the FNAC under MVI monitoring. Once the FNAC needle is inserted into the nodule, spot the stronger hypoechoic areas of the nodule on grey scale US, then perform various angulations of the needle to get a representative cytological sample of the target suspicious thyroid nodule.

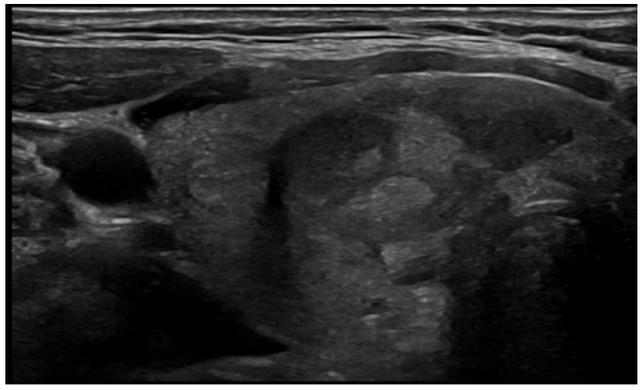


Figure 4b- Grey scale US, with ML6-15-D MHz probe displays hypoechoic areas to be preferentially aspirated during FNAC under US- monitoring.

B-Steer+ technology enhances the visualization of the FNAC needle echostructure during the interventional procedures, thus improving the operator's confidence. Note the "virtual wall" as a yellow oblique line to be perpendicular to the FNAC needle long axis:

- Left picture: the FNAC needle is introduced via an anterior left trans isthmic route to target the right thyroid nodule; the virtual yellow wall is displayed on left inferior corner of the picture.
- Right picture: the FNAC is performed via a right anterolateral route to reach the ipsilateral thyroid nodule. Note the left virtual wall, which is displayed on the right inferior corner. Comparison between MVI and grey scale allows the optimal pathway to prevent a sub capsular hemorrhage during FNAC procedure.

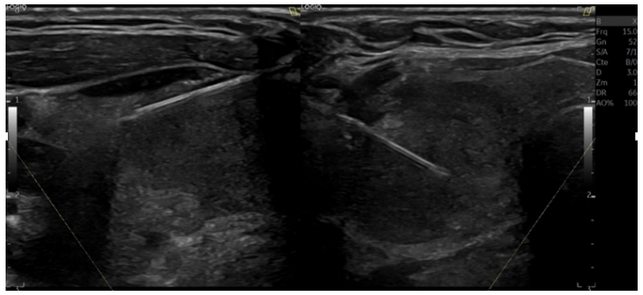


Figure 4c- Improvements of FNAC needle visualization with B-Steer+ during aspiration of right thyroid EU-TIRADS 5 nodule.

Noteworthy, the B-Flow technology depicts the capsular and subcapsular thyroid vasculature. Even though FNAC has a very low hemorrhage complication rate, the operator should not puncture the capsular vessel as this will cause a 48h constant neck pain and decrease the FNAC diagnostic accuracy.

Using CDUS or MVI monitoring increases the image contrast and decreases its temporal resolution, thus the FNAC needle motions are well depicted. In very difficult cases, the operator can memorize the back - and - forth distance of the FNAC motion under B-Steer+ monitoring, and switch to grey scale image, decrease the dynamic range to spot the hypoechoic suspicious area within the target nodule (to get a higher sensitivity of FNAC).

B-Steer+ technology enhances visualization of the needle echostructure during interventional procedures, improving the operator's confidence. A "90° US wall" is virtually shown that allows a far better visualization of the FNAC needle and its distal tip. A radial FNAC is thus possible to get a more representative cytological sample of the target thyroid nodule.

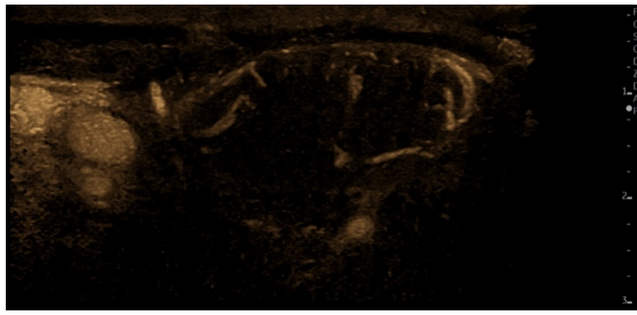


Figure 4d- Axial right thyroid nodule and capsular tiny vasculature on B-Flow technology.

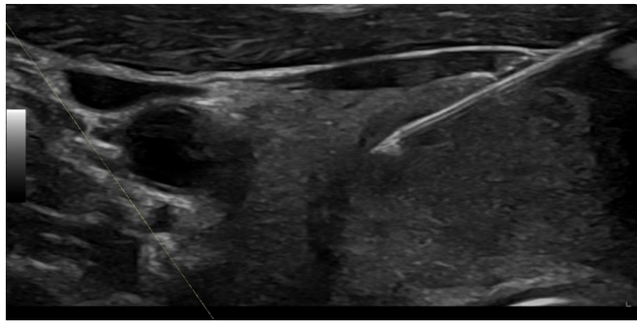


Figure 4e- B-Steer+ technology: FNAC needle must be oriented grossly perpendicular to the virtual yellow wall, and allows various subtle orientations of the FNAC needle, both superficial and in depth. Optimal visualization of the FNAC needle tip permits back- and- forth motions of the needle into the target nodule without any risk of needle misplacement or dislodgment.

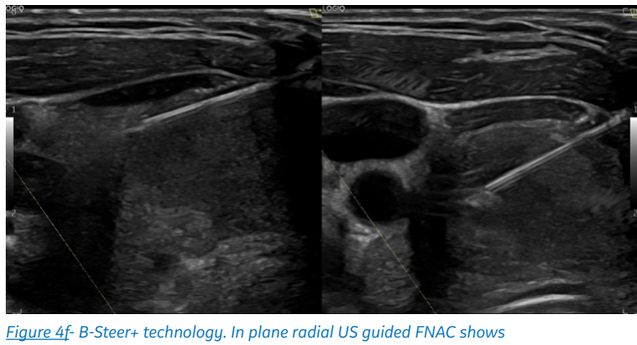


Figure 4f- B-Steer+ technology. In plane radial US guided FNAC shows various angulations of needle.

CASE 05

PATIENT'S HISTORY

A 71 years old T2N0M0- right breast cancer dyspneic female patient experienced sudden increase of breast cancer markers Ca15.3, eleven years after initial diagnosis. Clinical examination and thoraco-abdominopelvic CT scanning were unremarkable.

US of the neck disclosed infra clinic suspicious lymph node located at right level IV according to Robbins classification (3).

Thyroid gland US ruled out a thyroid tumor, thyroid gland scoring was EU-TIRADS 1 (normal parenchyma).

CHALLENGE

FNAC is challenging in this case of infra clinic supra clavicular lymph node, which is suspicious to be metastatic in a respiratory failure female patient treated with anticoagulant therapy. The suspicious lymph node is tiny, very close to the pleural dome.

SOLUTION

Accurate diagnosis and appropriate US settings led to the diagnosis of suspicious lymphadenopathy of probable breast malignant origin. FNAC of supraclavicular lymphadenopathy was the optimal solution to reach the diagnosis.

Resistive index (not shown) is high in favor of malignancy (RI >0.75), note an abnormal vascularity at the periphery and in the deep cortex of the suspicious supra clavicular level V lymph node (according to the Robbins classification) on radiant flow power Doppler imaging.

MVI technology depicts subtle tiny abnormal capsular vessels indicating tumoral neoangiogenesis due to subcapsular lymphatic sinus invasion by metastatic breast tumor cells.

FNAC was successfully performed without any hemorrhagic complication. FNAC final diagnosis was metastatic lymph node of breast origin. B-Steer+ technology displays various pathways of the FNAC needle leading to cytological diagnosis of infra clinic metastatic breast adenopathy eleven years after initial diagnosis.

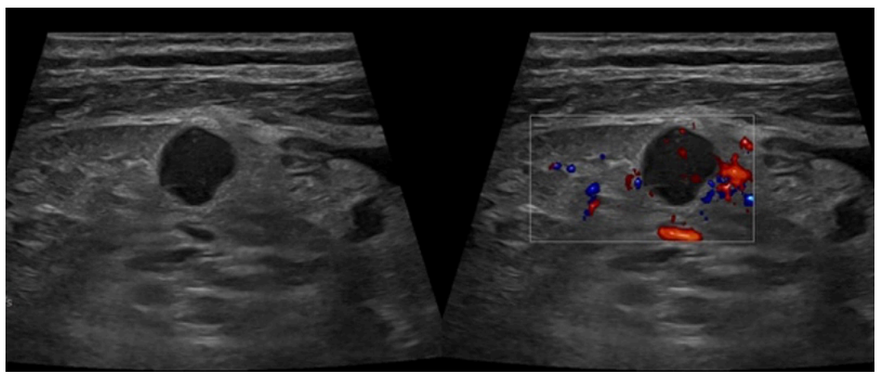


Figure 5a- Color Doppler study of the lymph node.

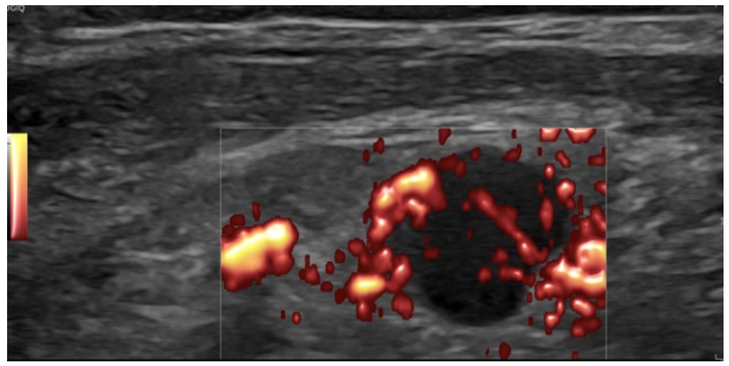


Figure 5b- PDI combined with Radiant*flow™.*

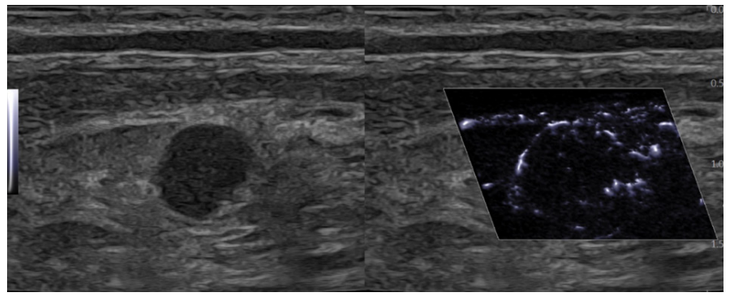


Figure 5c- Grey scale US of 7.3x 4.8mm lymph node (left) and MVI technology rules out normality of lymph node (right).

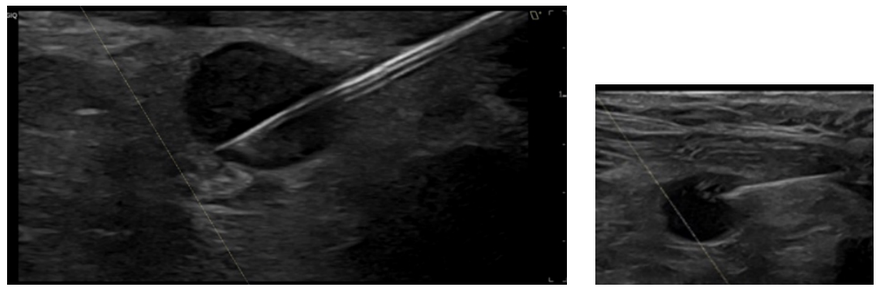


Figure 5d- B-Steer+ technology shows optimal needle track of the supraclavicular lymph node, located less than 10mm above the pleural dome.

Conclusion

Thanks to the multiparametric approach offered by the new performances of neck Ultrasound, the EU-TIRADS scoring and oncology TNM assessment are better defined.

The innovative performances of US clearly enable a better investigation for:

- In the near field of US neck probe depicting subtle tiny vessels, abnormal lymph nodes and thyroid nodules outlines
- The extra capsular spread of malignant thyroid micronodules
- Discovering neovasculature in lymph nodes
- At depth assessing small metastatic lymph nodes, or deep thyroid nodules in obese or short neck / respiratory failure patients.

Emerging technologies like Microvascular Imaging, Radiant*flow*™ or the elastography improve the US diagnosis accuracy, with new vascular or tissular informations never seen before.

The B-Steer+ technology enables a better FNAC needle visualization; this new feature gives a high operator's confidence and helps for assessing the BETHESDA SYSTEM Scoring and the danger zones in the neck.

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CCA: Common Carotid Artery
CDUS: Color Doppler Ultrasound
CNB: Core Needle Biopsy
FNAC: Fine Needle Aspiration Cytology
IJV: Internal Jugular Vein
ITA: Inferior Thyroid Artery
LT: Lymphocytic Thyroiditis
MCSG: Middle Cervical Sympathetic Ganglion
MVI: MicroVascular Imaging
NHML: Non Hodgkin Malignant Lymphoma
PD: US Power Doppler Ultrasound
PSV: Peak systolic velocity
PTC: papillary thyroid carcinoma
RFA: RadioFrequency Ablation
SDUS: Spectral Doppler Ultrasound
STA: Superior Thyroid Artery
TA: Toxic Adenoma
TPO: ThyroPerOxydase antibodies
US: Ultrasound.

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