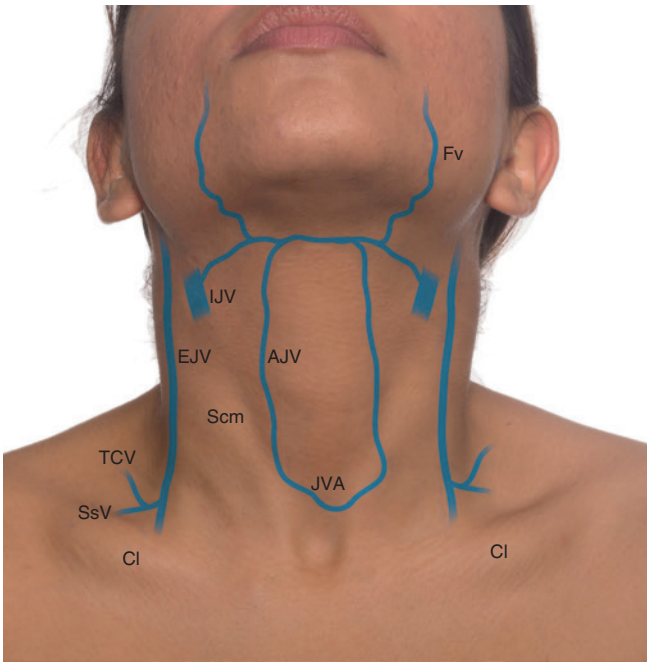


Fig. 8.25 Surface projections of the venous drainage of the head and neck. *AJV*, anterior jugular vein; *Cl*, clavicle; *EJV*, external jugular vein; *Fv*, facial vein; *IJV*, internal jugular vein; *JVA*, jugular venous arch; *Scm*, sternocleidomastoid; *SsV*, suprascapular vein; *TCV*, transverse cervical vein.

Ultrasound

EYE

Subject position

Imaging is performed with the subject sitting.

Transducer

Use a linear array transducer. Set the depth setting to 2–5 cm.

Transducer position

It is important that the eye remains closed and that sterile ultrasound gel is used. Apply adequate gel to the transducer and gently position the probe over the eyelid in transverse plane (Fig. 8.26). Tilt the probe slightly inferiorly. Avoid pressure onto the eye. After performing this examination, carefully wipe off any excess gel and rinse the eye with sterile saline.

Image features

The eyeball can be seen as a hypoechoic sphere-shaped ball (Fig. 8.26). The postremal (vitreous) chamber, which contains vitreous humor, fills much of the space. In front of the postremal chamber, the anterior chamber is in view. At

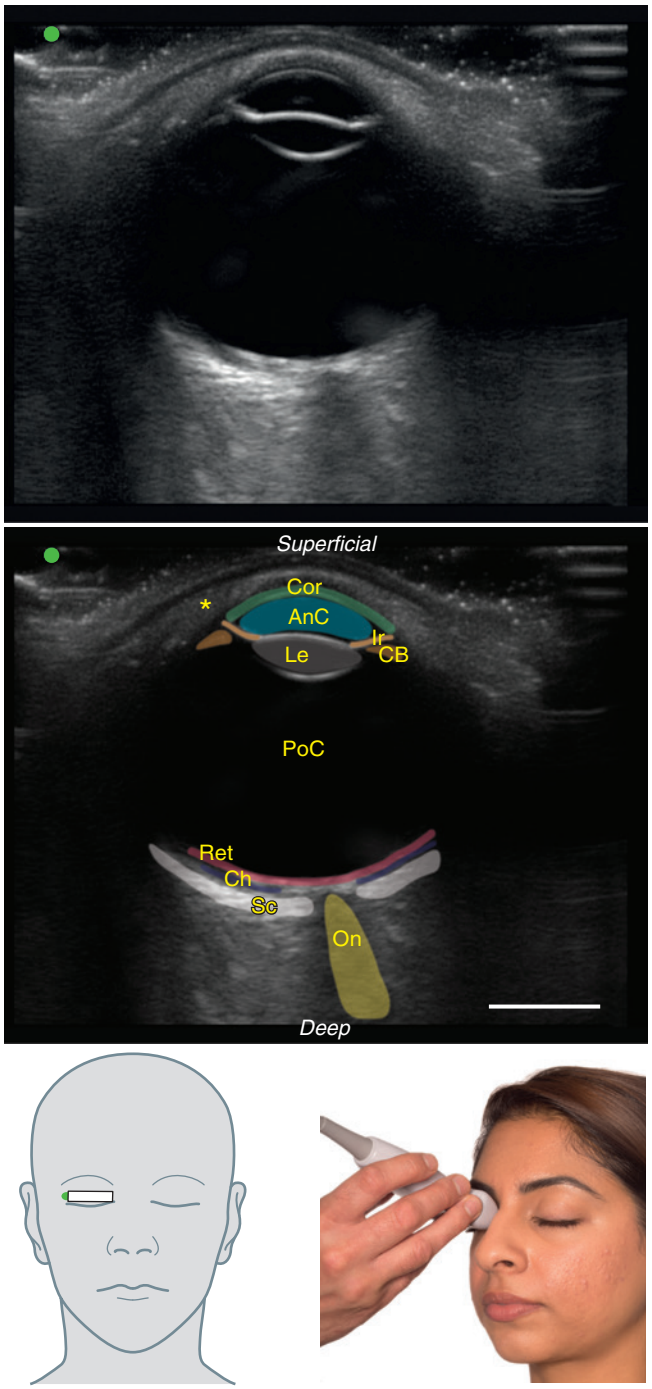


Fig. 8.26 Ultrasound of the right eye. *, eyelid; *AnC*, anterior chamber; *CB*, ciliary bodies; *Ch*, choroid; *Cor*, cornea; *Ir*, iris; *Le*, lens; *On*, optic nerve; *PoC*, postremal chamber; *Ret*, retina; *Sc*, sclera. Scale bar = 1 cm.

the front of the eyeball, the cornea appears as a thin hyperechoic line following the curve of the anterior chamber. Sitting between the anterior and postremal chambers, the iris and lens can be seen. The iris appears as two short bright streaks behind which the conical-shaped lens sits. The surfaces of the lens produce bright reflections, which outline its shape. At the iris, the cornea becomes continuous with

the outer wall of the eyeball, called the sclera. The mid-gray colored ciliary bodies can be seen sitting lateral to the lens. The inner layer of the eyeball, the retina, has a mid-gray color compared to the underlying middle layer, the choroid, which is relatively hypoechoic. The outer dense layer of the eyeball, the sclera, appears as a mid- to light-gray thick layer. The three layers of the eyeball are best examined in the posterior wall of the eyeball. Behind the eye, the optic nerve will be in view as a hypoechoic shadow.

PAROTID GLAND

Subject position

Imaging is performed with the subject sitting.

Transducer

Use a linear array transducer. Set the depth setting to 2–5 cm.

Transducer position

Position the transducer in a transverse plane immediately inferior to the ear, posterior to the ramus of the mandible, with the orientation marker to the left. Scan inferiorly toward the angle of the mandible.

Image features

Towards the right side of the image, the hyperechoic surface of the ramus of the mandible will be in view (Fig. 8.27). Superficial to the mandible, the masseter muscle can be seen. Posterior to the mandible, the large parotid gland has a homogeneous mid-gray color. Posterior to the gland, the sternocleidomastoid muscle will be in view. Scanning inferiorly through the parotid gland, it may be possible to identify intraparotid lymph nodes (Fig. 8.27A). These appear as hypoechoic ovals, approximately 3–5 mm in diameter, with a central hyperechoic hilum. Close to the ramus of the mandible, the retromandibular vein and external carotid artery (deep to the vein) can be seen in transverse orientation running parallel to the mandible. However, in some individuals, fat within the gland may prevent inspection of these vessels. Note that the facial nerve can be inspected in the anterior portion of the gland as it passes through the gland, onto the surface of the masseter muscle. To observe the facial nerve, the transducer should be positioned anterior to the ear with the orientation marker pointing cephalic. In this view, the nerve appears in the short axis. It is 1–2 mm in diameter and has a notable hyperechoic border.

SUBMANDIBULAR GLAND

Subject position

Imaging is performed with the subject sitting. The head should be tilted posteriorly.

Transducer

Use a linear array transducer. Set the depth setting to 2–5 cm.

Transducer position

Position the transducer in the transverse plane immediately anterior to the angle of the mandible (Fig. 8.28). Scan anteriorly along the body of the mandible, which should be close to the lateral edge of the transducer.

Image features

On the lateral side of the image, the hyperechoic surface of the angle of the mandible will be in view (Fig. 8.28). Scanning from posterior to anterior, along the length of the body of the mandible, the submandibular gland will appear as a large triangular structure with a homogenous mid-gray color. It should be noted that the inferior portion of the parotid gland can be seen at the angle of the mandible and should not be mistaken for the submandibular gland, which sits anterior to the parotid. Towards the medial side of the submandibular gland, the facial artery can be observed. Deep to the facial artery, the submandibular duct will be in view. Both structures are observed in the transverse plane. Doppler can be used to distinguish the artery from the duct. In contrast to the artery, there will be no signal from the duct. Scanning toward the anterior of the gland, the mylohyoid muscle will be seen as a hypoechoic band passing obliquely across the image from the mandible toward the hyoid. Sitting either side of this muscle, the superficial and deep parts of the submandibular gland will be in view. Scanning anteriorly, the course of the facial artery can be inspected as it runs superficially over the gland toward the ramus of the mandible (Figs. 8.28B and C). The sublingual gland will come into view anterior to the submandibular gland.

FLOOR OF THE ORAL CAVITY

Subject position

Imaging is performed with the subject sitting. The head is best tilted posteriorly.

Transducer

Use a linear array transducer. Set the depth setting to 2–5 cm.

Transducer position

Position the transducer in the transverse plane immediately posterior to the chin (Fig. 8.29). Scan in a posterior direction toward the hyoid bone.

Image features

At either side of the image, shadows formed by the body of the mandible may be visible (Fig. 8.29). In this position,

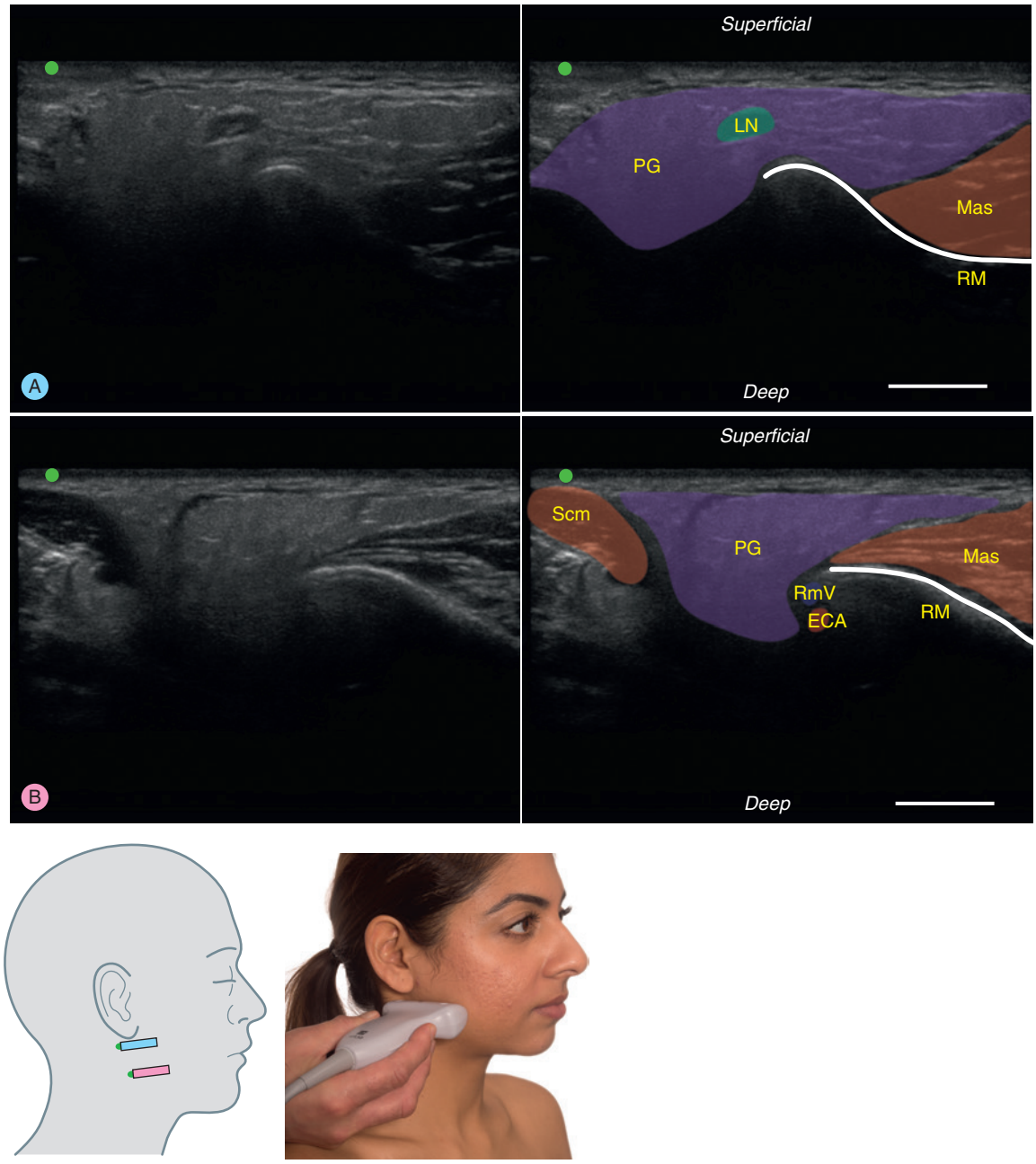


Fig. 8.27 Ultrasound of the right parotid gland. A, Immediately inferior to the ear. B, Inferior level. *ECA*, external carotid artery; *LN*, lymph node; *Mas*, masseter; *PG*, parotid gland; *RM*, ramus mandible; *RmV*, retromandibular vein; *Scm*, sternocleidomastoid. Scale bar = 1 cm.

the suprahyoid muscles in the floor of the oral cavity can be observed in short axis view. Superficially, the anterior bellies of the left and right digastric muscles can be seen. Deep to the digastric muscles, the two mylohyoid muscles form a narrow arc across the image. Sitting below the mylohyoid muscles, the geniohyoid muscles can be observed. Deep to the geniohyoid muscles, the genioglossus muscles will be in view. Swallowing will cause contraction of these muscles. Sitting lateral to the genioglossus muscles, the sublingual glands are visible, which have a homogenous mid-gray color, and are lighter compared to the adjacent muscle. On the medial side of each gland, the sublingual vessels and submandibular duct may be visible.

CAROTID SYSTEM

Subject position

Imaging is performed with the subject sitting and the head rotated to the side.

Transducer

Use a linear array transducer. Set the depth setting to 2–5 cm.

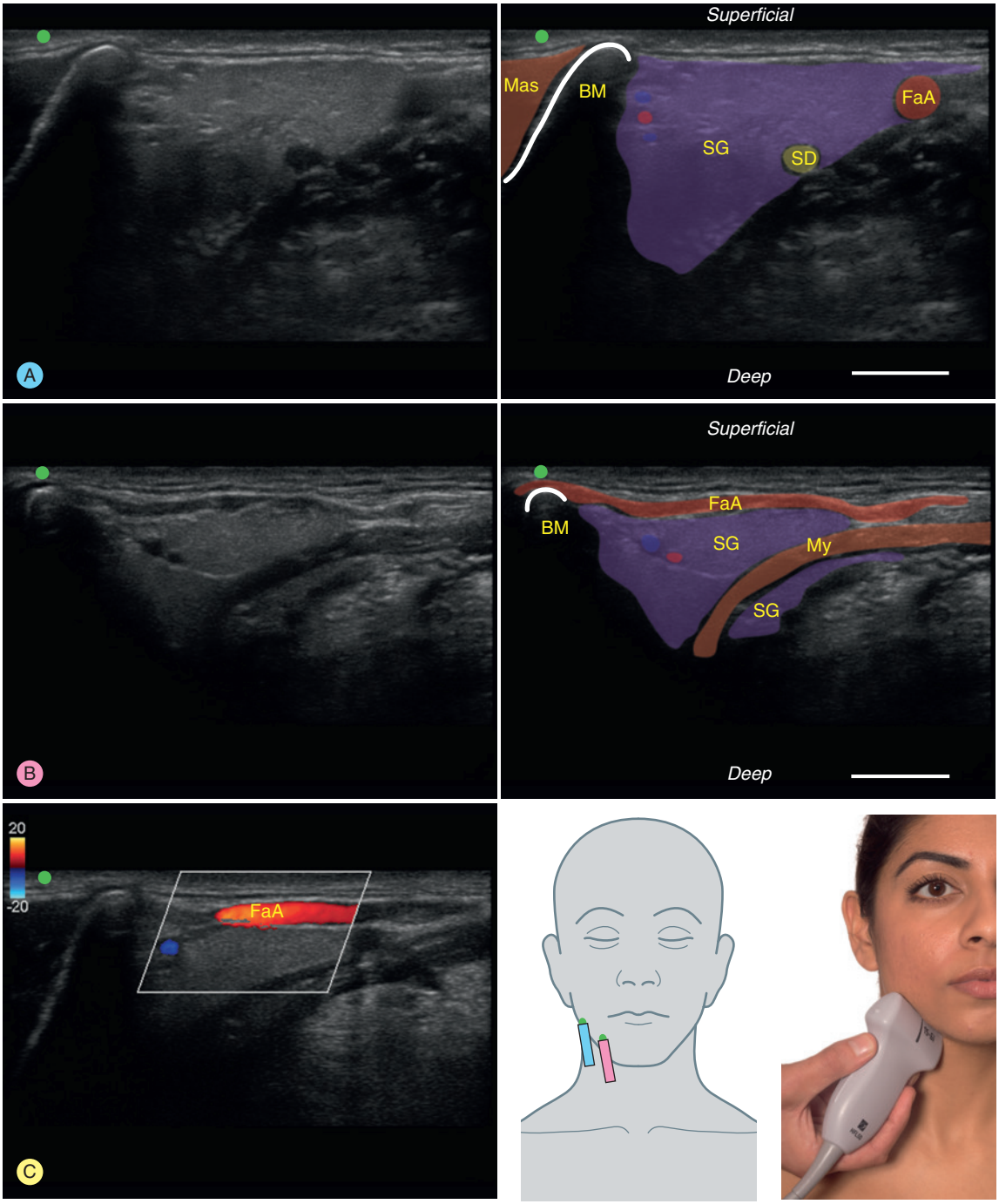
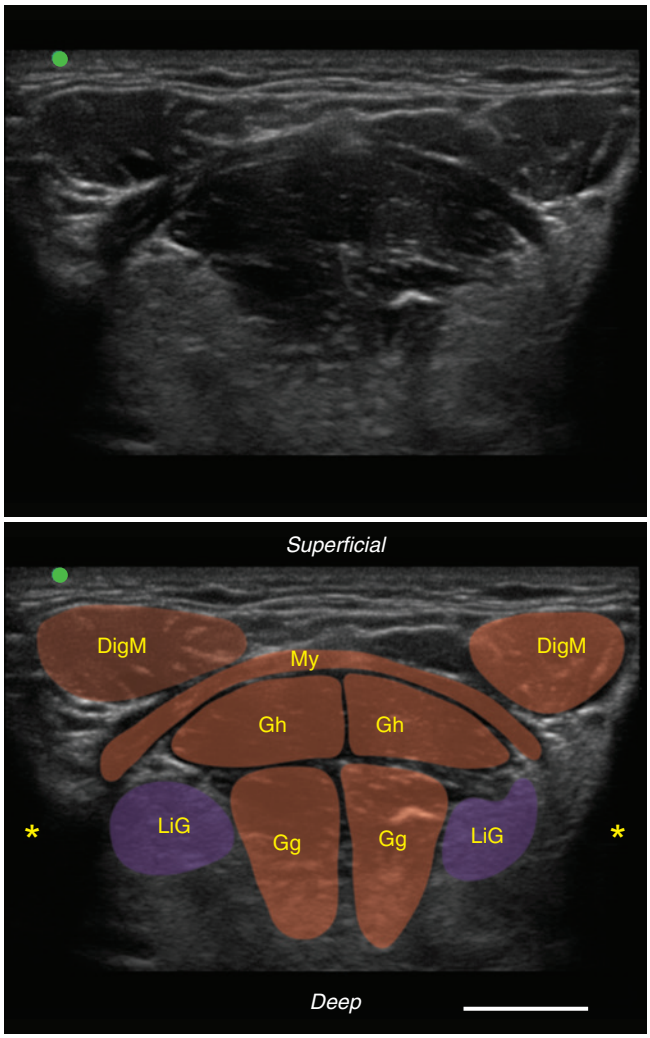


Fig. 8.28 A, B, Ultrasound of the right submandibular gland. A. Posterior mandible. B. Anterior mandible. C, Doppler of the facial artery. *BM*, body mandible; *FaA*, facial artery; *Mas*, masseter; *My*, mylohyoid muscle; *SD*, submandibular duct; *SG*, submandibular gland. Scale bar = 1 cm.



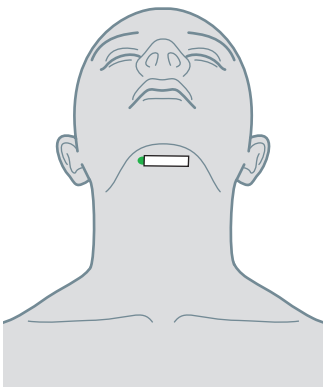


Fig. 8.29 Ultrasound of the floor of the oral cavity. *, shadows due to body of mandible; *DigM*, digastric muscle; *Gg*, genioglossus muscle; *Gh*, geniohyoid muscle; *LiG*, lingual gland; *My*, mylohyoid muscle. Scale bar = 1 cm.

Transducer position

Position the transducer in transverse plane on the anterior surface of the neck, immediately superior to the clavicle, to the right or left side of the midline (Fig. 8.30). Scan in a superior direction following the sternocleidomastoid muscle.

Image features

Scanning in a superior direction from the lower part of the neck, the large sternocleidomastoid muscle can be observed in its short-axis (Fig. 8.30). It lies superficially across the image and has a flattened appearance. Immediately below the surface, above the sternocleidomastoid muscle, the thin layer formed by the platysma muscle will be visible. Deep to the sternocleidomastoid muscle, the common carotid artery and internal jugular vein can be inspected. The artery lies medial and deep to the vein, and is more rounded. The vein appears flattened. Doppler can be used to examine blood flow within these vessels (Video 8.1). Sitting between the artery and vein, the vagus nerve may be visible. These three structures are surrounded by the hyperechoic carotid sheath. Lateral to this neurovascular bundle (left on image), the anterior scalene muscle can be observed. Sitting on the anterior wall of this muscle, the small phrenic nerve can be seen as it descends over the surface of the muscle. In the inferior part of the neck (Fig. 8.30A), immediately postero-lateral to the anterior scalene muscle, the trunks of the brachial plexus can be seen in their short-axis. The trunks appear as three hypoechoic circles. Deep to the common carotid artery, the longus colli muscle will be visible. Towards the midline, the sternothyroid (inferiorly) and sternohyoid (superiorly) muscles can be seen medial to the sternocleidomastoid muscle. Deep to the sternothyroid, the thyroid gland can be examined (see below).

Scanning superiorly, the course of the common carotid artery and internal jugular vein can be inspected. Immediately inferior to the level of the thyroid cartilage, the superior belly of the omohyoid muscle is observed extending immediately below the sternocleidomastoid muscle (Fig. 8.30B). Towards the midline of the neck, deep to the omohyoid, the sternohyoid and sternothyroid muscles can be inspected.

Scanning superior to the level of the thyroid cartilage (at the level of the C4 vertebra), the common carotid artery bifurcates into the internal and external carotid arteries. There is, however, considerable variability in the position of the bifurcation of this vessel. The thyroid cartilage appears anechoic and cannot easily be inspected on ultrasound. At the start of its course, the internal carotid artery sits lateral to the external carotid artery. At this location, the carotid sinus (a dilation in the wall of the internal carotid artery) can be inspected. Anterior to the carotid artery

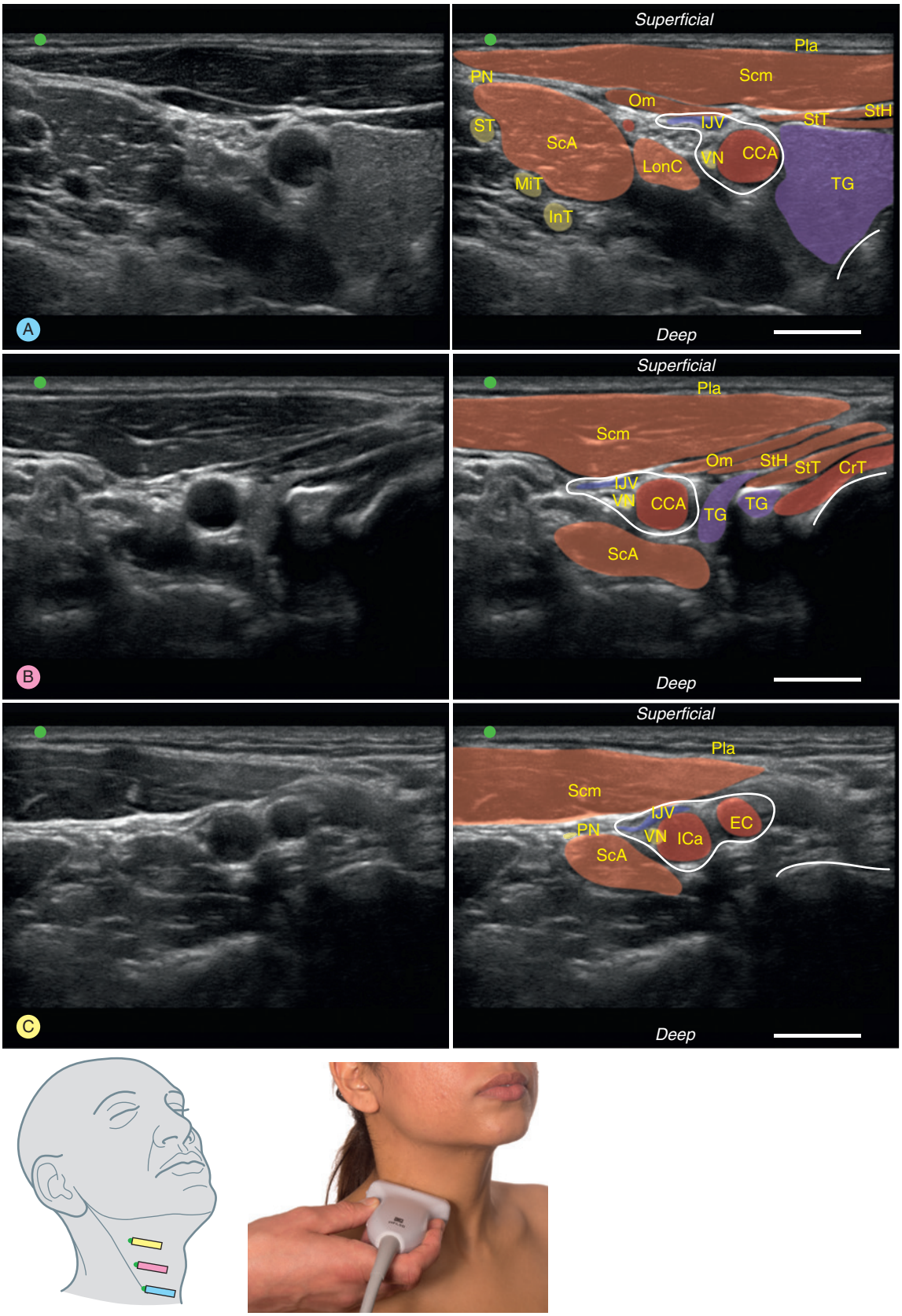


Fig. 8.30 Ultrasound of the right carotid system. A, Inferior neck. B, Mid neck. C, Superior neck. *CCA*, common carotid artery; *CrT*, cricothyroid; *EC*, external carotid; *ICa*: internal carotid; *IJV*, internal jugular vein; *InT*, inferior trunk; *LonC*, longus colli; *MiT*, middle trunk; *Om*, omohyoid; *Pla*, platysma; *PN*, phrenic nerve; *ScA*, scalenus anterior; *Scm*, sternocleidomastoid; *ST*, superior trunk; *StH*, sternohyoid; *StT*, sternothyroid; *TG*, thyroid gland; *VN*, vagus nerve. Scale bar = 1 cm.

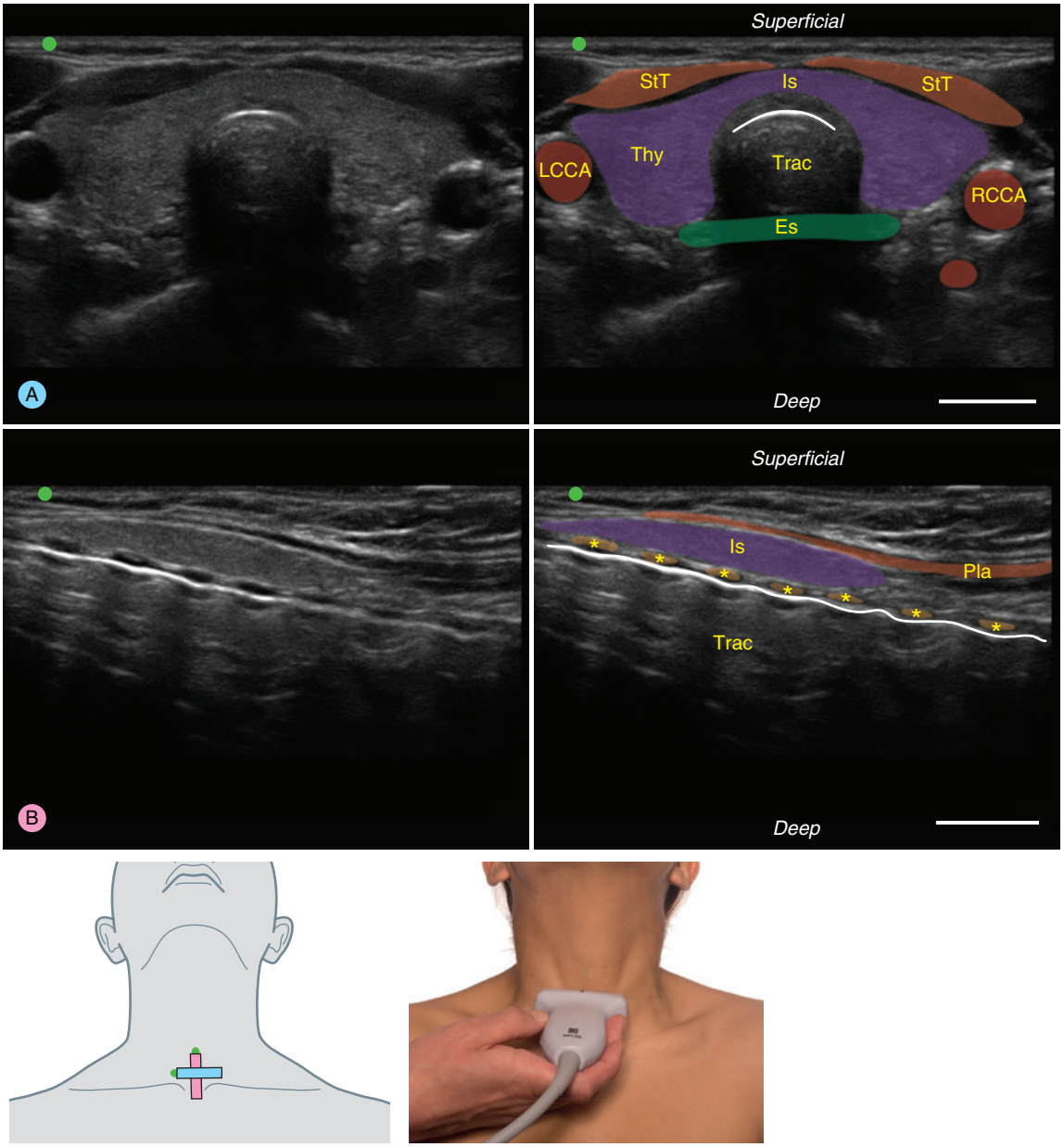


Fig. 8.31 Ultrasound of the thyroid gland. A. Short-axis view. B. Long-axis view. White line in B represents the air-mucosal interface. *, cartilaginous rings of the trachea; *Es*, esophagus; *Is*, isthmus; *LCCA*, left common carotid artery; *Pla*, platysma; *RCCA*, right common carotid artery; *StT*, sternothyroid; *Thy*, thyroid; *Trac*, trachea. Scale bar = 1 cm.

the flattened internal jugular vein is seen. Overlying the neurovascular bundle the sternocleidomastoid muscle will be in view.

THYROID GLAND

Subject position

Imaging is performed with the subject sitting.

Transducer

Use a linear array transducer. Set the depth setting to 2–5 cm.

Transducer position

Position the transducer across the midline immediately below the thyroid cartilage in the transverse plane for short-axis views or mid-sagittal plane for long-axis views (Fig. 8.31).

Image features

As with all glands, the thyroid gland has a homogenous mid-gray texture. In the transverse plane, the two lobes fill much of the image (Fig. 8.31A). The isthmus can be seen joining the lobes. Along the midline, the anterior surfaces of the tracheal rings appear as hyperechoic arcs, whereas

the lumen is anechoic. Posterior to the trachea, the lateral hyperechoic curved edges of the esophagus may be visible as it extends beyond the edges of the trachea. The esophagus cannot be observed directly behind the trachea. Lateral to the thyroid, the common carotid vessels will be in view.

In the sagittal plane, the isthmus of the thyroid gland can be inspected (Fig. 8.31B). Deep to the isthmus, the cartilaginous rings of the trachea will be in view. Immediately below the rings, a hyperechoic wavy line will be visible on the anterior wall of the trachea. This line is formed by the air-mucosal interface. Deep to the air-mucosal interface, a reverberation artifact can be observed within the trachea.

POSTERIOR TRIANGLE OF NECK

With the transducer positioned lateral to sternocleidomastoid muscle in line with the clavicle, the subclavian artery, vein and brachial plexus can be inspected (see Chapter 6).

In the Clinic

Ultrasound provides an effective tool for examining a range of structures within the head and neck. In particular, B-mode imaging is used to examine the glands and palpable masses in the neck. This includes the cervical lymph nodes, where ultrasound can be used to identify metastatic malignant nodes, as well as the presence of lymphadenopathy. The salivary glands are routinely assessed by ultrasound for signs of swelling, which may be associated with inflammation or obstructive calculi (sialolithiasis), as well as for the presence of cysts and neoplasms. In the thyroid gland, thyroid nodules are identified using ultrasound. Furthermore, fine needle aspiration of such nodules is performed under ultrasound guidance. Congenital lesions, such as lymphangiomas, can be relatively easily assessed with ultrasound in children. B-mode imaging also provides a tool for assessing trauma to the neck, such as injury to the larynx or trachea. Importantly, during assessment of the neck, Doppler imaging, in particular power Doppler, is used to assess the vascularity of localized masses and the glands to assist in diagnosis. Doppler ultrasound is also used to examine blood flow within the carotid arteries (carotid Doppler). In particular, it is used in the screening and evaluation of carotid artery stenosis or occlusion. Table 8.4 provides an overview of some of the head and neck conditions that can be diagnosed or monitored by ultrasound.

Table 8.4 Head and neck conditions that can be diagnosed or monitored by ultrasound

Structure	Pathology
Eye	Vitreous hemorrhage, cataracts, retinal detachment, lens implants, retinoblastoma, melanoma
Salivary glands	Abscess formation, sialolithiasis, sialadenitis, cysts, neoplasms
Thyroid	Thyroid nodules, adenomas, thyroid malignancy
Lymph nodes	Lymphadenopathy, malignant lymph nodes, core sampling for lymphoma
Carotid arteries	Carotid artery stenosis

Summary Checklist

- Surface projections of the bones of the skull
- Surface projections of eye, ear, nose and oral cavity
- Surface projections of the neuro-vasculature in the head and neck
- Ultrasound imaging of the vasculature in the neck
- Ultrasound imaging of the eye
- Ultrasound imaging of the glands of the neck