The Neck is More than Thyroid Alone:
3 D US of Cervical Lymph Nodes, Salivary & Parathyroid Glands, Palpable/Visible Abnormalities

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The potential benefits of three-dimensional ultrasound (3D US) compared to 2D US of the neck beyond the thyroid has yet to be explored.

We will illustrate the potential benefits of adding 3D US to 2D US in evaluation of:

- Cervical lymph nodes
- Parathyroid glands
- Parotid & submandibular glands
- Palpable/visible abnormalities
Materials and Methods

3D US acquires a volume of parallel 2D US slices in one acquisition, using a dedicated 3D transducer. A structure can be viewed in three perpendicular planes at once, as with this enlarged multilobular cervical lymph node.

Using the volume analysis program (VOCAL©), a contour of a necrotic node can be generated to create a 3D “shell” of the surface geometry, as in this metastatic lymph node, and calculate an accurate volume.
Materials and Methods

3D US: Tomographic ultrasound (TUI)

Post-processing of a single data set can generate serial consecutive slices of selected thickness and orientation, as in CT or MRI; for example, in a solid tumor of the parotid gland (A; arrow), & a metastatic lymph node (B)
Normal lymph node: 2D US with color Doppler

- Cortex: Smooth, thin (<3mm)
- Hypoechoic
- Hilar flow (arrow)

Reactive cervical lymph node

2D US: Increased echogenicity of the cortex, a non-specific but abnormal appearance

3D US with color Doppler
Multiplanar coronal reconstruction aids in defining the hyperemia (arrow), predominantly hilar, typical for a reactive lymph node
Metastatic cervical lymph node

2D US with color Doppler of a lymph node with hyperemia in a patient with tall cell variant follicular cell carcinoma of the thyroid

3D US with color Doppler not only accentuates the hyperemia, but surface rendering shows the direction of flow from the periphery (arrow), typical for metastatic disease
Hodgkin's lymphoma: cervical lymph node

2D US grey scale and power Doppler:
Hypoechoic lobulated node with scattered vascularity

3D US with color Doppler:
Round, hypoechoic lymph node with intranodal reticulation (yellow arrow) hilar vascularity (pink arrow)
Parathyroid: 2D US

2 pairs of parathyroid glands:
Each gland is normally 0.5 × 0.3 × 0.1 cm
2D US appearance: hypoechoic, smoothly marginated, no hypervascularity

Abnormal

Hypoechoic or heterogeneous nodule
Well-defined margins
> 0.9 cm in any dimension
Regional increased blood flow
Characteristic peripheral vascularity
Feeding vessel from carotid artery
Multiplanar color Doppler reformatted images, including surface rendered images, demonstrate the characteristic hyperemia and peripheral vascularity (arrows). An accurate volume of this small parathyroid adenoma can be calculated using the VOCAL© program.
Normal parotid gland

Sagittal

Transverse

Color Doppler image from multiplanar reconstruction shows the ECA (yellow arrow) and retromandibular vein (pink arrow).

Anatomic Landmarks:
- Mandible (pink arrow)
- Parotid parenchyma (green arrows)

Homogeneous echogenicity, depends on fat content.

The volume data set is obtained with a stationary transducer.

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The retromandibular vein is visualized in sagittal orientation & separates the superficial and deep lobes. It is a marker for the facial nerve, whose branches are anterior.
Abnormal parotid gland: Pleomorphic adenoma

- Homogeneous, often hypoechoic, lobulated
- Well-circumscribed
- May contain calcification
- Variable vascularity
- Usually solitary, unilateral

Surface rendering of coronal image enhances appreciation of the volume of the adenoma
Normal Submandibular gland

This is an enlarged but otherwise normal right submandibular gland in a patient undergoing chemotherapy.

HG: Hyoglossus muscle
MH: Mylohyoid muscle
SM: Submandibular gland
FA: Facial artery

A series of stacked coronal images are used to evaluate the gland in small increments, useful for visualization of the Wharton duct.

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Abnormal submandibular gland: dilated Wharton duct, sialolithiasis

In this patient with pain, the 3D multiplanar reconstruction with coronal view aids in visualization of the dilated Wharton duct containing sialoliths (arrows).
Palpable abnormality: Thyroglossal duct cyst

Hypoechoic, homogeneous
Midline, or close to midline
At the level of the hyoid, or infra-hyoid,
rarely supra-hyoid
Smooth-walled, well-marginated
wall thickening due to hemorrhage,
cellular debris
Solid component is unusual,
r/o papillary carcinoma (1% patients)

Multiple reconstructions and volume calculation of a thyroglossal duct cyst with a solid component, in another patient
Conclusion

3D US is not yet widely used for assessment of the neck outside of the thyroid, but initial experience indicates that it is a useful technique.

3D US tools, which include multiplanar reconstruction, tomographic ultrasound imaging, and volumetric reconstructions, are effective and accessible.

3D US provides added diagnostic information compared to 2D US alone in multiple varied clinical applications.