

Teaching Case

A radiation oncologist's guide to contour the parotid gland



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Introduction

The parotid gland is the largest of the salivary glands and is primarily responsible for salivation and prevention of dry mouth as well as oral health. Routinely, the parotid gland is near target in head and neck cancer cases. It is critical that attention be given to avoid unnecessary dose to the parotid glands to preserve saliva, taste, and oral health.

The facial nerve (CN VII) passes through the gland and divides it into the superficial and deep lobes. Anteriorly, it overlies the lateral surface of the masseter muscle; laterally, it is surrounded by subcutaneous fat planes of the cheek; and posterosuperiorly, it is bounded by the external auditory canal. The deep lobe is medial to CN VII and is bound by the parapharyngeal space medially, the mastoid process of the temporal bone posteriorly, and the ramus of the mandible anteriorly. Superiorly, the deep lobe extends to the level of the stylomastoid foramen.^{1,2}

It should be noted that, inferiorly, below the angle of the mandible, the parotid tail inserts between platysma and sternocleidomastoid muscle in the area of the posterior submandibular space. Although the gland is divided into the 2 lobes, this anatomical distinction does not aid in the contouring process. However, the retromandibular vein, which is seen coursing through the deep lobe just along the medial margin of CN VII, may be useful for the radiation oncologist. There may be circumstances in which it would

be useful to contour the superficial lobe separate from the deep lobe and this landmark could be useful by using the lateral edge of the retromandibular vein to distinguish.

An accessory parotid gland may be noted in 21% to 61% of individuals, according to various autopsy studies.³ This is normal salivary tissue present in close association or anterior to Stensen's duct, lying on the masseter muscle but not contiguous with the "main" parotid gland. Although it is not clear that it is important to include this tissue in the parotid gland contour, it has been described for physicians so that it may be included.

Although a recent paper indicates boundaries for the gland,⁴ there is no additional information on how to identify the gland or on nuances of the identification. The consensus panel indicates that the cranial border is the external auditory canal and mastoid process and that the caudal border is the posterior aspect of the submandibular space. Anteriorly, the masseter muscle posterior border as well as the mandibular bone and medial and lateral pterygoid muscles are the border. The anterior belly of the sternocleidomastoid muscle and the lateral side of the posterior border of the digastric muscle are recognized as the posterior border. Laterally, the border is the platysma and the subcutaneous fat. Medially, the posterior belly of the digastric muscle, the styloid process, and the parapharyngeal space are the borders of the gland; this is simplified in Table 1.

It is recommended to include the carotid artery, retromandibular vein, and extracranial facial nerve in the contours.

Although the borders are specific, it may be difficult to identify each of these areas, and there may be variation of

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Table 1 Anatomic boundaries of parotid gland

Cranial	Caudal	Anterior	Posterior	Lateral	Medial
External auditory canal and mastoid process	Posterior aspect of the submandibular space	Masseter muscle, posterior border mandibular bone, medial and lateral pterygoid muscles	Anterior belly sternocleidomastoid, lateral side of posterior belly of the digastric muscle (posteromedial)	Subcutaneous fat, platysma	Posterior belly of digastric muscle, styloid process, parapharyngeal space

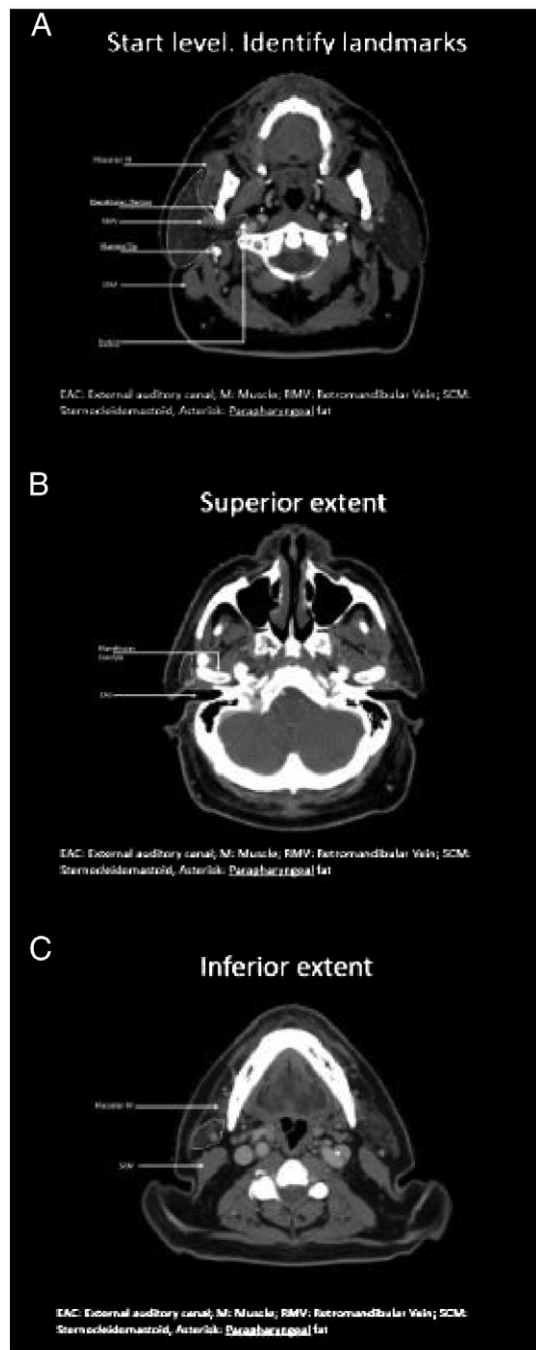


Fig. 1 Start level. (A) Identify landmarks. (B) Superior extent. (C) Inferior extent. EAC, external auditory canal; M, muscle; RMV, retromandibular vein; SCM, sternocleidomastoid. *Parapharyngeal fat.

the lobe with an accessory gland or areas that are difficult to delineate and identify; therefore, this paper aims to further address these issues and help the radiation oncologist specifically identify the regions recognized as borders.

Contouring guidelines

The parotid gland is clearly visible on computed tomography (CT) and magnetic resonance imaging. Though it may be seen more clearly, it will be discussed with regards to characteristics on CT scan because the radiation oncologist will contour on a CT. Intravenous contrast is recommended because the gland diffusely enhances, which helps to delineate it from the adjacent structures. See Fig 1A–C for the associated axial cuts to aid in the understanding of the text.

Because the upper and lower aspects of the gland are more difficult to identify, we suggest starting by identifying the “mid” aspect of the gland and then working cranially and caudally.

Step 1. Using a contrast CT, identify the salt and pepper appearing gland on axial images. The largest cross-sectional area of the gland will be seen at the level of upper one-third of the mandibular ramus. Additional landmarks at that level include the retromandibular vein, the posterior auricular artery, and the parapharyngeal space.

Step 2. Identify the axial image that shows the mandibular ramus, tip of the mastoid, and the styloid process. These are 3 easily identifiable bony landmarks. The masseter and sternocleidomastoid (SCM) muscles will be easily identifiable on the same image (Fig 1A). The gland is prominent and easily identifiable at this level. It will be limited by the SCM and mastoid tip posteriorly, by parapharyngeal fat medially, and may extend along the lateral margin of masseter muscle. It is important to cover the superficial portion as it covers the masseter muscle. Posteriorly, the sternocleidomastoid muscle and digastric muscle are guides for the gland. Contrast is particularly helpful for separating out the medial lying digastric muscle.

The retromandibular vein is often seen at this level as well. An imaginary line lateral to the vein and parallel to the mandibular ramus would represent the course of the facial nerve.

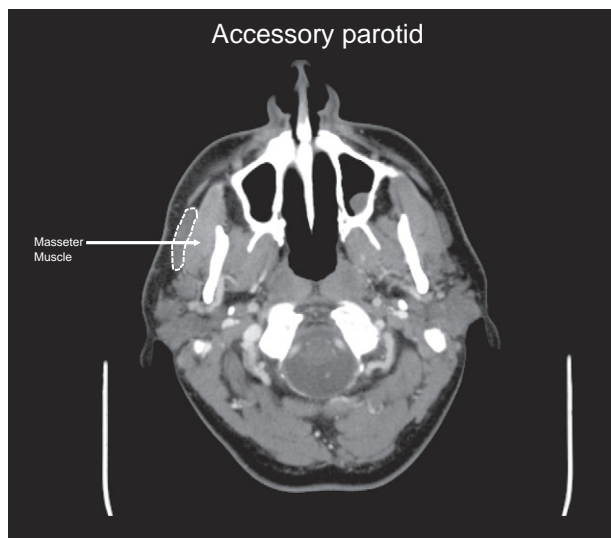


Fig. 2 Accessory parotid.

Step 3. Cranial extent. Contour the gland cranially. The superior most extent will be at the axial level of the external auditory canal. The parotid will be bound posteriorly by the anterior wall of the external auditory canal wall and medially by the mandibular condyle.

Step 4. Caudal extent. Delineate the gland caudally. Using the start point (Fig 1A), contour the gland as it extends caudally between the SCM and masseter muscle. Keep in mind that the parotid tail may extend all the way to the axial level of the submandibular gland.

Accessory parotid and Stenson's duct

When present, the accessory parotid will be easily identified as soft tissue density lateral to the masseter muscle (Fig 2). Keep in mind that the accessory parotid can have different CT density or magnetic resonance imaging signal intensity from the remainder of the parotid.

Stenson's duct

A landmark for identifying Stenson's duct is the anterior facial vein. On axial images, Stenson's duct will be seen coursing horizontally into the buccal space

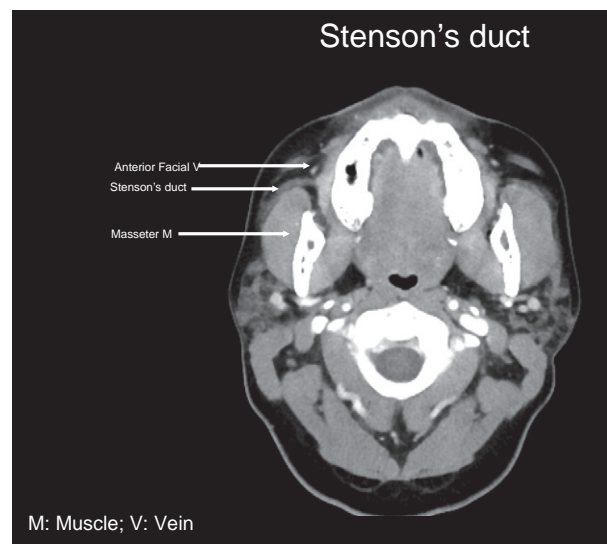


Fig. 3 Stenson's duct. M, muscle; V, vein.

between the anterior facial vein (anterior to the duct) and the masseter muscle (posterior to the duct) (Fig 3).

Conclusion

These instructions will help radiation oncologists contour the parotid as is done in national protocols.

References

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