

# Cranial Nerves IX-XII Contouring Atlas for Head and Neck Cancer

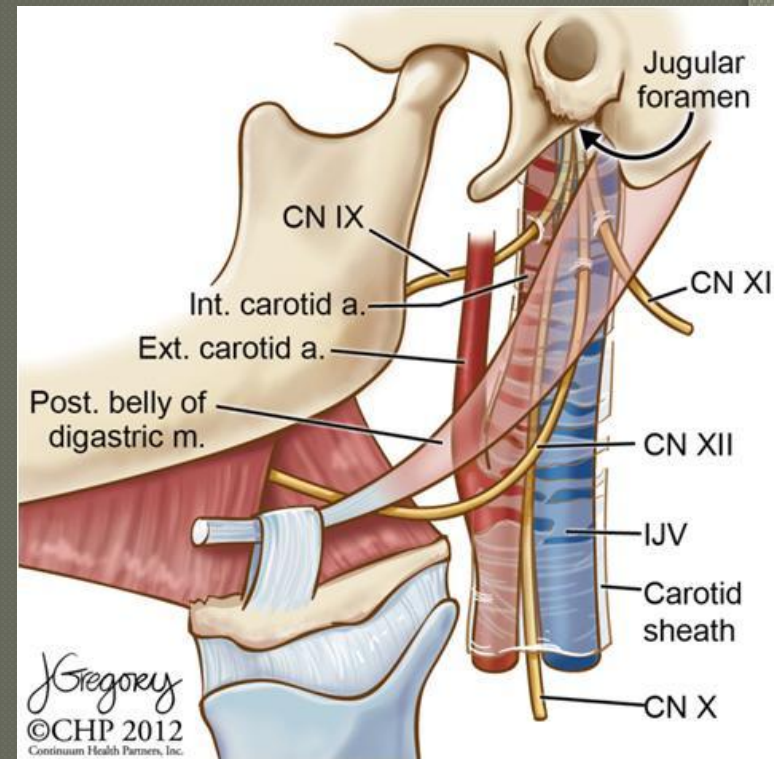
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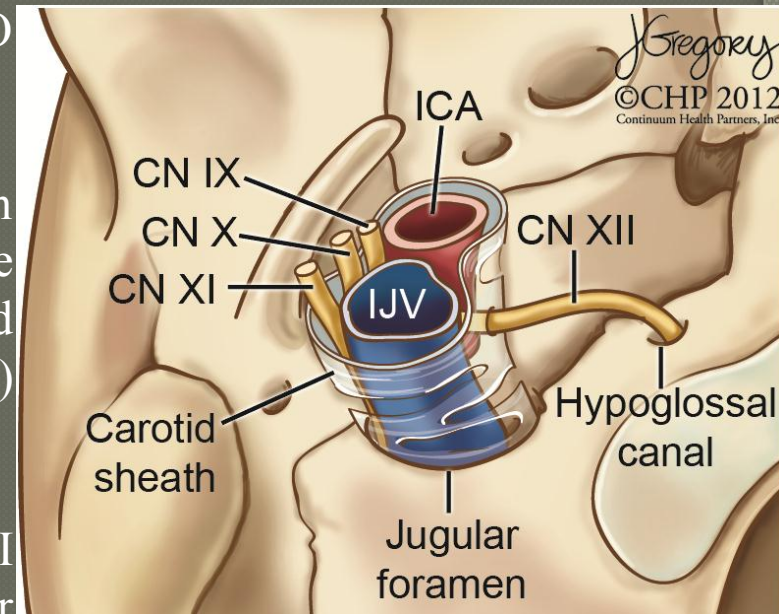
- Due to anatomical nature of CNs IX, X and XI, they were grouped as one structure while CN XII was contoured individually.
- XII CN emerges from the ventrolateral aspect of the MO and enters the hypoglossal canal and then exits from skull base.
- It proceeds to run behind the X CN, and then between the internal jugular vein (IJV) and internal carotid artery (ICA) until the lower border of C3.
- At this level it travels lateral to the bifurcation of the common carotid and loops anteriorly above the greater horn of the hyoid bone to run on the lateral surface of the hyoglossus muscle (Figures B 1-3).



**Medical illustration of the cranial nerves (CNs) IX-XII routes via skull base and upper neck.**

# Cranial Nerves IX-XII Contouring Atlas for Head and Neck Cancer

- CNs IX-XI emerge from the lateral aspect of the MO and pass through the jugular foramen (JF).
- After their exit from the JF they pass vertically down the neck within the carotid sheath, lying between the IJV and ICA as far as the upper border of the thyroid cartilage (i.e. at the level of lower border of C4) (Figures A 1-14).
- For the sake of ease we recommend stop all CN IX-XII contouring at the upper border of hyoid bone or lower border of C3 (i.e. bifurcation of the carotid artery).



**Medical illustration of the cranial nerves (CNs) IX-XII routes via skull base and upper neck.**

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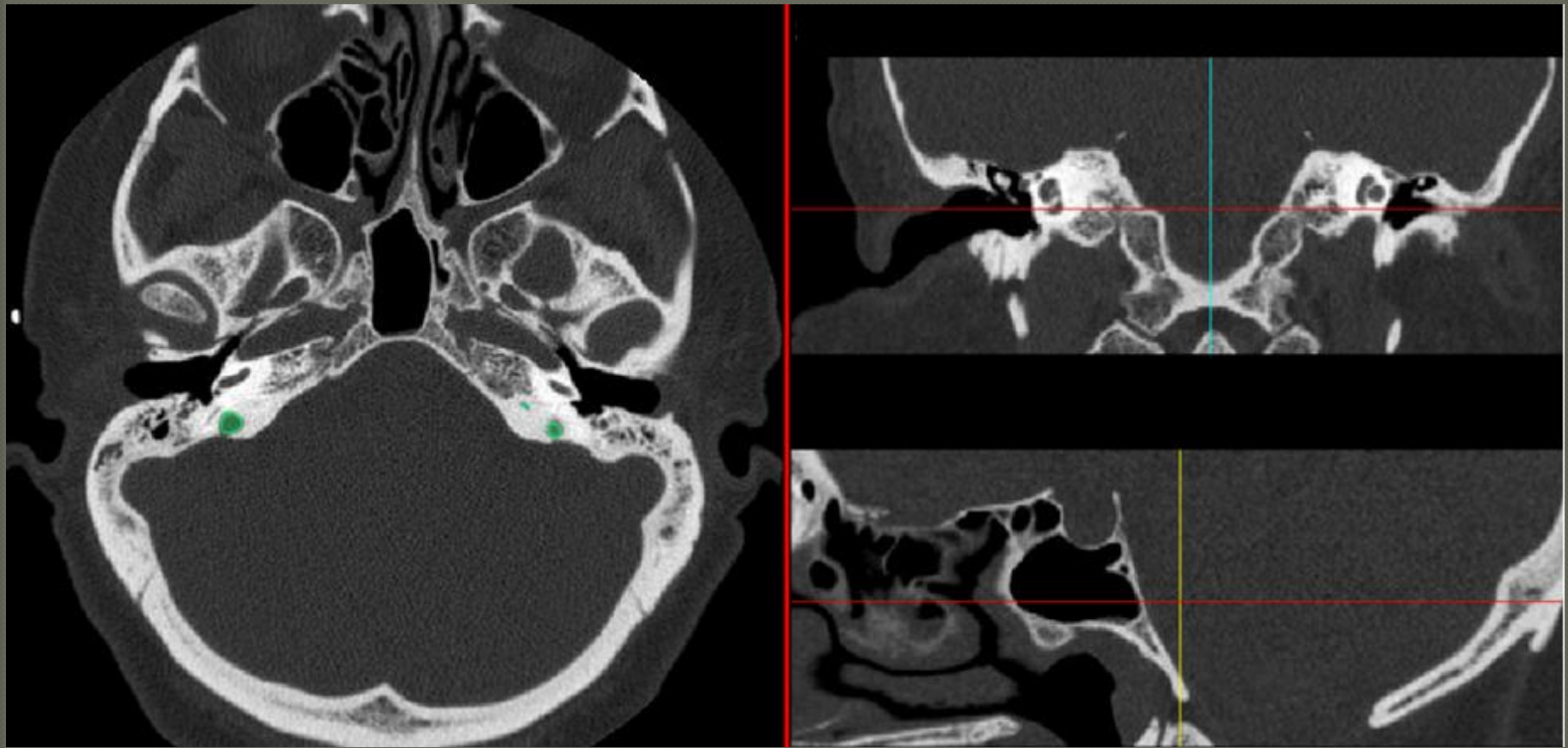
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## Developing contouring atlas

- CT simulation ( $\pm$ IV contrast) while head in neutral position and immobilized with extended thermoplastic mask.
- CT slice thickness should be  $\leq 2.5$  mm
- Use a 3 mm contouring brush.
- Identify, contour, and follow the space in the JF (green) and hypoglossal canal (yellow).
- CNs IX-XI OAR in green and CN XII OAR in yellow.
- For CN XII identify and follow the hypoglossal canal (yellow).
- For CN IX, X, and XI: identify and follow the JF (green).
- Of note, the JF has 2 foramina the pars nervosa contains the CN IX (dark green) and the pars venosa contains the CN X and XI.
- All CNs (IX-XII) exit skull base and lie within the carotid sheath, between the IJV and ICA.
- From that level contour the ICA with 3 mm margin expansion to ensure including the carotid sheath, CN IX-XII, and the anterior portion of the IJV.
- Continue to contour the CNs following the ICA down to the bifurcation of the common carotid, or lower border of C3. We don't recommend the upper border of hyoid bone as landmark as it moves with swallowing.



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Start contouring at that level of intracranial opening of jugular foramen (JF); identify and follow the 2 foramina; the anteromedial foramen (pars nervosa-smaller foramen) contains the CN IX (green) and the posterolateral foramen (pars venosa-wider foramen) contains the CN X and XI (lemon green).

# Cranial Nerves IX-XII Contouring Atlas for Head and Neck Cancer



Contour the CN IX-XI (green) following the JF and internal carotid artery (ICA) down to the lower border of C3 (i.e. bifurcation of the common carotid artery -CCA)

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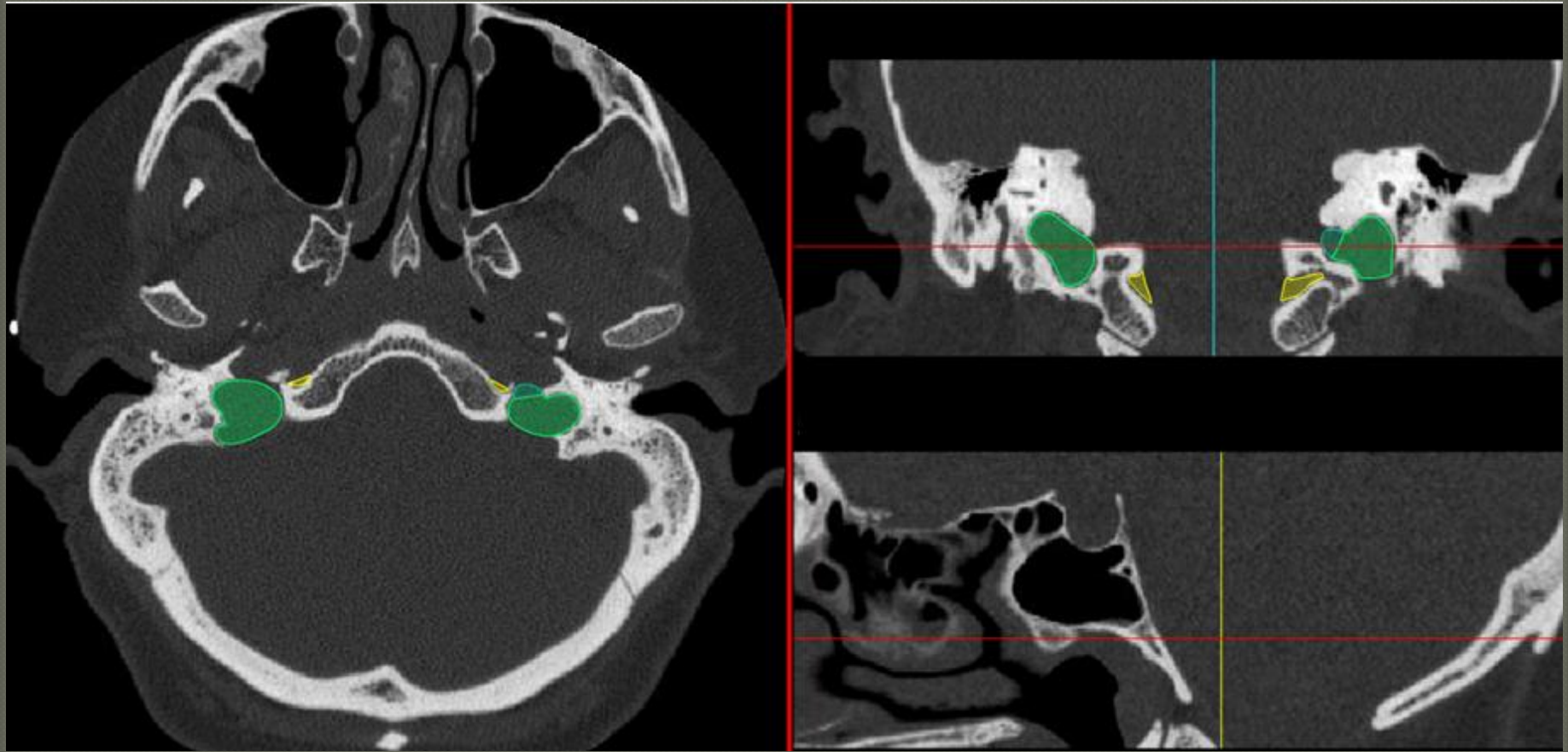
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The 2 foramina meet and form the JF at which all IX-XI merge and exit skull base.  
keep contouring the CN IX-XI (green) along the ICA sheath down to the lower border of C3.



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At the level of intracranial opening of hypoglossal canal start contouring the CN XII (yellow) down to the lower border of C3 where CN XII follows the lingual artery course.

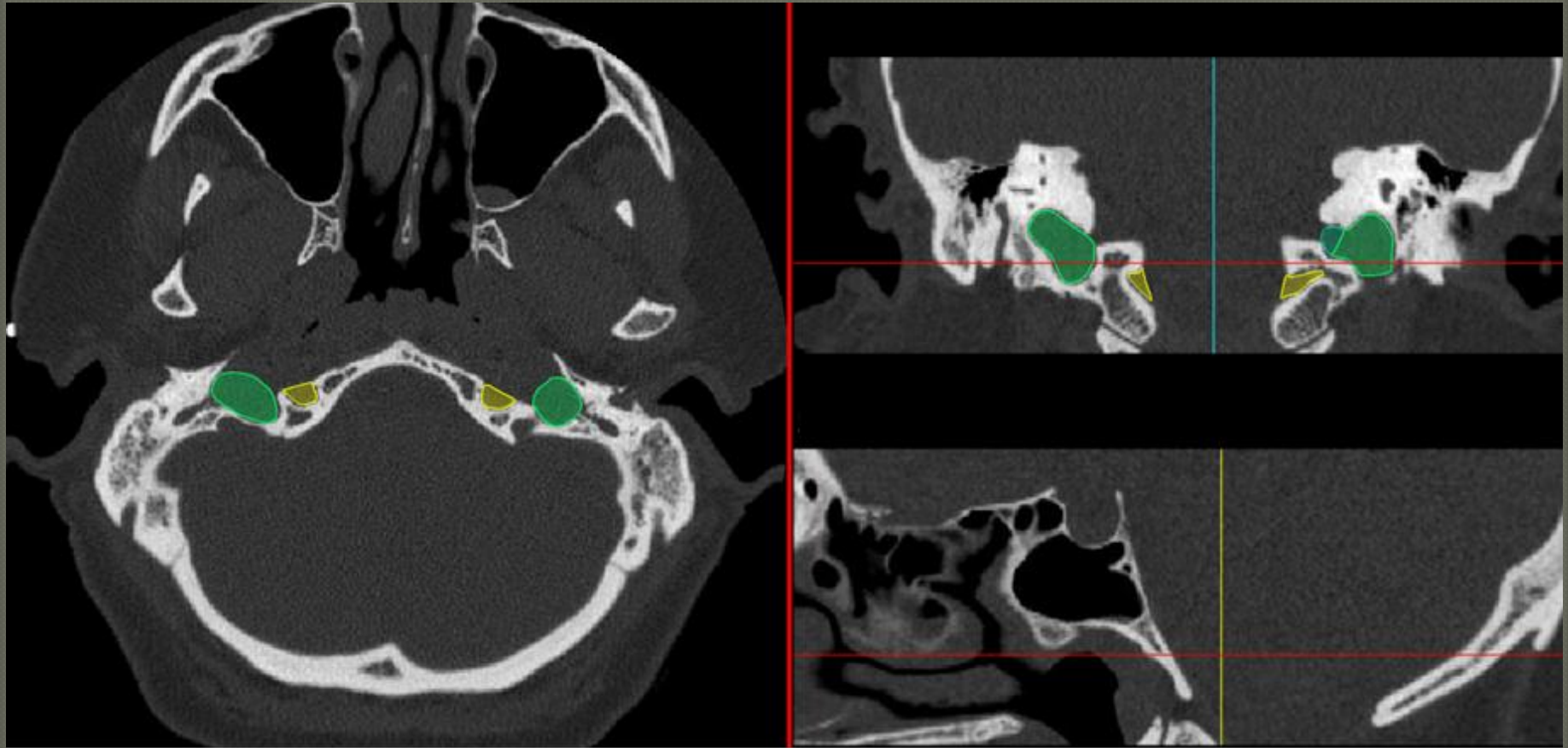
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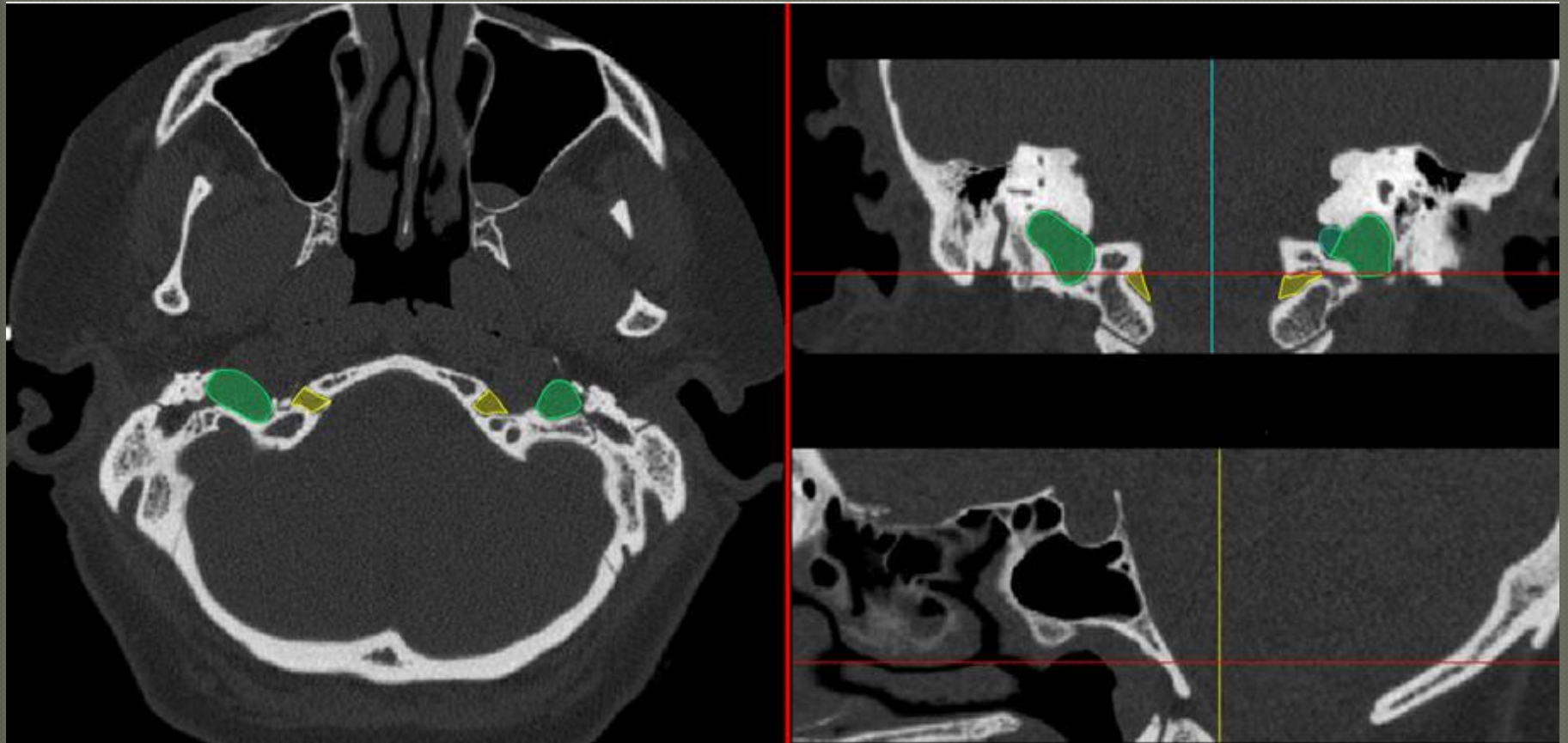
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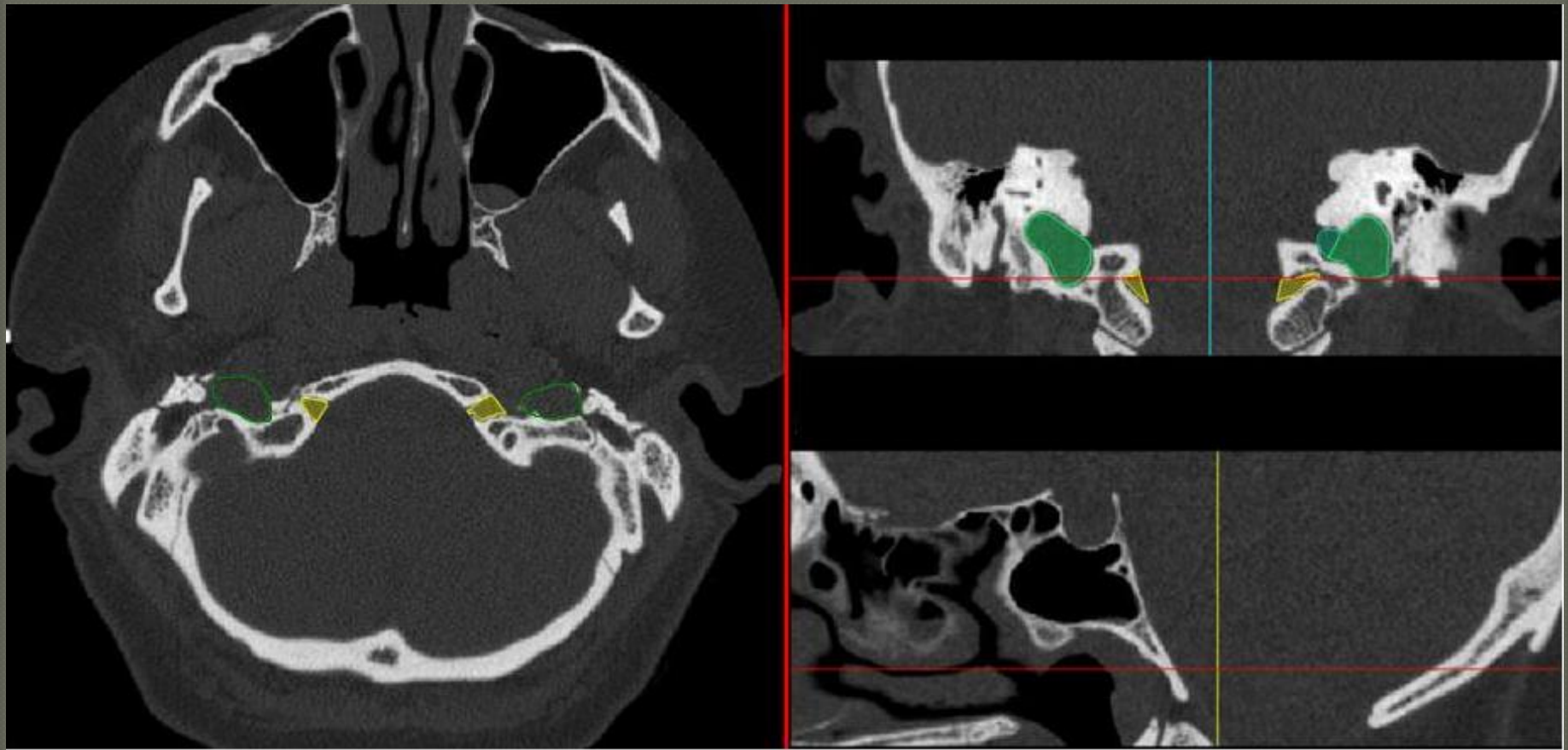
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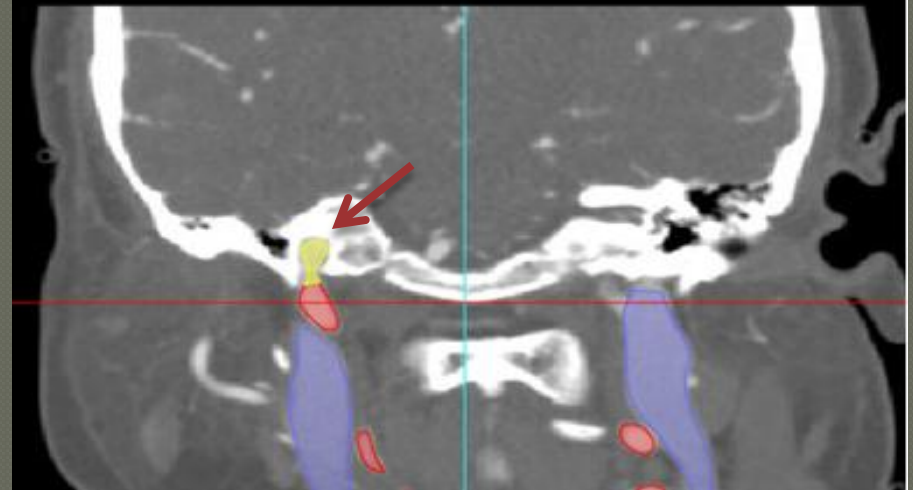
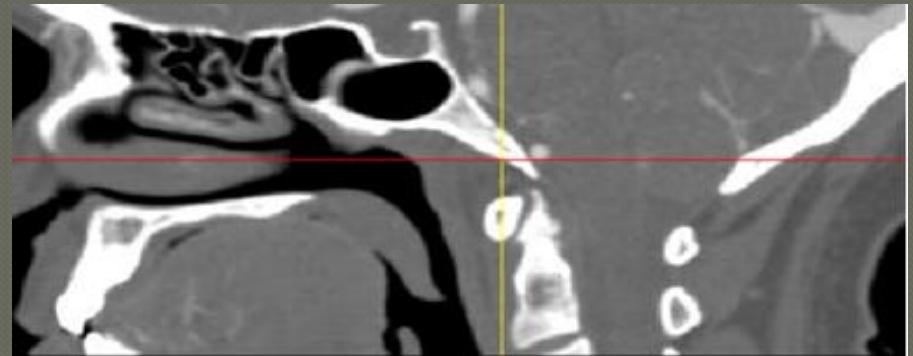
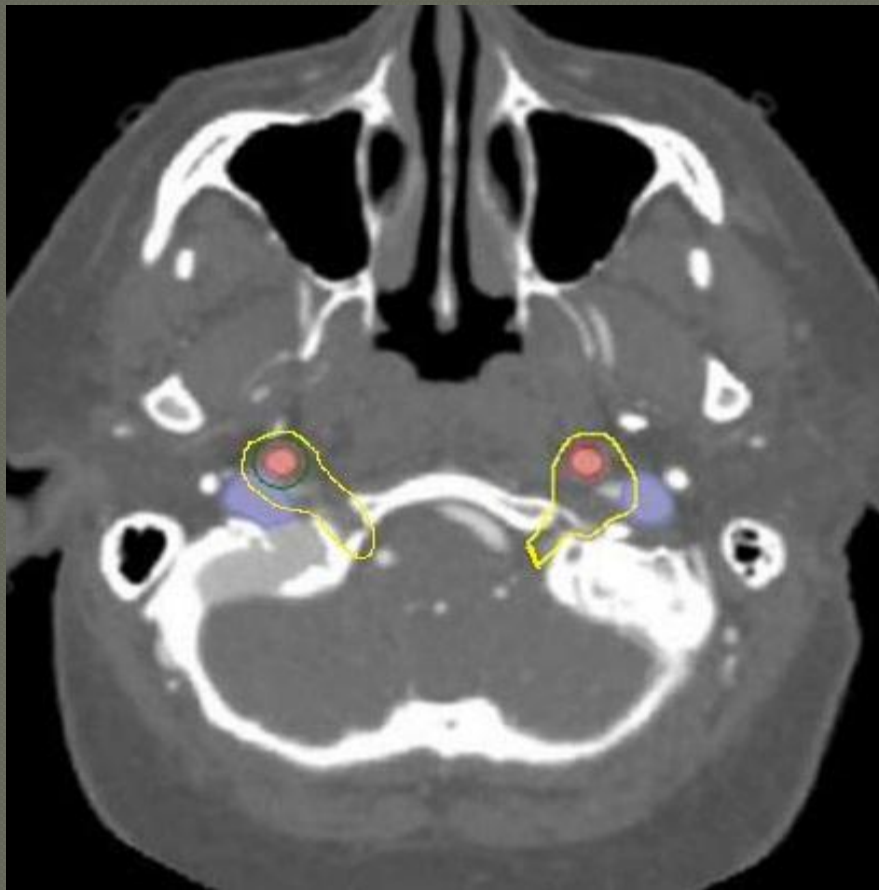


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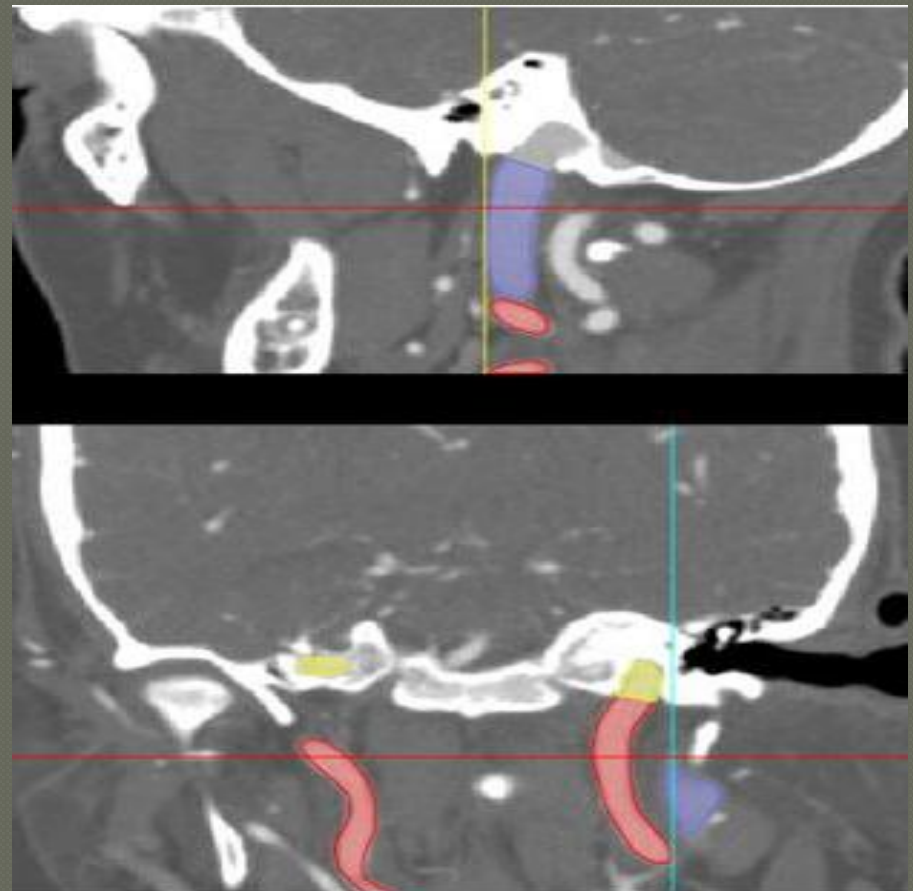
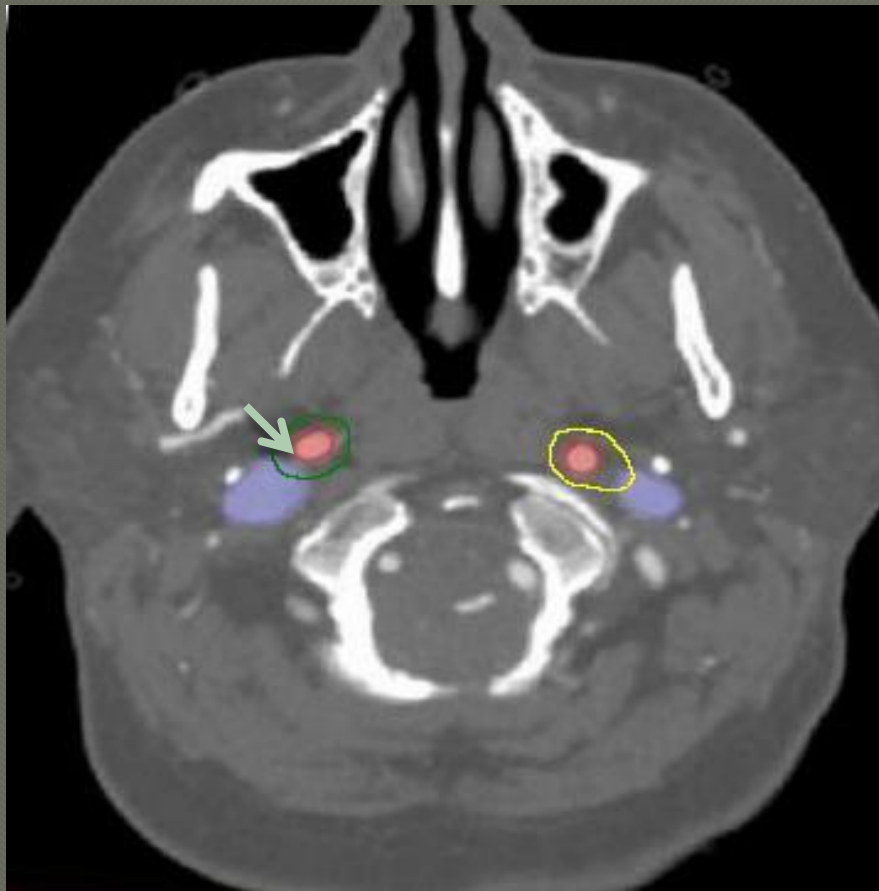
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Internal carotid artery (ICA=red), internal jugular vein (IJV=blue), CN IX-XI (green), and CN XII (yellow). The intracranial portion of the CN XII (yellow) emerges from the brainstem, enters the hypoglossal canal (yellow), and then exits the skull base and joins the CN IX-XI in the carotid sheath (arrow).

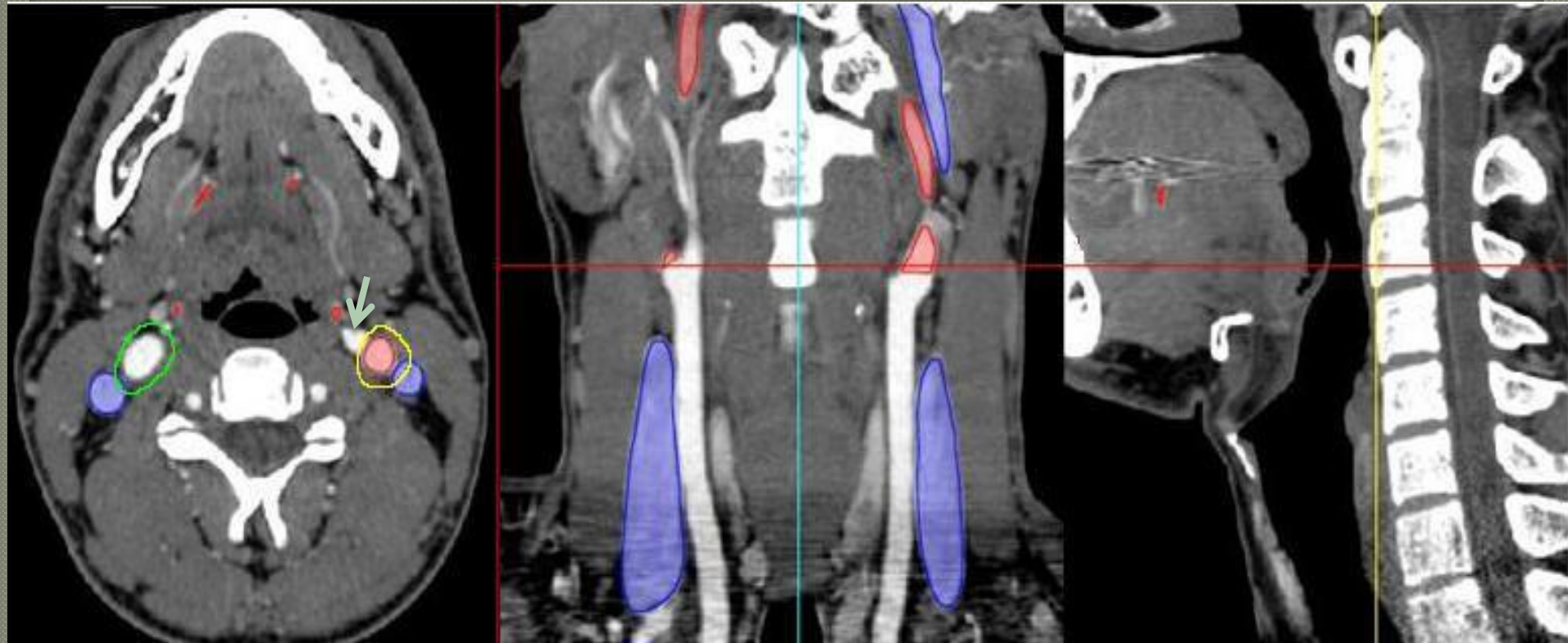


# Cranial Nerves IX-XII Contouring Atlas for Head and Neck Cancer



ICA (red), IJV (blue), CN IX-XI (green), and CN XII (yellow) all lie within the carotid sheath. Notice the contours are expanded few mm to include the anteriomedial portion of the IJV (arrow).

# Cranial Nerves IX-XII Contouring Atlas for Head and Neck Cancer



ICA (red) at the level of CCA bifurcation (arrow), CN XII (yellow) travels lateral to the bifurcation of the CCA, following the lingual artery, and loops anteriorly above the greater horn of the hyoid bone to run on the lateral surface of the hypoglossus muscle. At that level (i.e. Lower border of C3) the CN IX-XII contouring ends.