

# Breast Cancer Atlas for Radiation Therapy Planning: Consensus Definitions



# Collaborators

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# Content

- Overlying principles: slides 4 - 6
- Consensus definitions of anatomical boundaries:  
slides 7 - 12
- Illustrative cases:
  - A: Stage I intact post-lumpectomy left breast  
(slides 13 - 30)
  - B: Stage III post-mastectomy left breast  
(slides 32 - 51)
  - C: Stage III intact post-lumpectomy right  
breast (slides 54 - 71)

# Overlying principles: Breast Contour

## Breast CTV:

- Considers referenced clinical breast at time of CT
- Includes the apparent CT glandular breast tissue
- Incorporates consensus definitions of anatomical borders (see table)
- Includes the lumpectomy CTV

Lumpectomy GTV: Includes seroma and surgical clips when present

# Overlying principles: Chestwall Contour

## Chestwall CTV:

- Considers referenced clinical chestwall at time of CT
- Incorporates consensus definitions of anatomical borders (see table)
- Includes the mastectomy scar (*may not be feasible for occasional cases where the scar extends beyond the typical borders of the chestwall*)

# Overlying principles: Nodal volumes

Regional nodal CTV:

- Nodal volumes contoured for targeting will depend on the specific clinical case
- Considers consensus definitions of anatomical borders (see table)
- The three levels of the axilla can overlap caudal to cranial
- “Axillary apex” was considered level III of the axilla

# Breast and Chestwall Contour: Anatomical Boundaries

	<i>Cranial</i>	<i>Caudal</i>	<i>Anterior</i>	<i>Posterior</i>	<i>Lateral</i>	<i>Medial</i>
Breast <sup>1</sup>	Clinical Reference + Second rib insertion <sup>a</sup>	Clinical reference + loss of CT apparent breast	Skin	Excludes pectoralis muscles, chestwall muscles, ribs	Clinical Reference + mid axillary line typically, excludes latissimus dorsi m. <b>b</b>	Sternal-rib junction <sup>c</sup>
Breast + Chestwall <sup>2</sup>	Same	Same	Same	Includes pectoralis muscles, chestwall muscles, ribs	Same	Same
Chestwall <sup>3</sup>	Caudal border of the clavicle head	Clinical reference+ loss of CT apparent contralateral breast	Skin	Rib-pleural interface. (Includes pectoralis muscles, chestwall muscles, ribs)	Clinical Reference/ mid axillary line typically, excludes latissimus dorsi m <sup>a</sup> <b>b</b>	Sternal-rib junction <sup>b</sup>

# Contouring Comments: Breast and Chestwall

1. Breast: After appropriate lumpectomy for breast only treatment
  - a. Cranial border is highly variable depending on breast size and patient position. The lateral aspect can be more cranial than the medial aspect depending on breast shape and patient position.
  - b. Lateral border is highly variable depending on breast size and amount of ptosis.
  - c. Medial border is highly variable depending on breast size and amount of ptosis. Clinical reference needs to be taken into account. Should not cross midline.

# Contouring Comments: Breast and Chestwall

- 2. Breast-Chestwall:** CTV after appropriate lumpectomy for more locally advanced cases includes those:
- With clinical stage IIb, III who receive neoadjuvant chemotherapy and lumpectomy
  - Who have sufficient risk disease to require post-mastectomy radiation had mastectomy done
- 3. Chestwall:** CTV after appropriate mastectomy:
- a.** Lateral border meant to estimate the lateral border of the previous breast. Typically extends beyond the lateral edge of the pectoralis muscles but excluded the latissimus dorsi muscle
  - b.** Clinical reference marks need to be taken into account. The chestwall typically should not cross midline. Medial extent of mastectomy scar should typically be included

# Regional Nodal Contours: Anatomical Boundaries

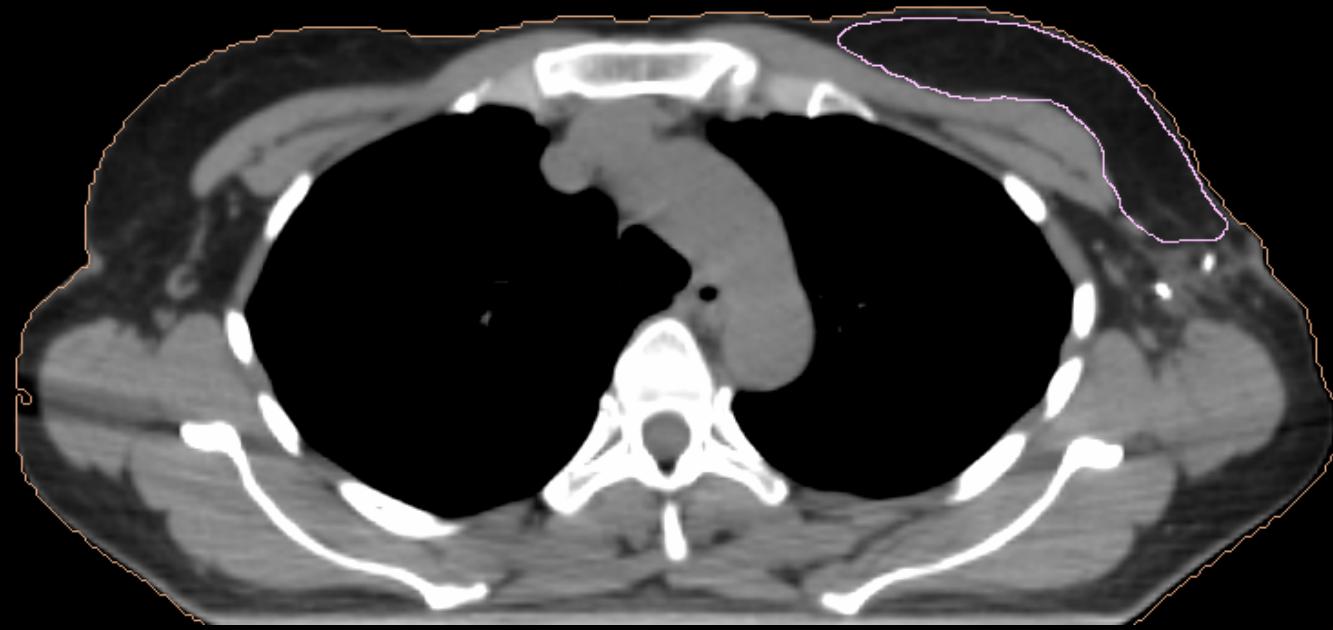
	<i>Cranial</i>	<i>Caudal</i>	<i>Anterior</i>	<i>Posterior</i>	<i>Lateral</i>	<i>Medial</i>
Supra-clavicular	Caudal to the cricoid cartilage	Junction of brachioceph.-axillary vns./ caudal edge clavicle head <b>a</b>	Sternocleido mastoid (SCM) muscle (m.)	Anterior aspect of the scalene m.	<u>Cranial:</u> lateral edge of SCM m. <u>Caudal:</u> junction 1 <sup>st</sup> rib-clavicle	Excludes thyroid and trachea
Axilla- Level I	Axillary vessels cross lateral edge of Pec. Minor m.	Pectoralis (Pec.) major muscle insert into ribs <b>b</b>	Plane defined by: anterior surface of Pec. Maj. m. and Lat. Dorsi m.	Anterior surface of subscapularis m.	Medial border of lat. dorsi m.	Lateral border of Pec. minor m.
Axilla- level II	Axillary vessels cross medial edge of Pec. Minor m.	Axillary vessels cross lateral edge of Pec. Minor m. <b>c</b>	Anterior surface Pec. Minor m.	Ribs and intercostal muscles	Lateral border of Pec. Minor m.	Medial border of Pec. Minor m.
Axilla- level III	Pec. Minor m. insert on coracoid	Axillary vessels cross medial edge of Pec. Minor m. <b>d</b>	Posterior surface Pec. Major m.	Ribs and intercostal muscles	Medial border of Pec. Minor m.	Thoracic inlet
Internal mammary	Superior aspect of the medial 1 <sup>st</sup> rib.	Cranial aspect of the 4 <sup>th</sup> rib	- <b>e.</b>	- <b>e.</b>	- <b>e.</b>	- <b>e.</b>

# Contouring Comments: Regional Nodal Volumes

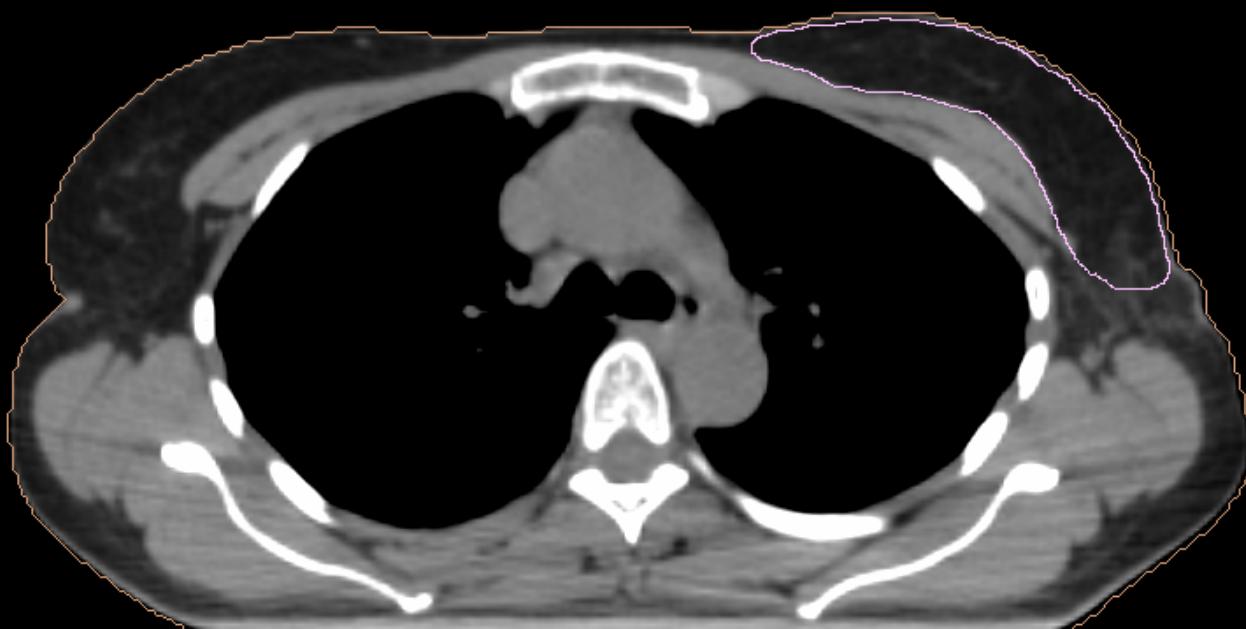
- a. Supraclavicular caudal border meant to approximate the superior aspect of the breast/ chestwall field border
- b. Axillary level I caudal border is clinically at the base of the anterior axillary line
- c. Axillary level II caudal border is the same as the cranial border of level 1
- d. Axillary level III caudal border is the same as the cranial border of level II
- e. Internal Mammary lymph nodes: encompass the internal mammary/ thoracic vessels

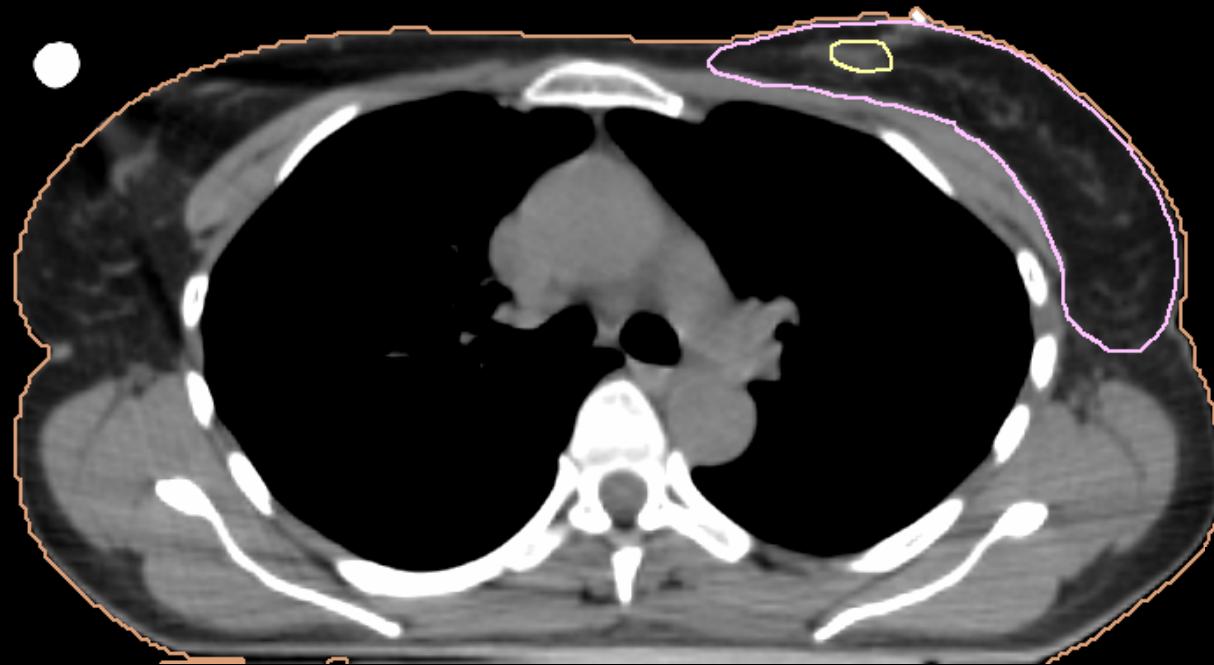
# Case A- Intact post lumpectomy breast

- Stage I ( T1c, N0, M0) Left breast cancer
- Surgery: Lumpectomy and sentinel node biopsy
- Radiation: Breast
- Six surgical clips placed at lumpectomy site
- External markers placed at time of CT:
  - BB at AP set-up point
  - 4 wire markers for clinical estimate of cranial, caudal, medial, and lateral extent of anticipated tangents
  - Wire extending from 9-3 o'clock around the infra-mammary fold
  - Wire over the lumpectomy scar

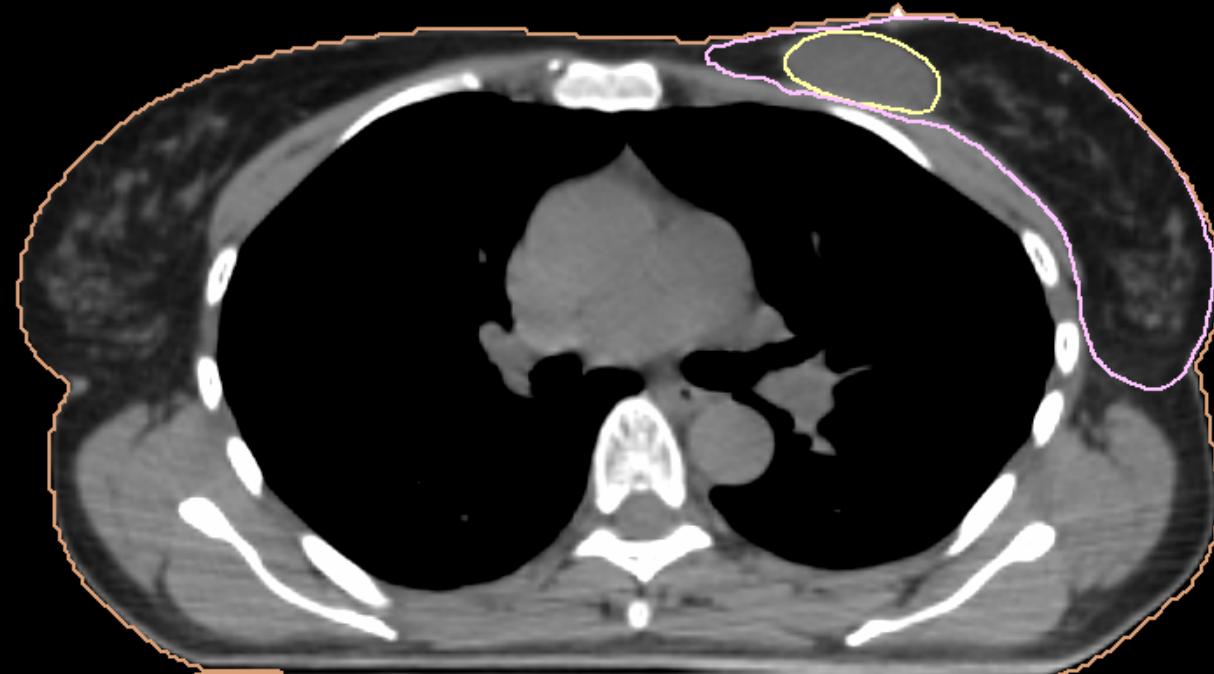


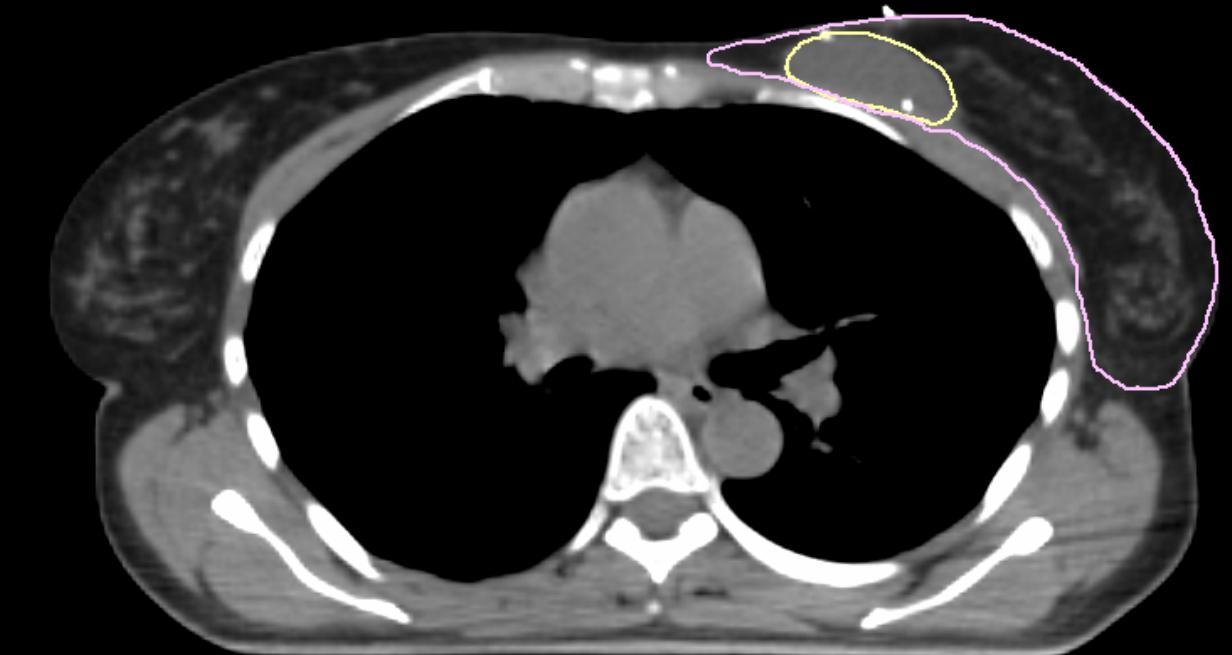
■ Lumpectomy  
■ Breast  
■ Heart



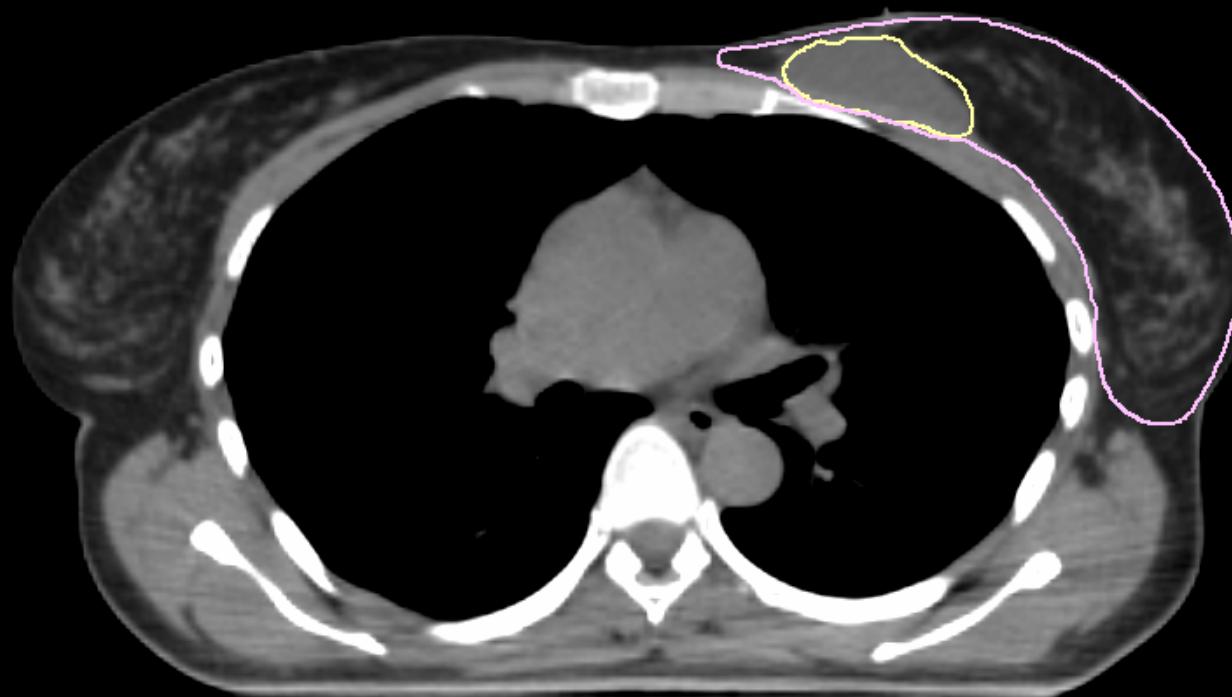


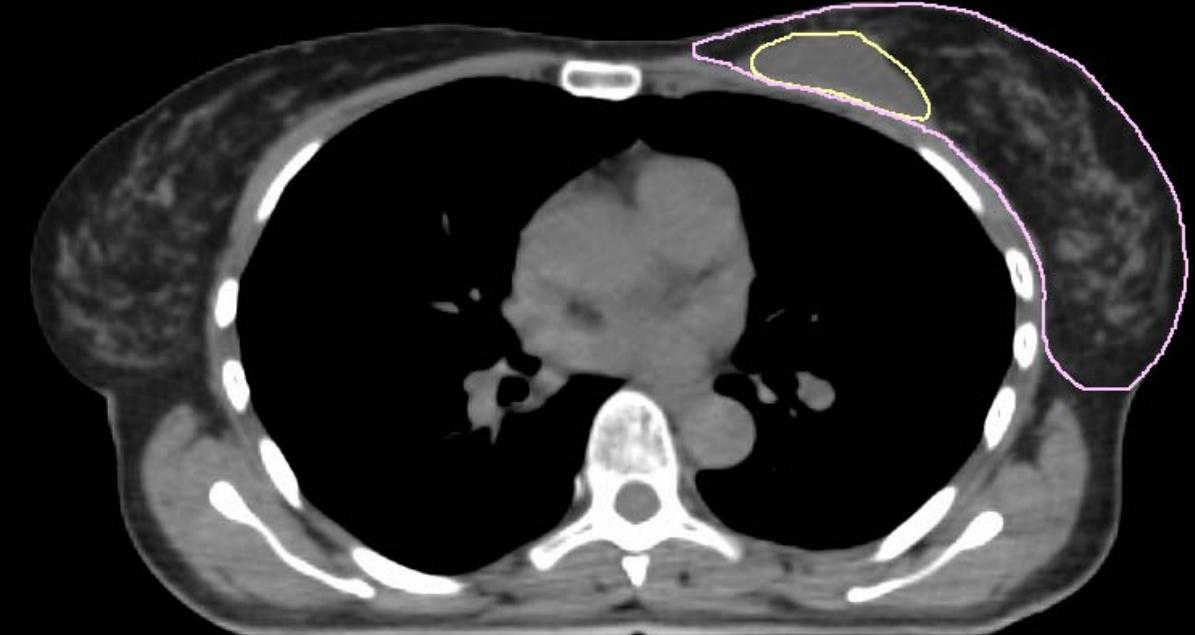
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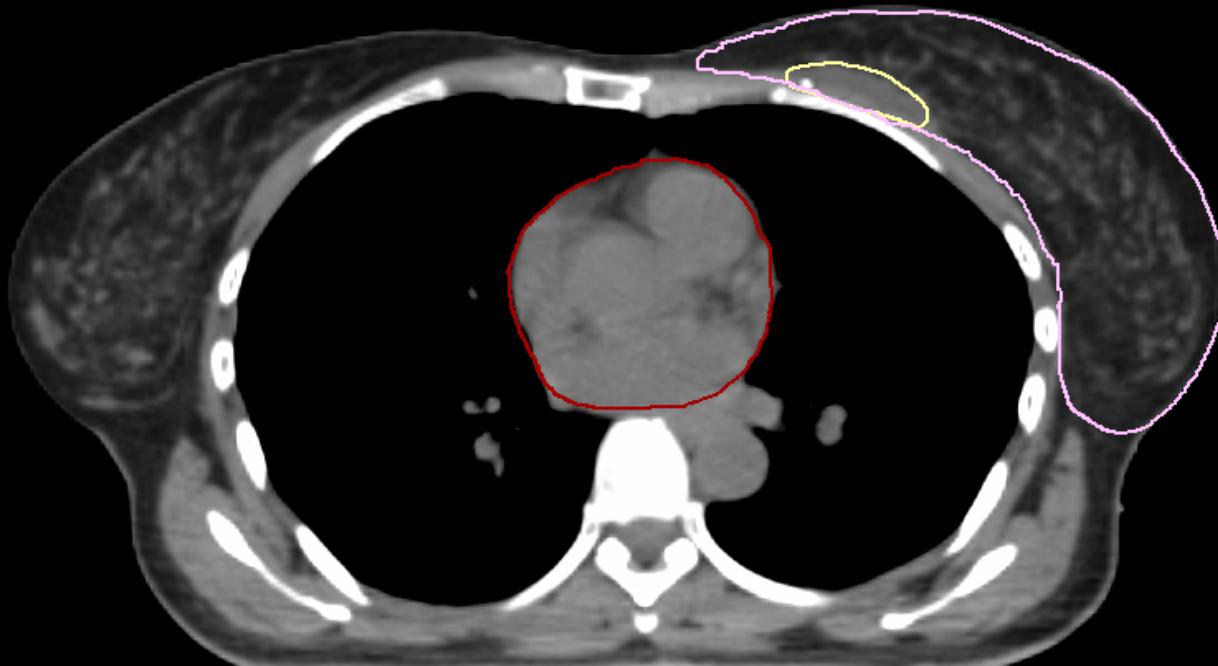


■ Lumpectomy  
■ Breast  
■ Heart



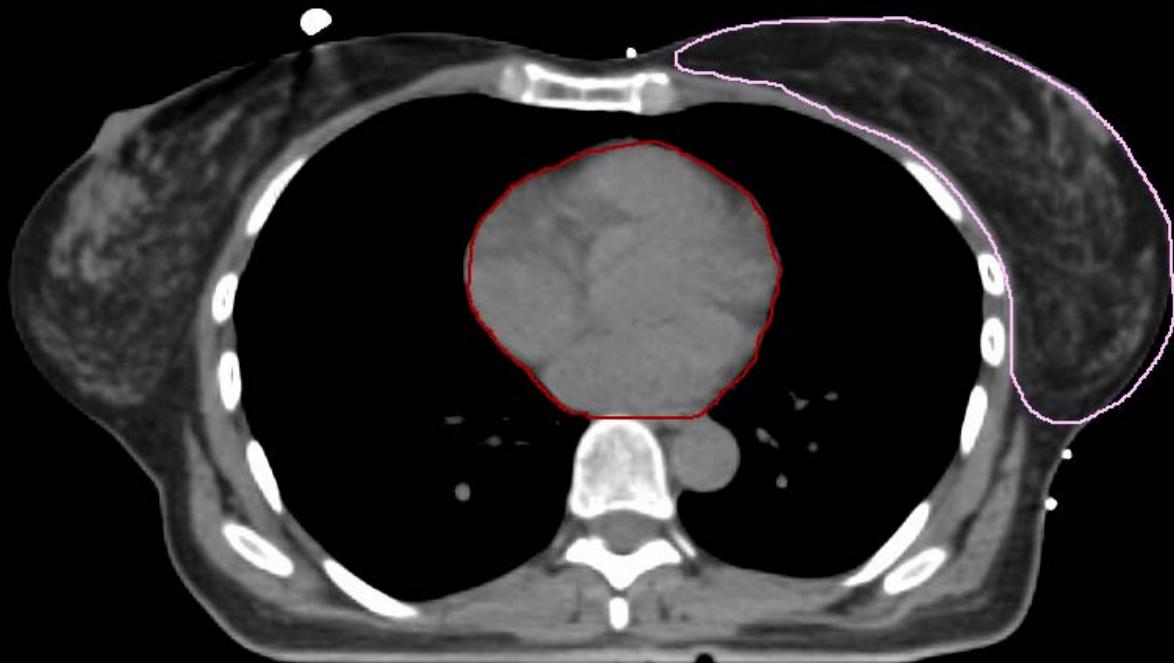


- Lumpectomy
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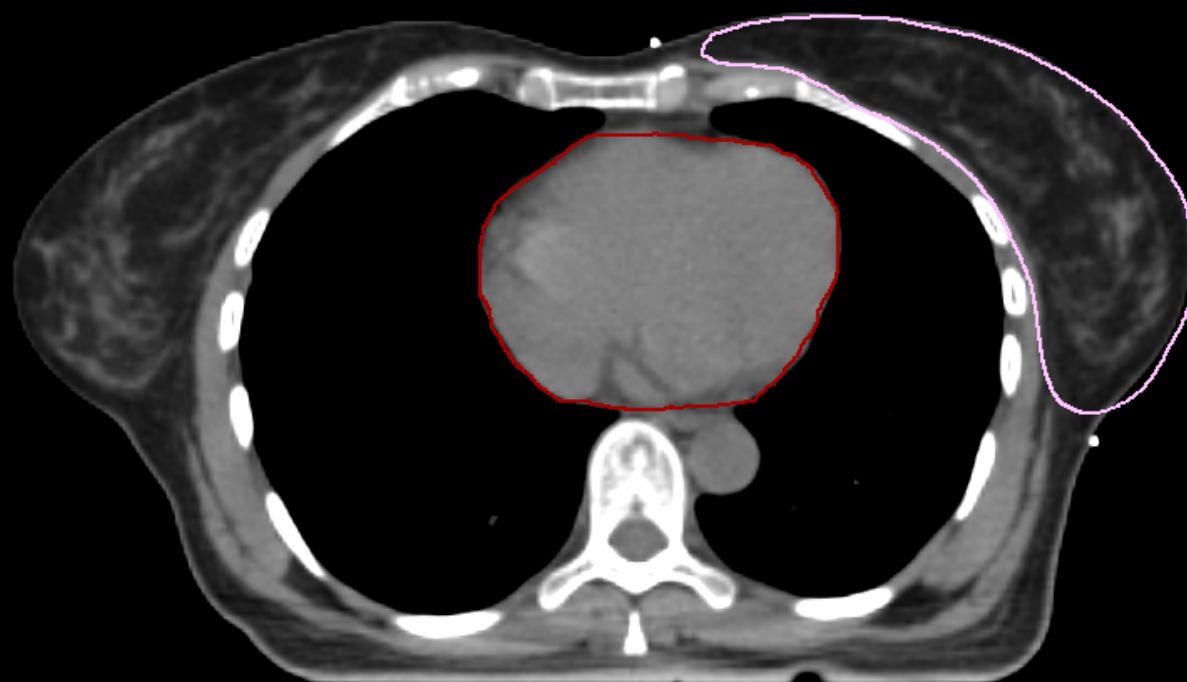


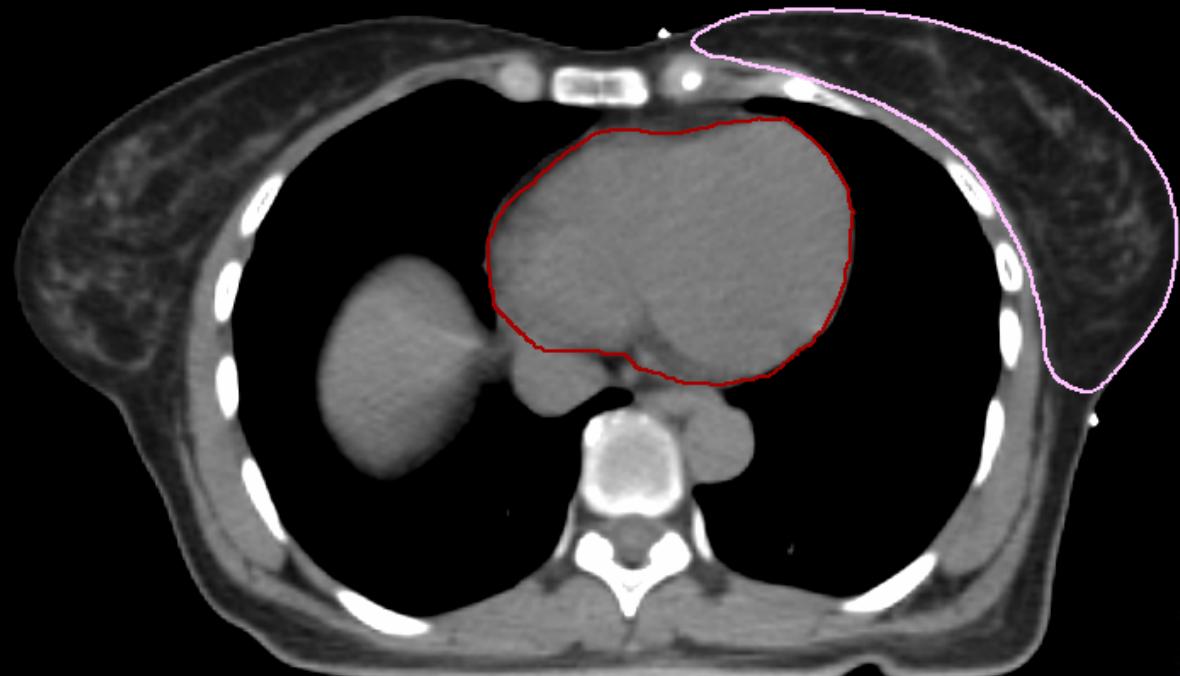
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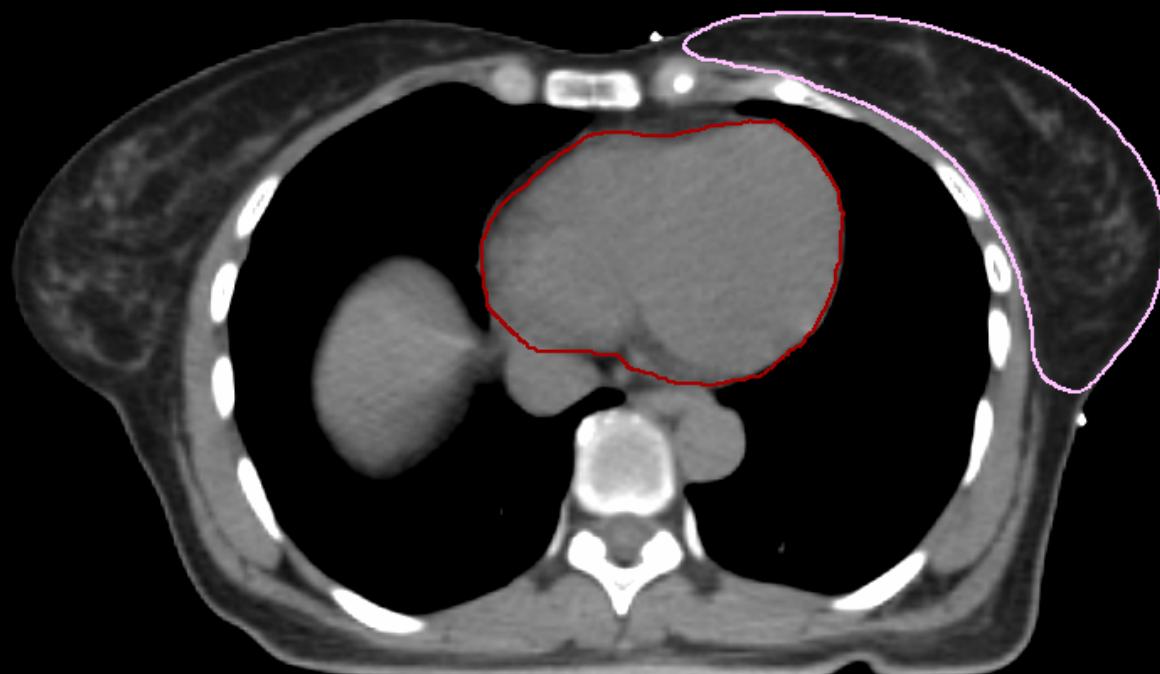


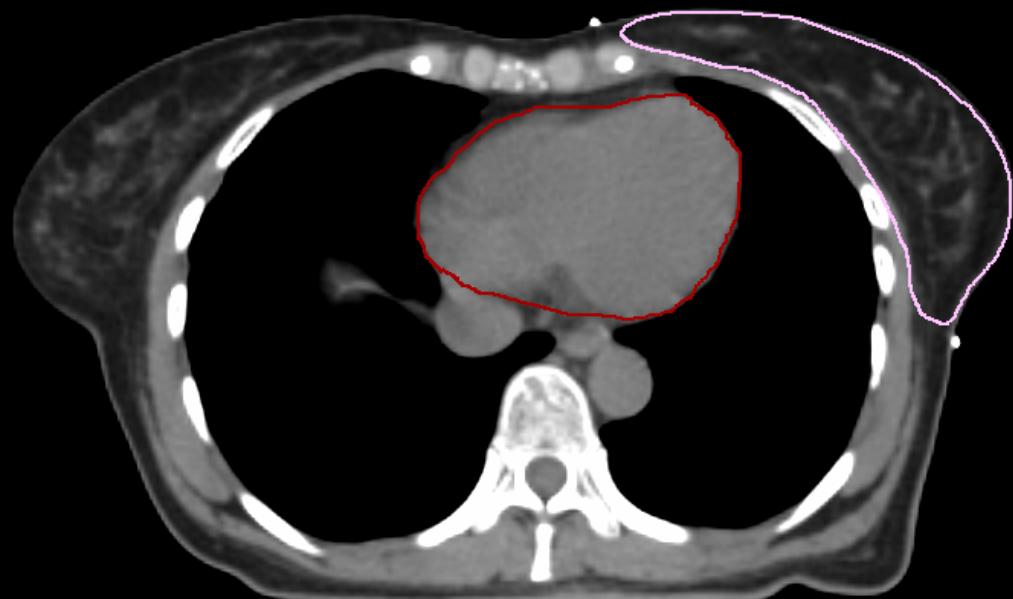
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■ Breast  
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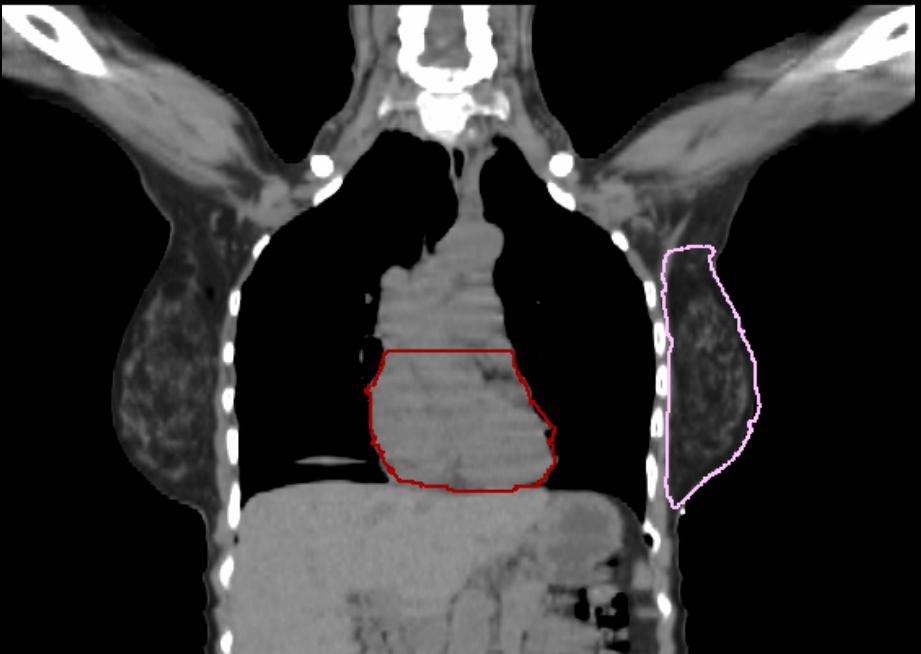


- Lumpectomy
- Breast
- Heart



- Lumpectomy
- Breast
- Heart





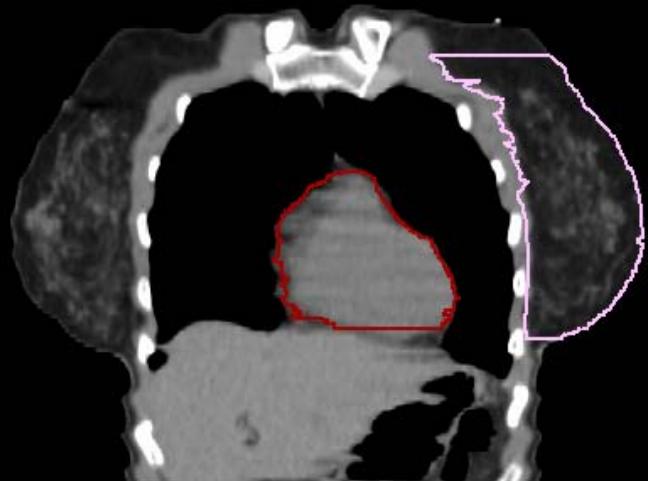
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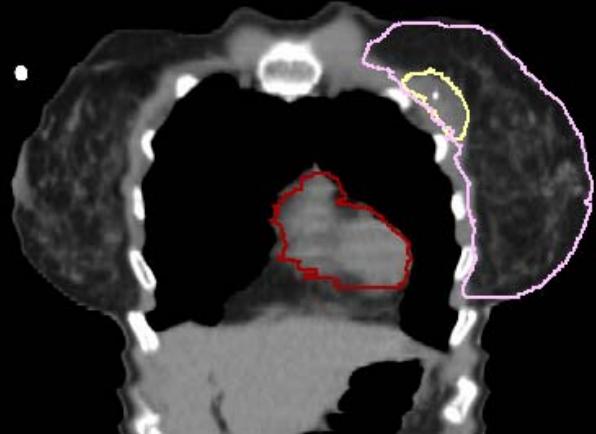


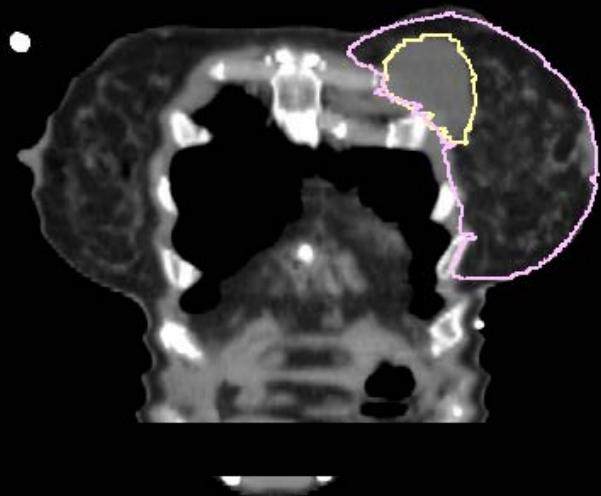
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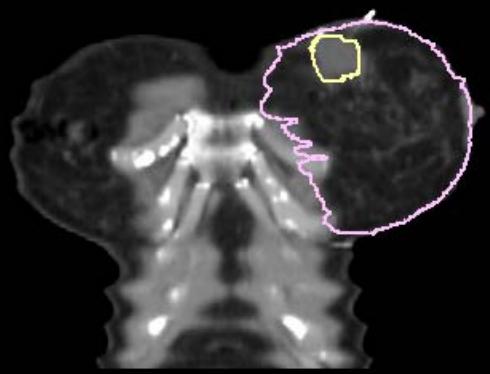


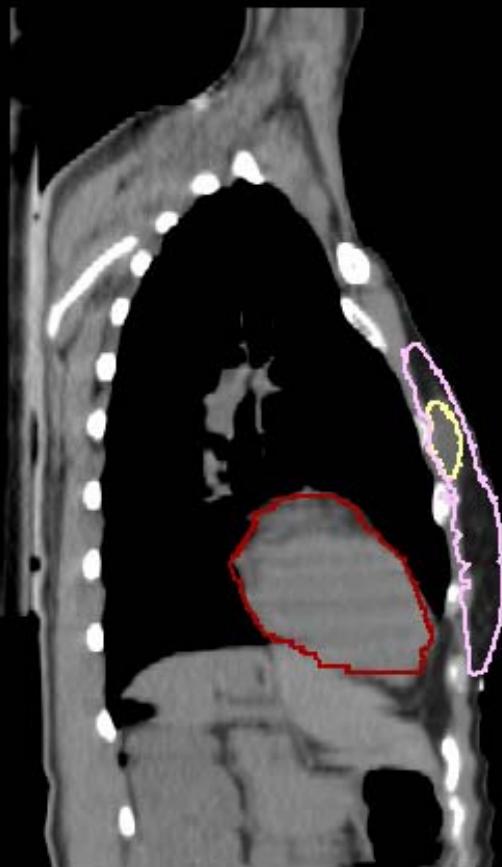
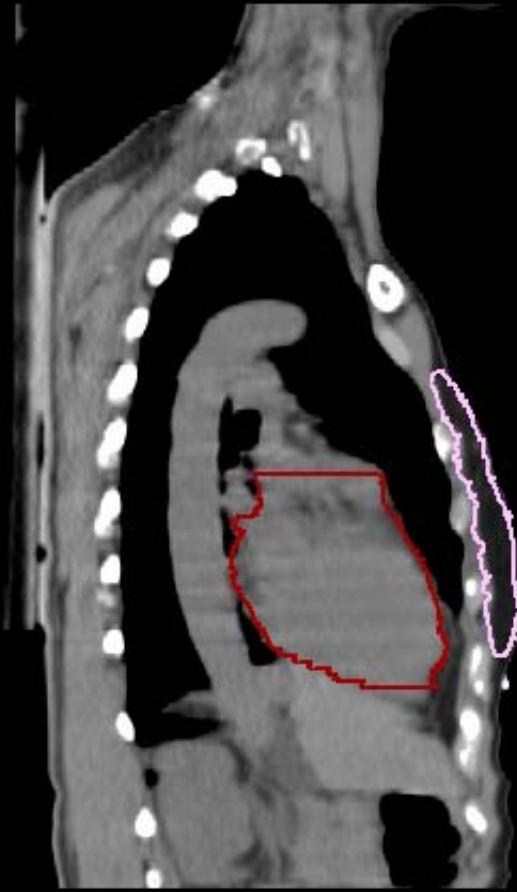
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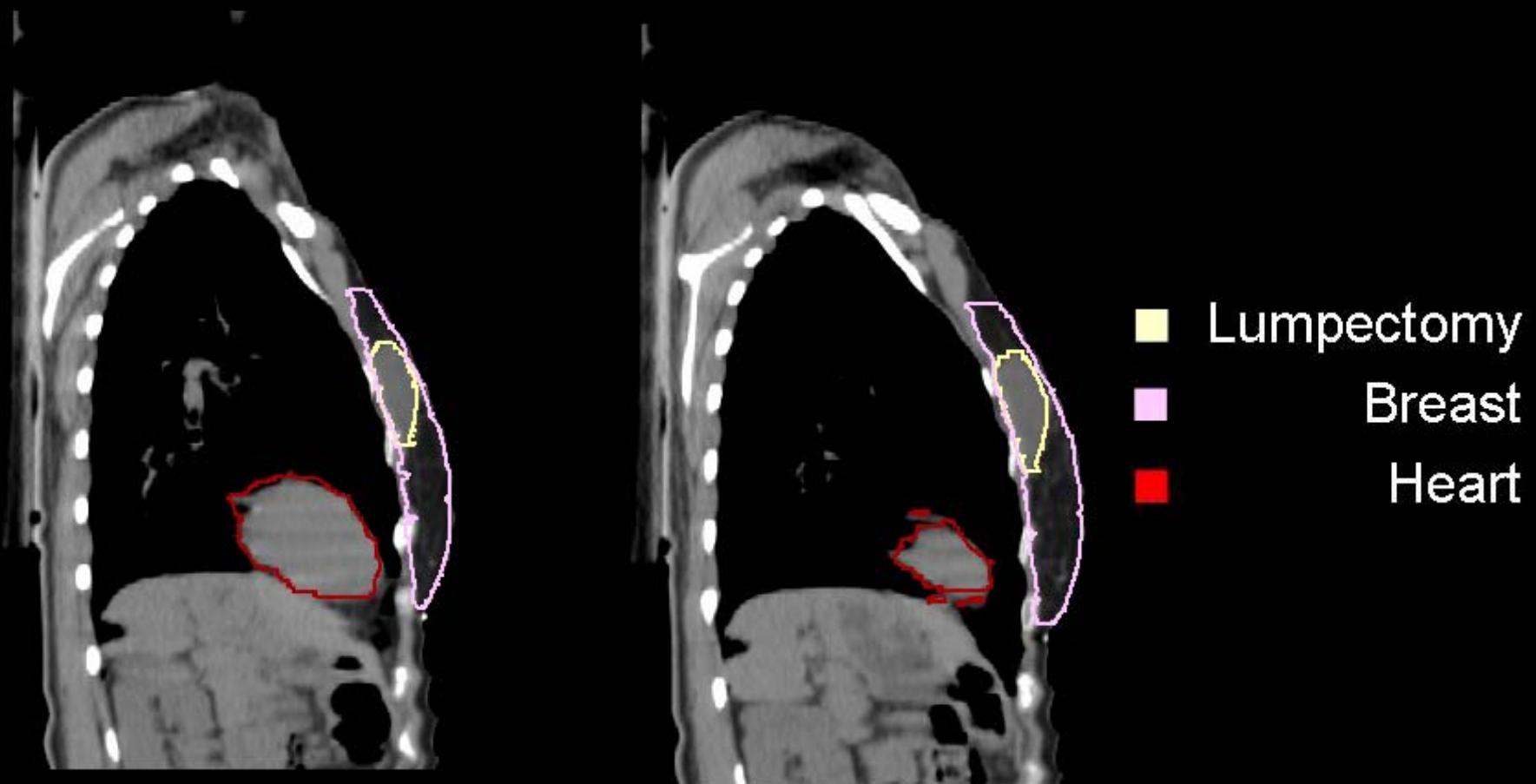


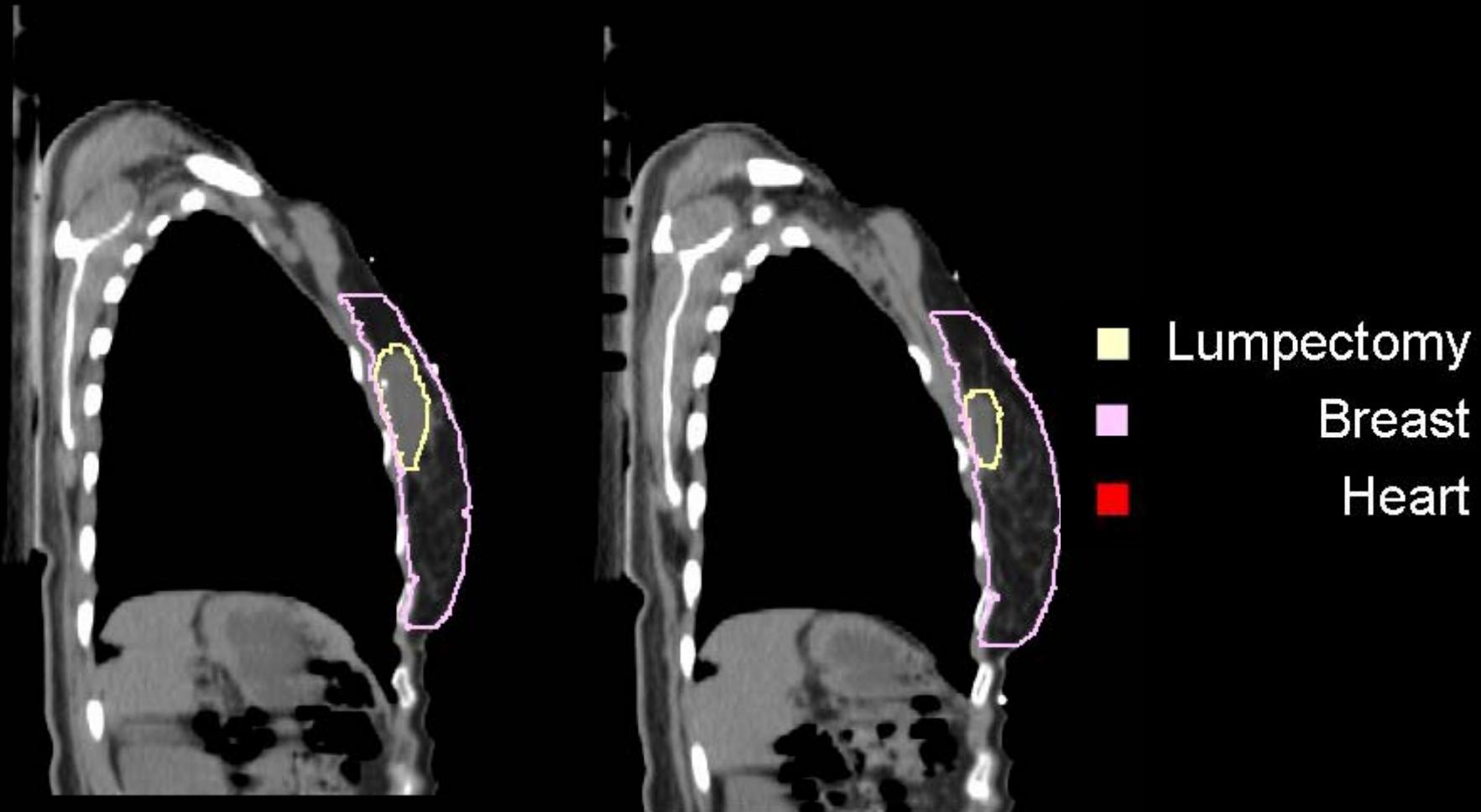
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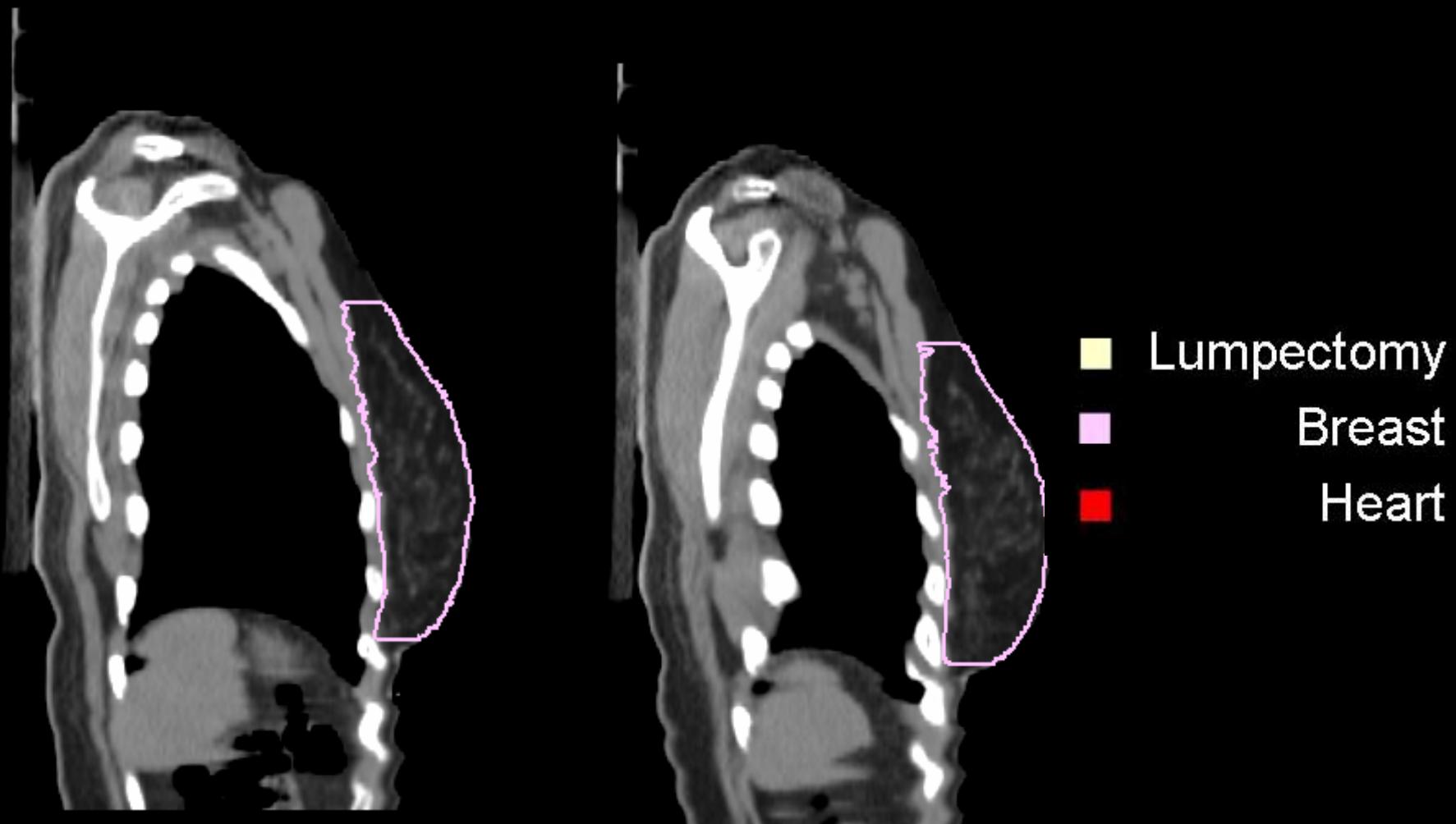


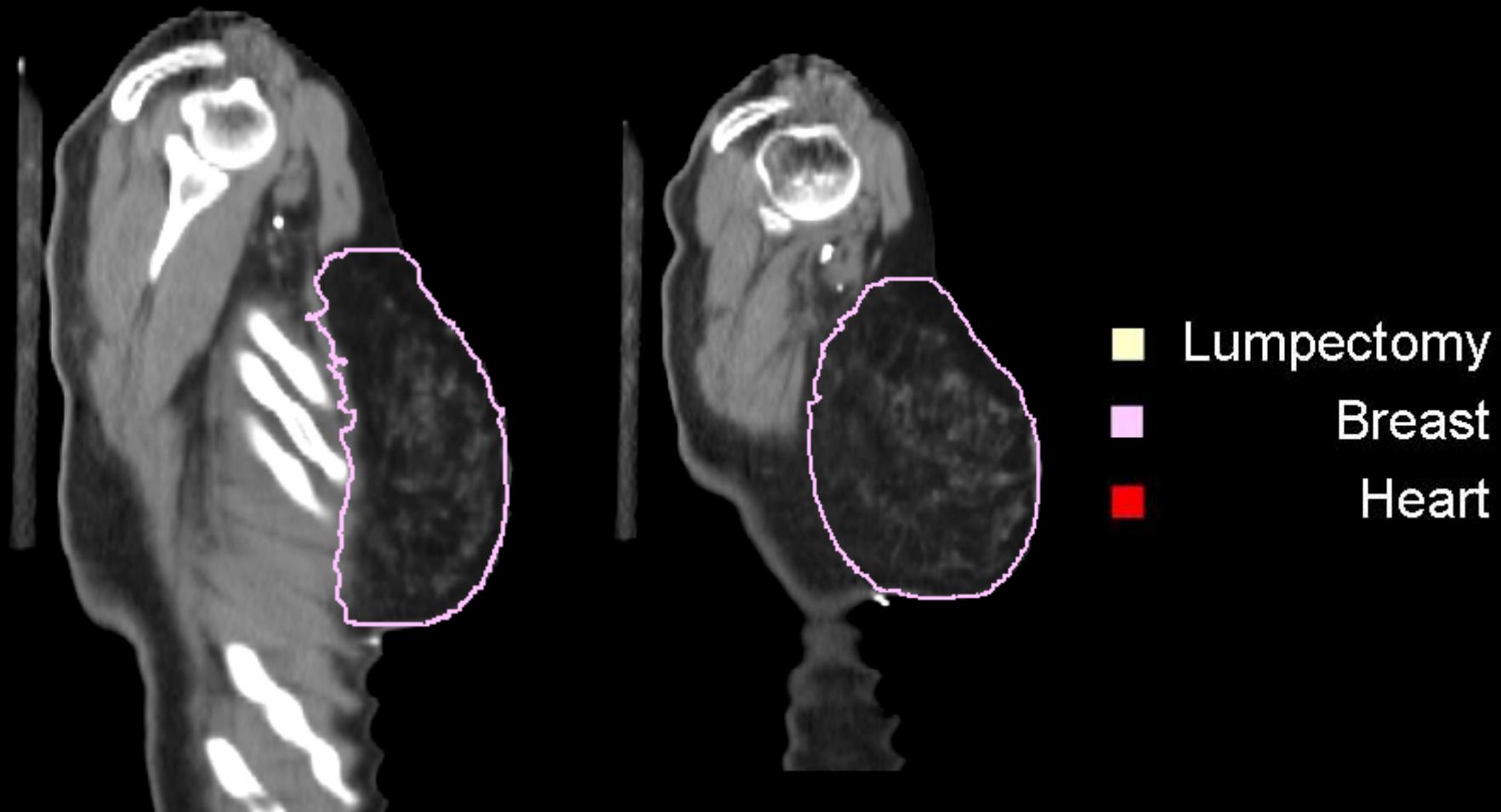


- Lumpectomy
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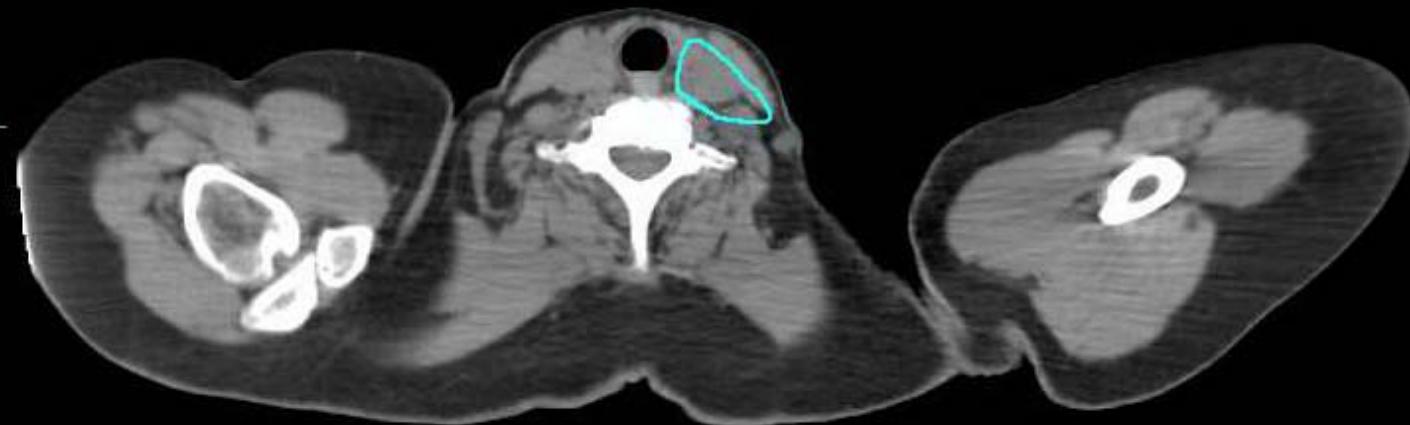




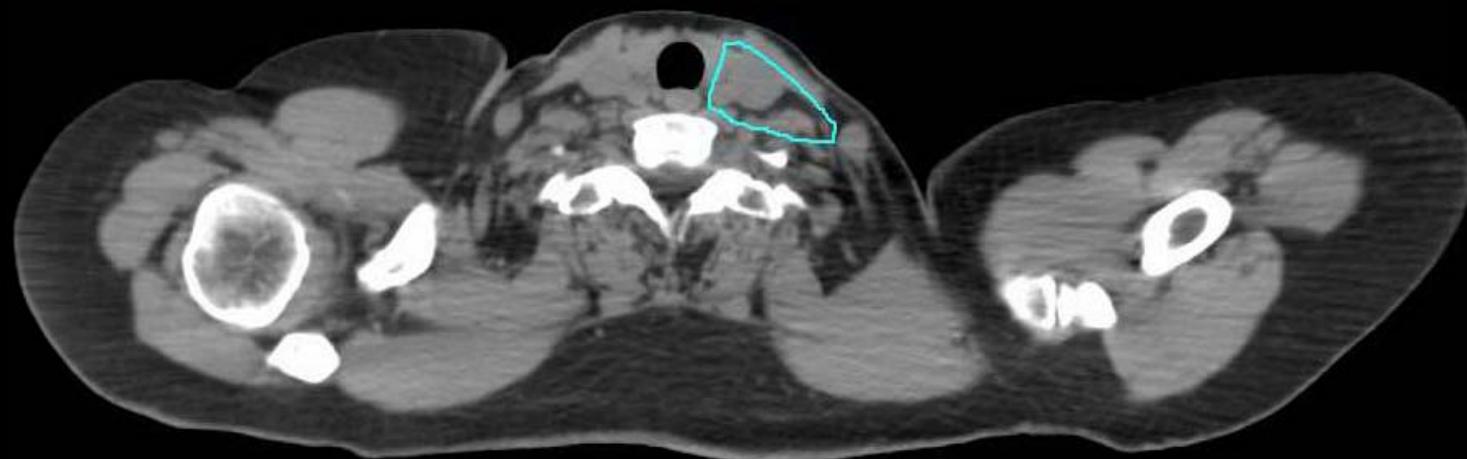


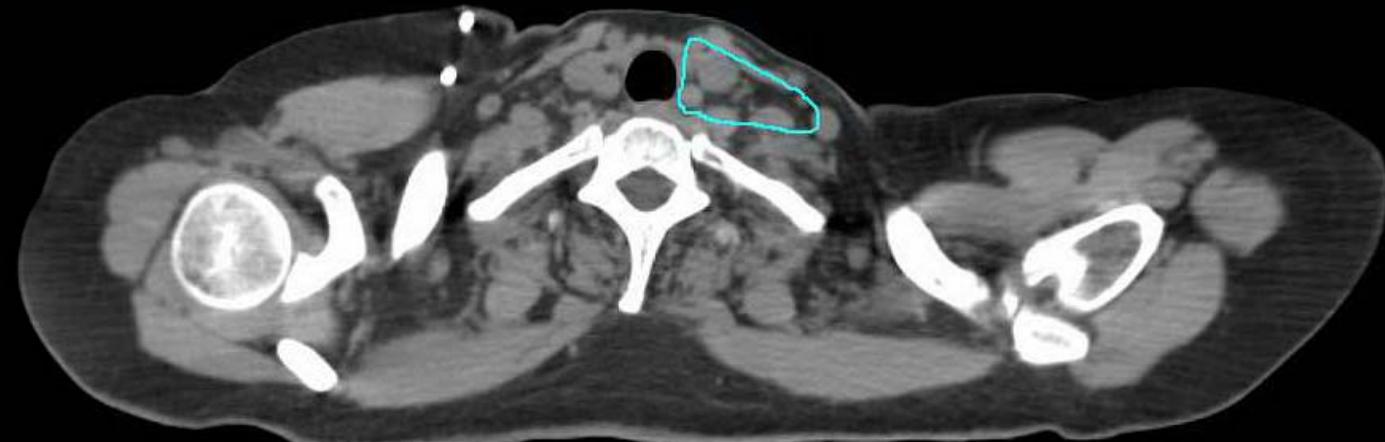
# Case B: Post-mastectomy, Stage III

- Stage IIIB (T-3, N-3, M-0) left breast cancer, tumor size 7 cm, 11/15 nodes positive
- Surgery: total mastectomy and axillary node dissection
- Radiation: chestwall  $\pm$  regional lymph nodes
- External wires present on CT:
  - Wire on mastectomy scar
  - BB on AP set-point at clinically estimated level of the match for the supraclavicular  $\pm$  axilla with the chestwall  $\pm$  IMC fields
  - Wires at lateral and inferior clinically estimated extent of the chestwall

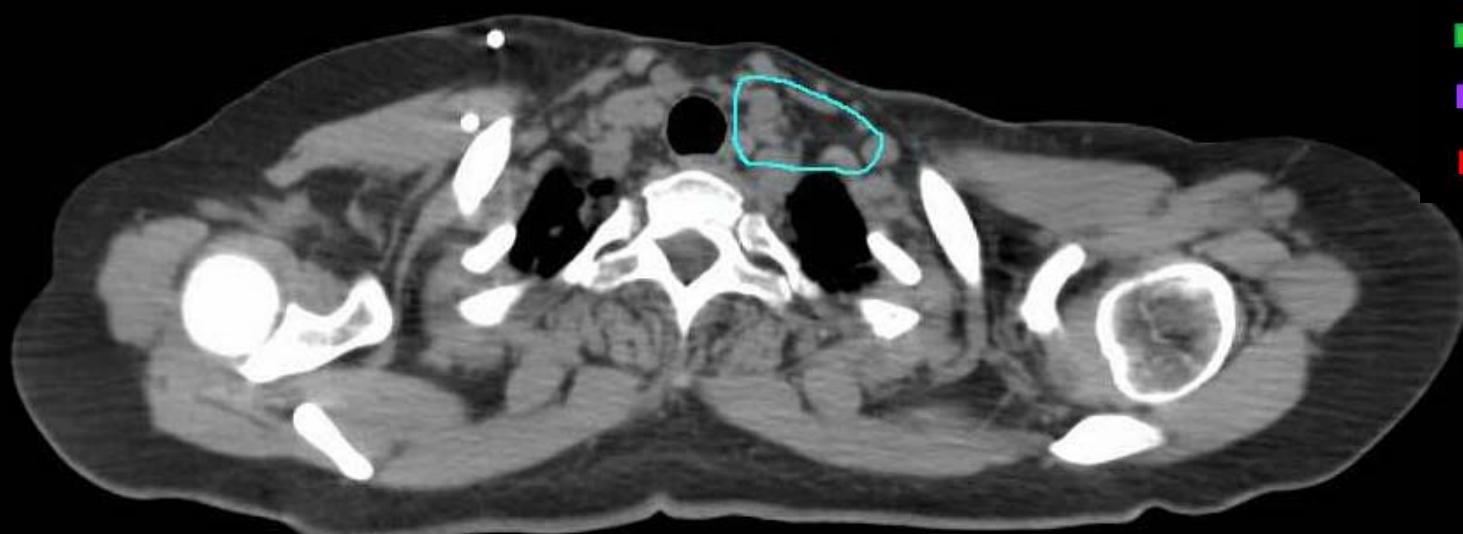


- Supraclavicular
- Axilla level 3
- Axilla level 2
- Axilla level 1
- Internal mammary
- Chestwall
- Heart



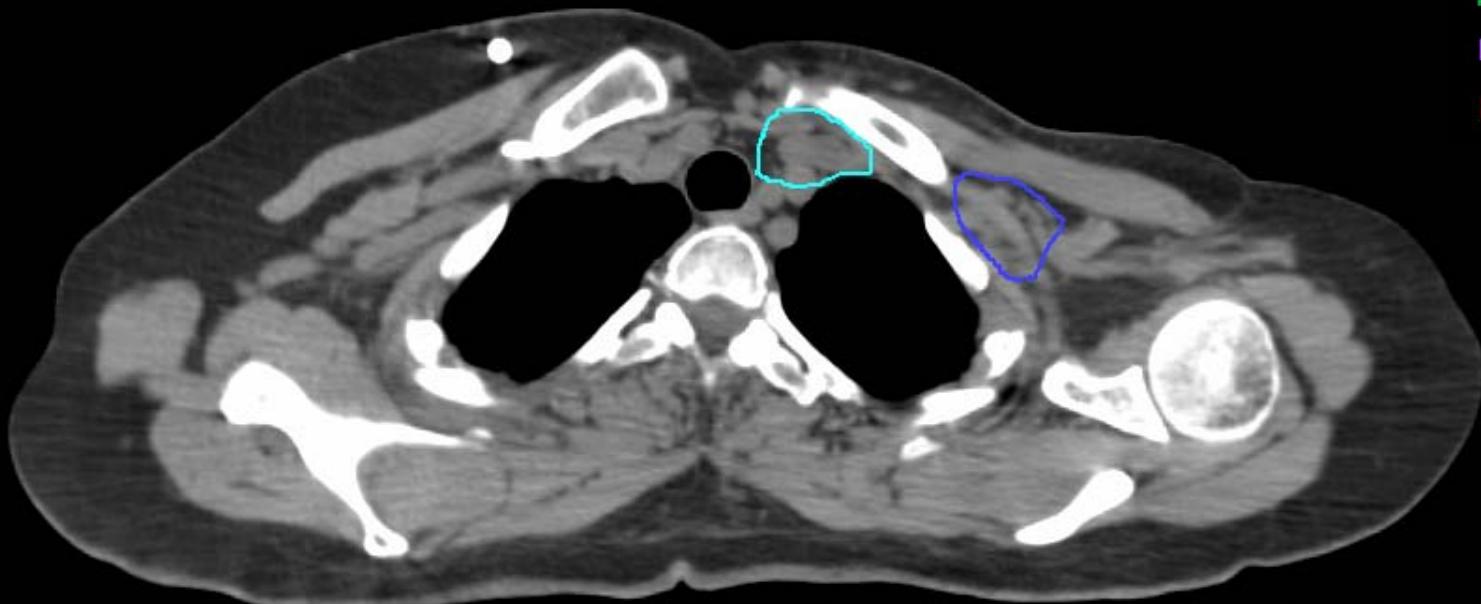


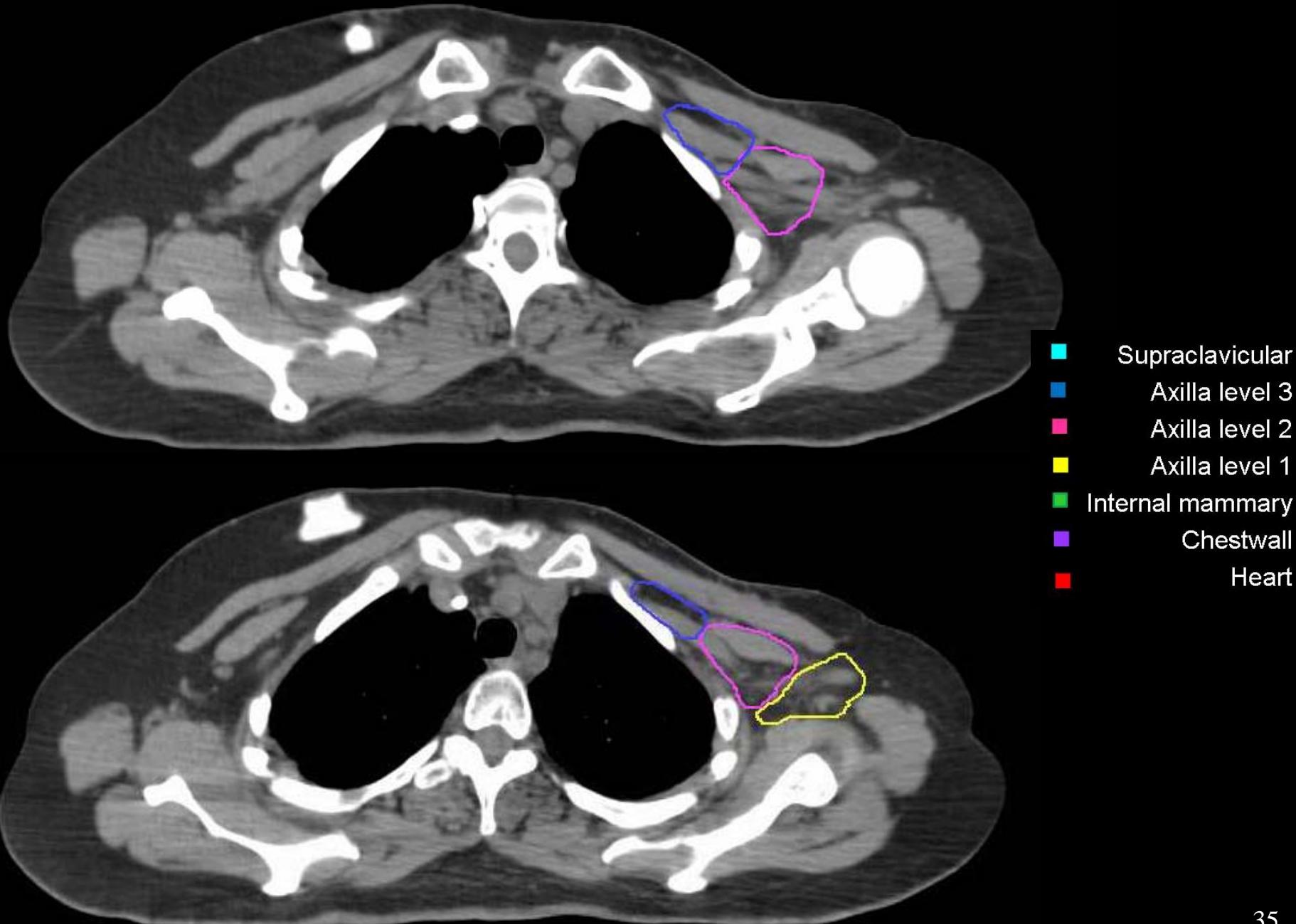
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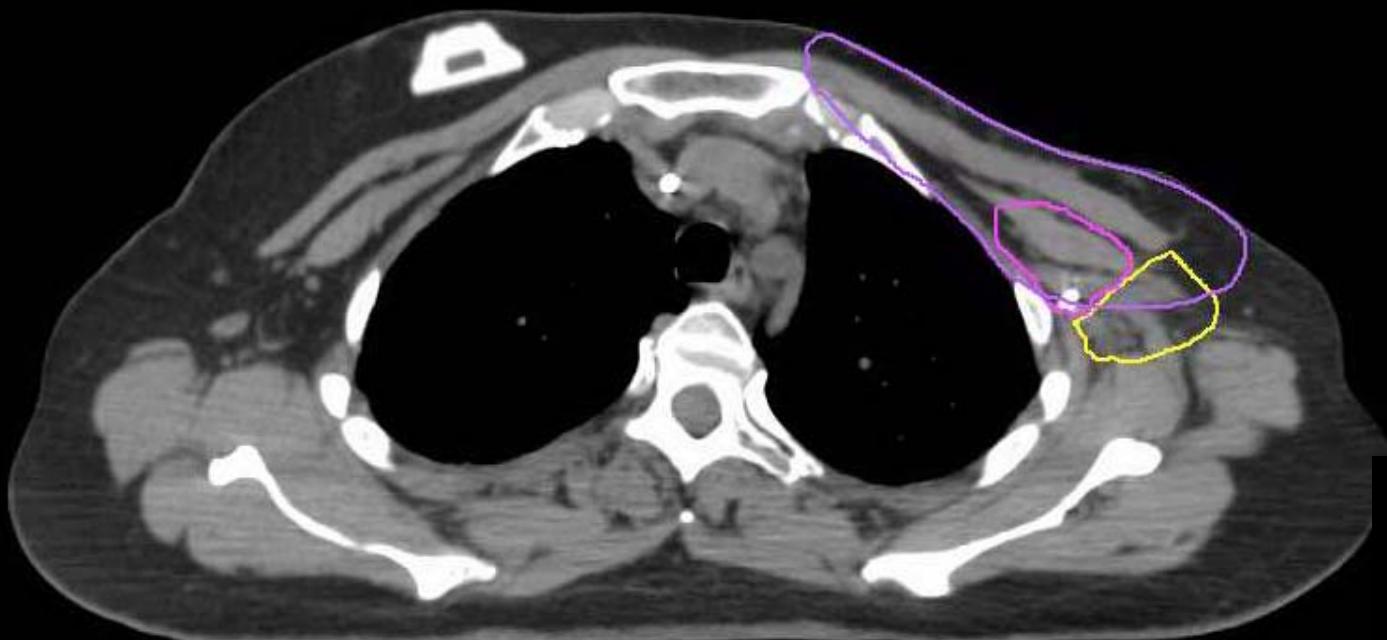




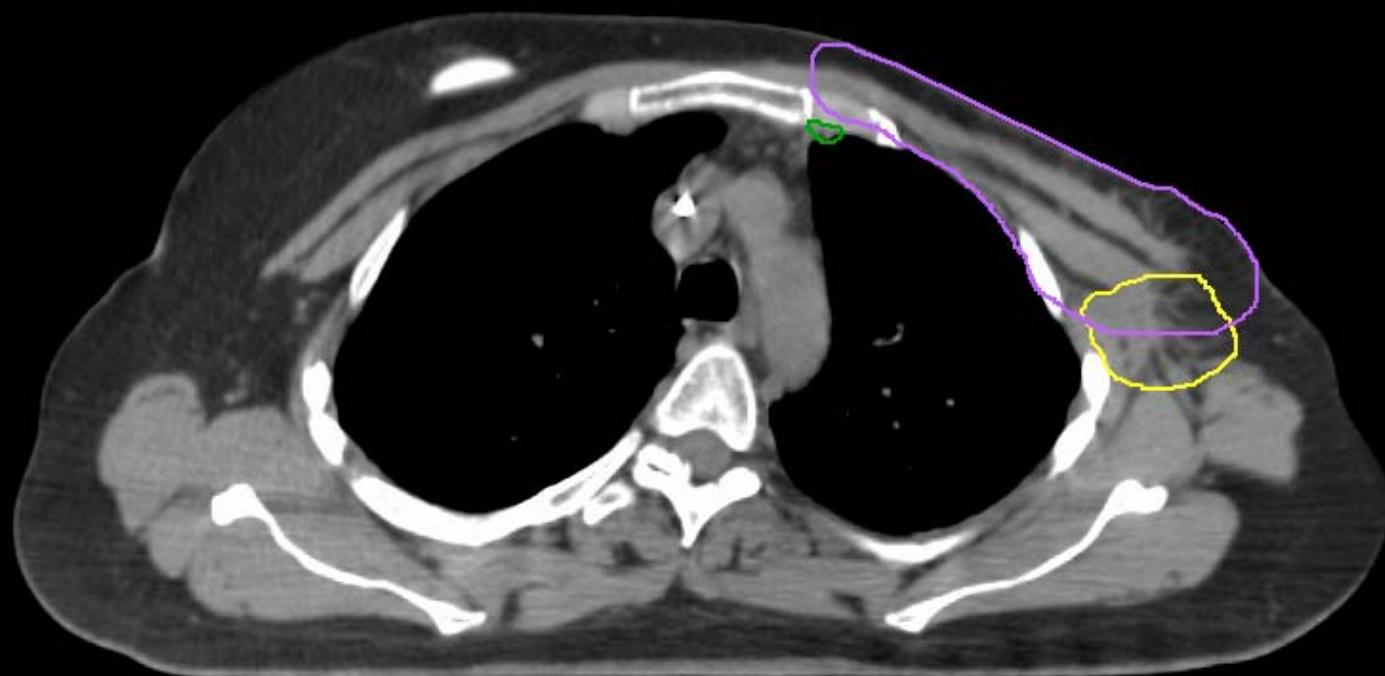
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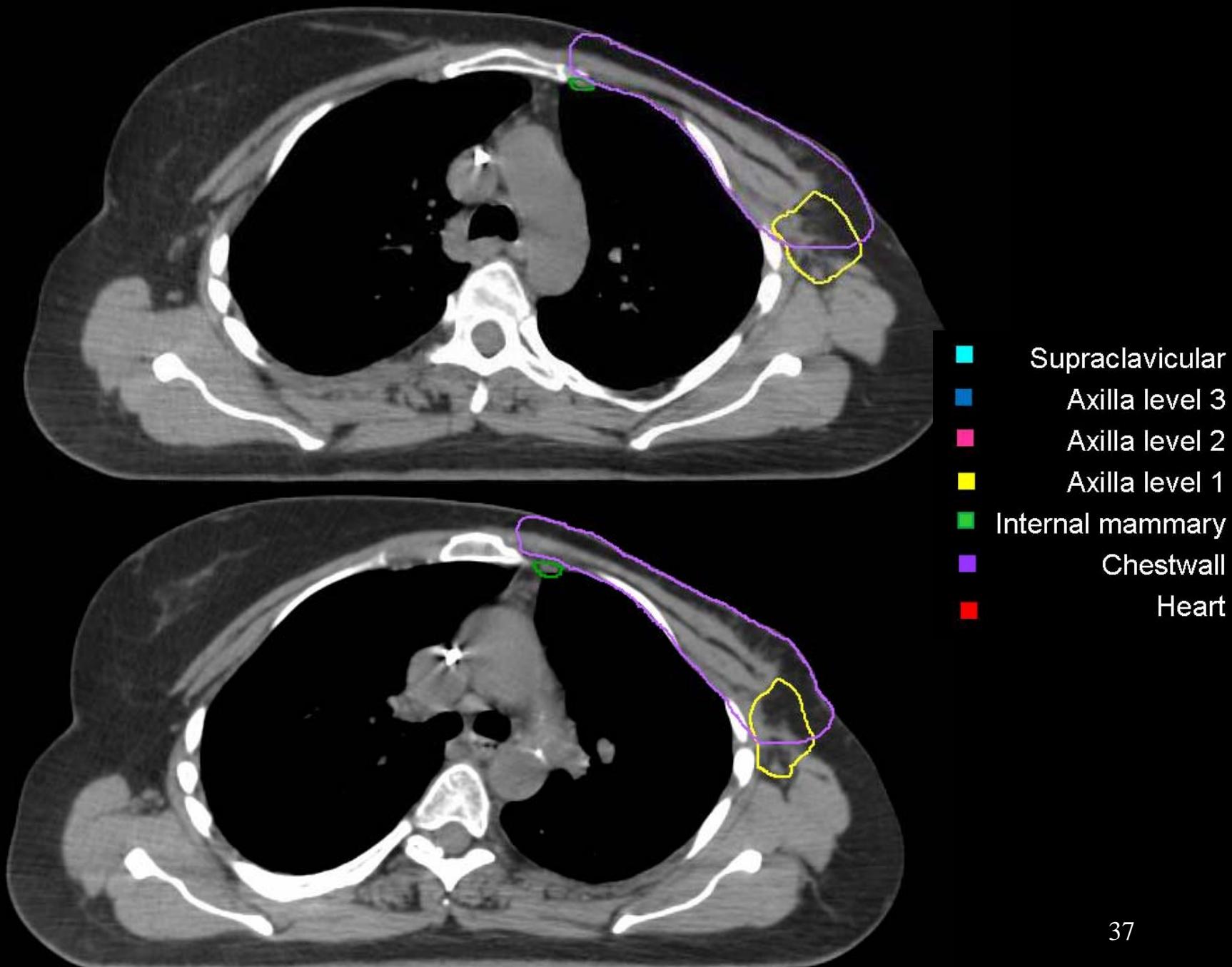


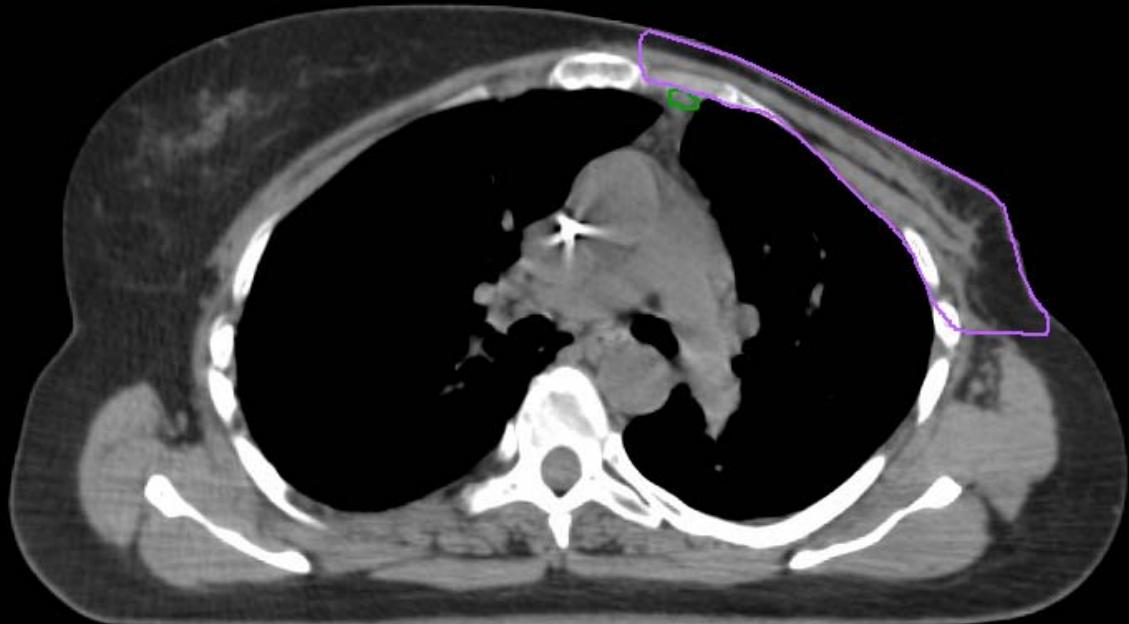




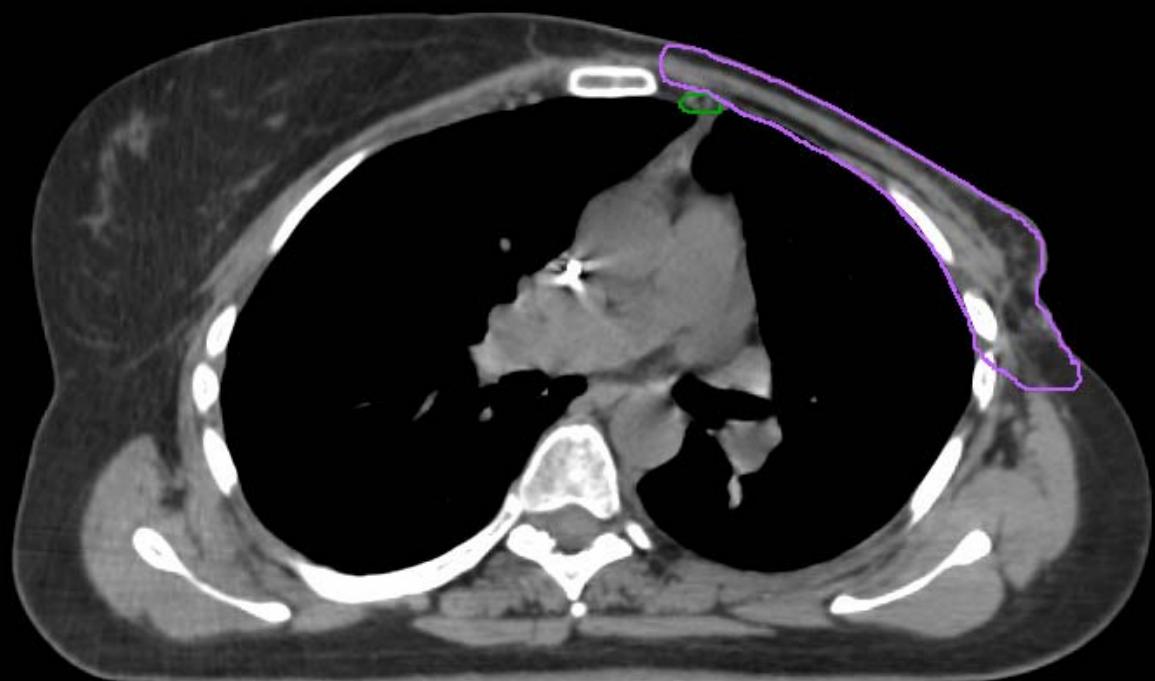
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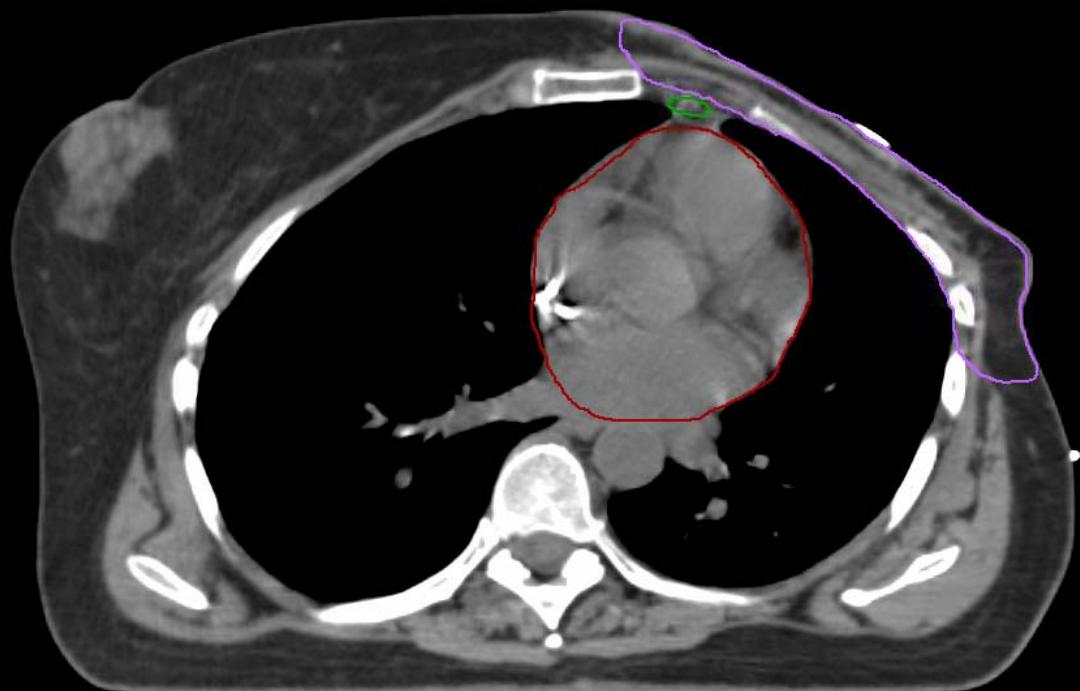
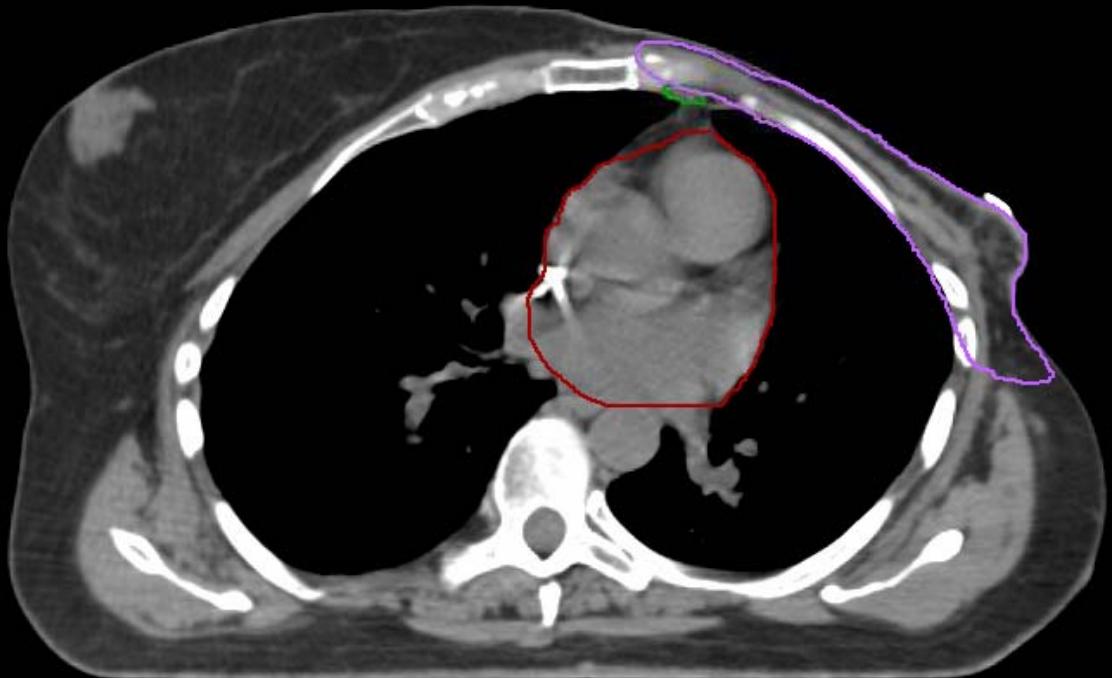




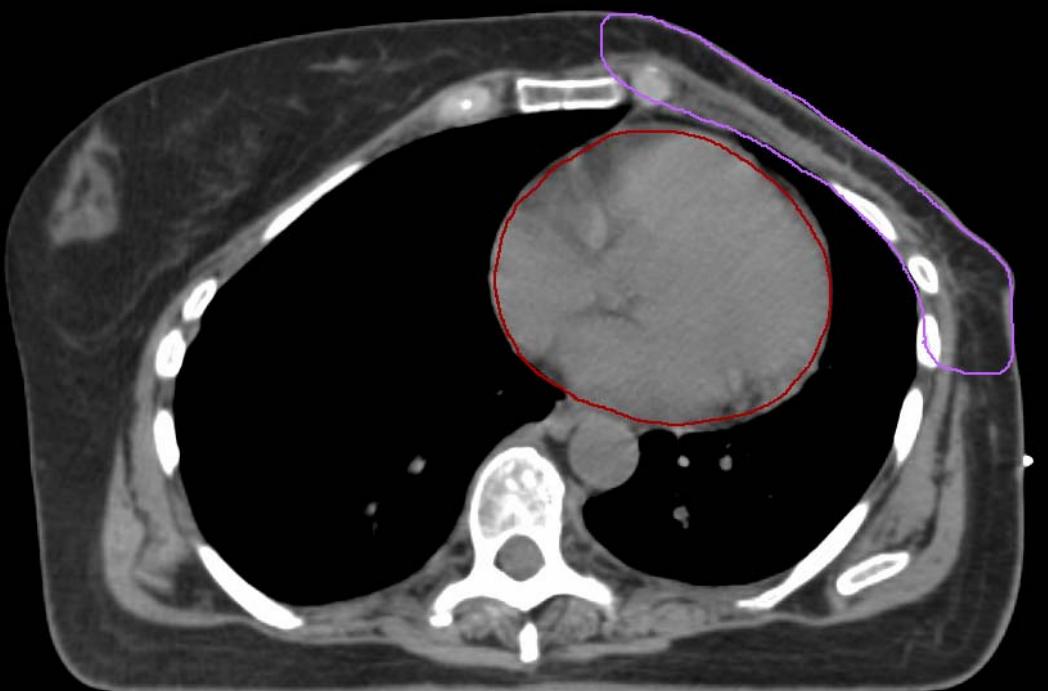
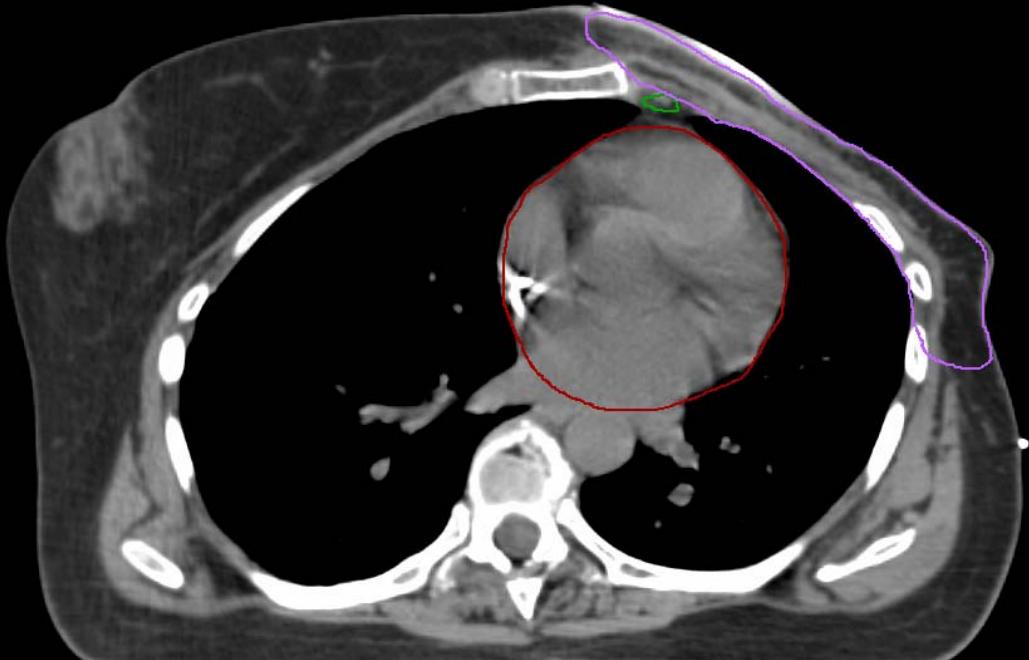


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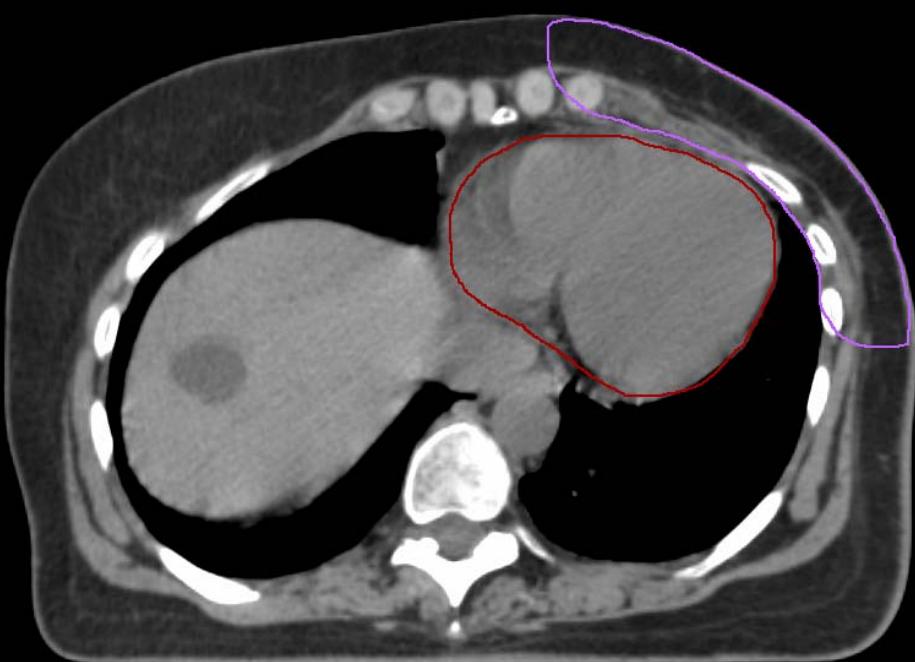
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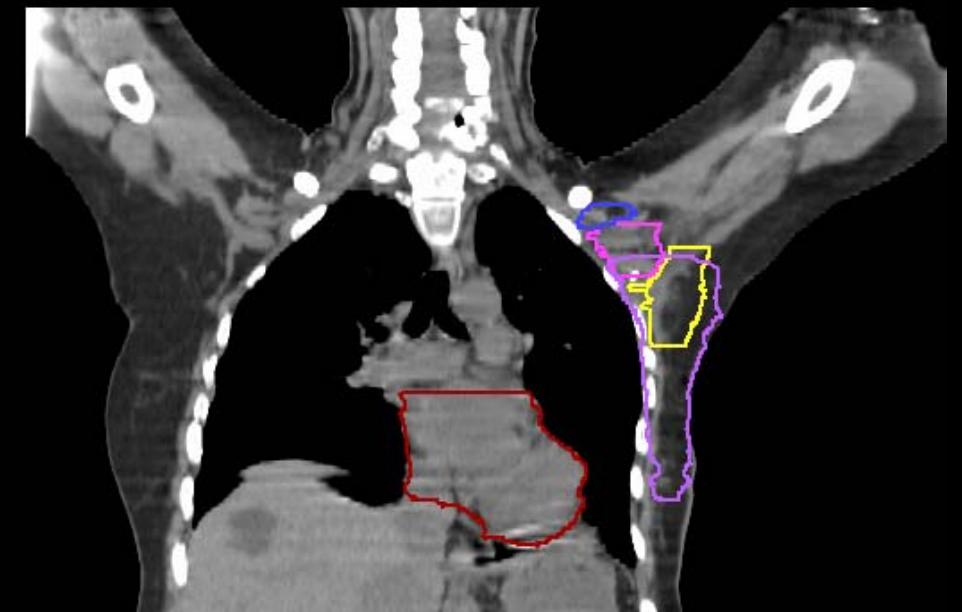
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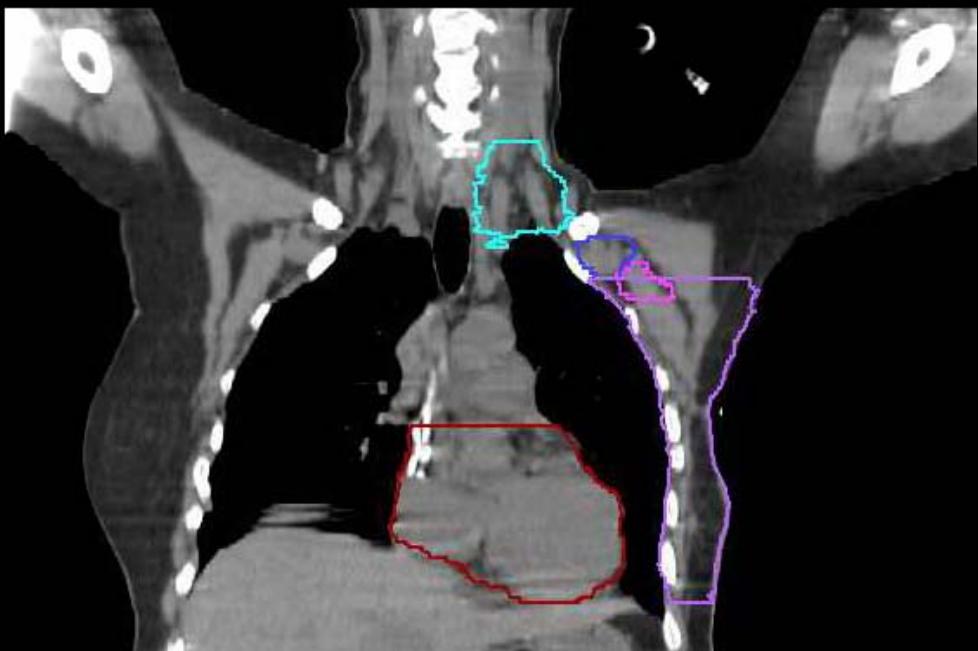
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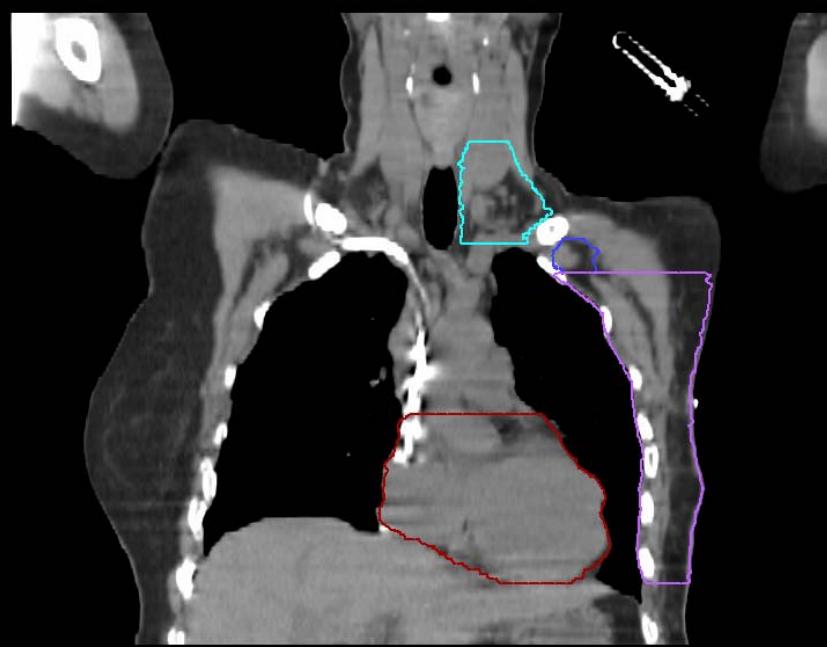


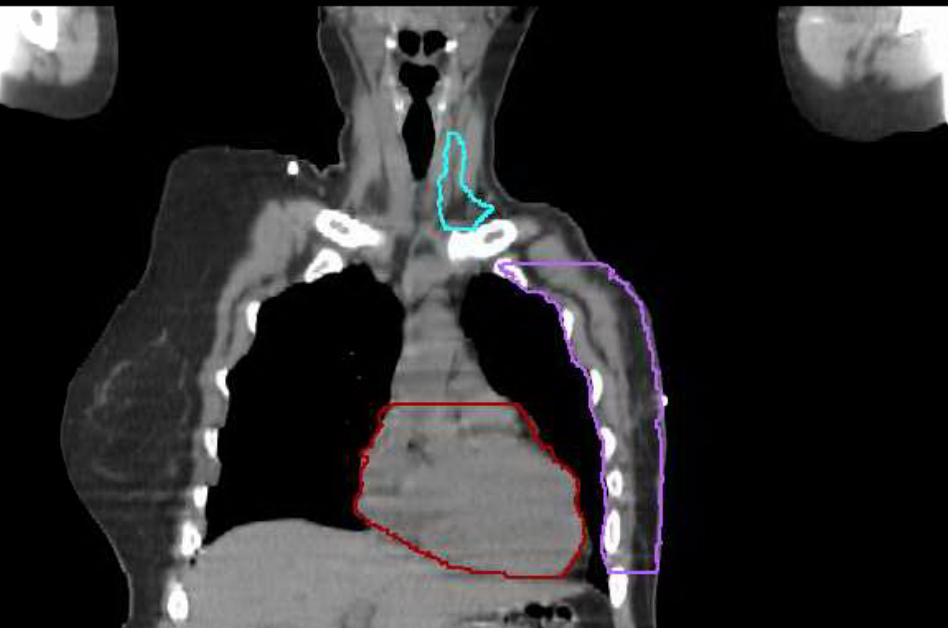
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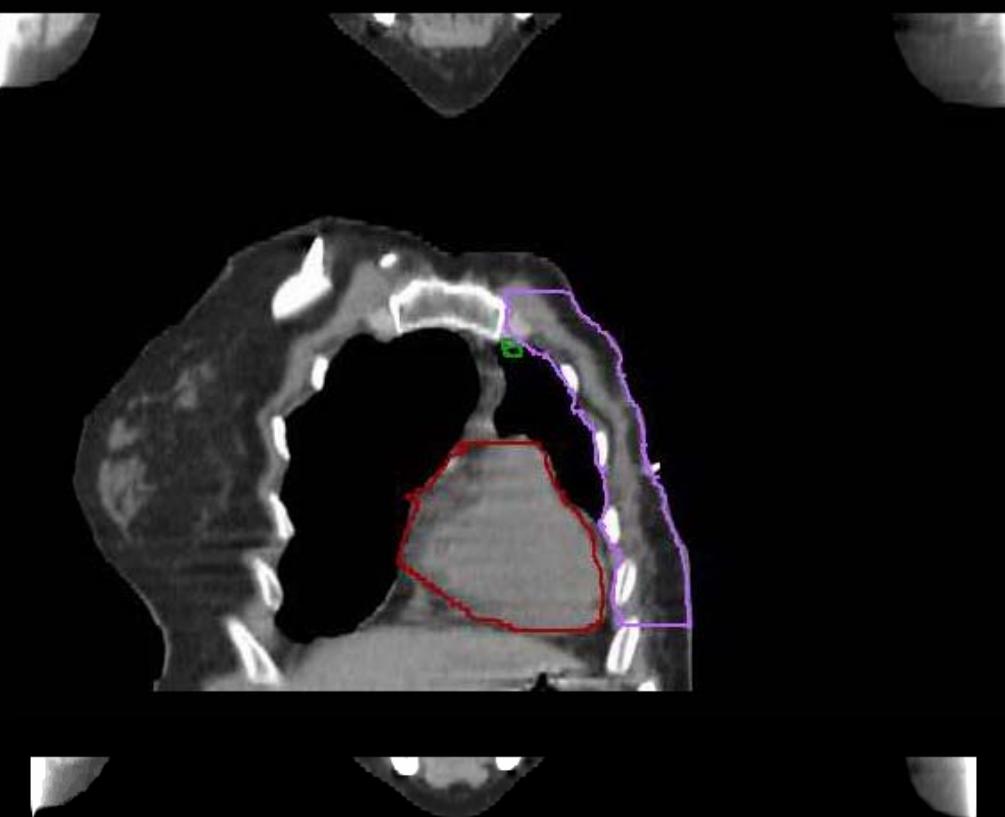
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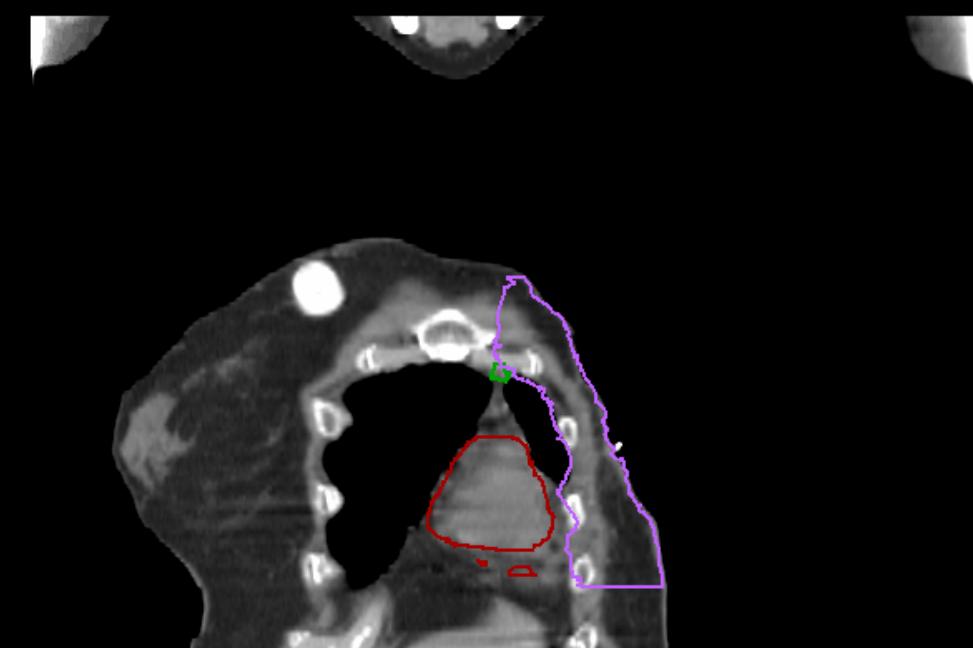


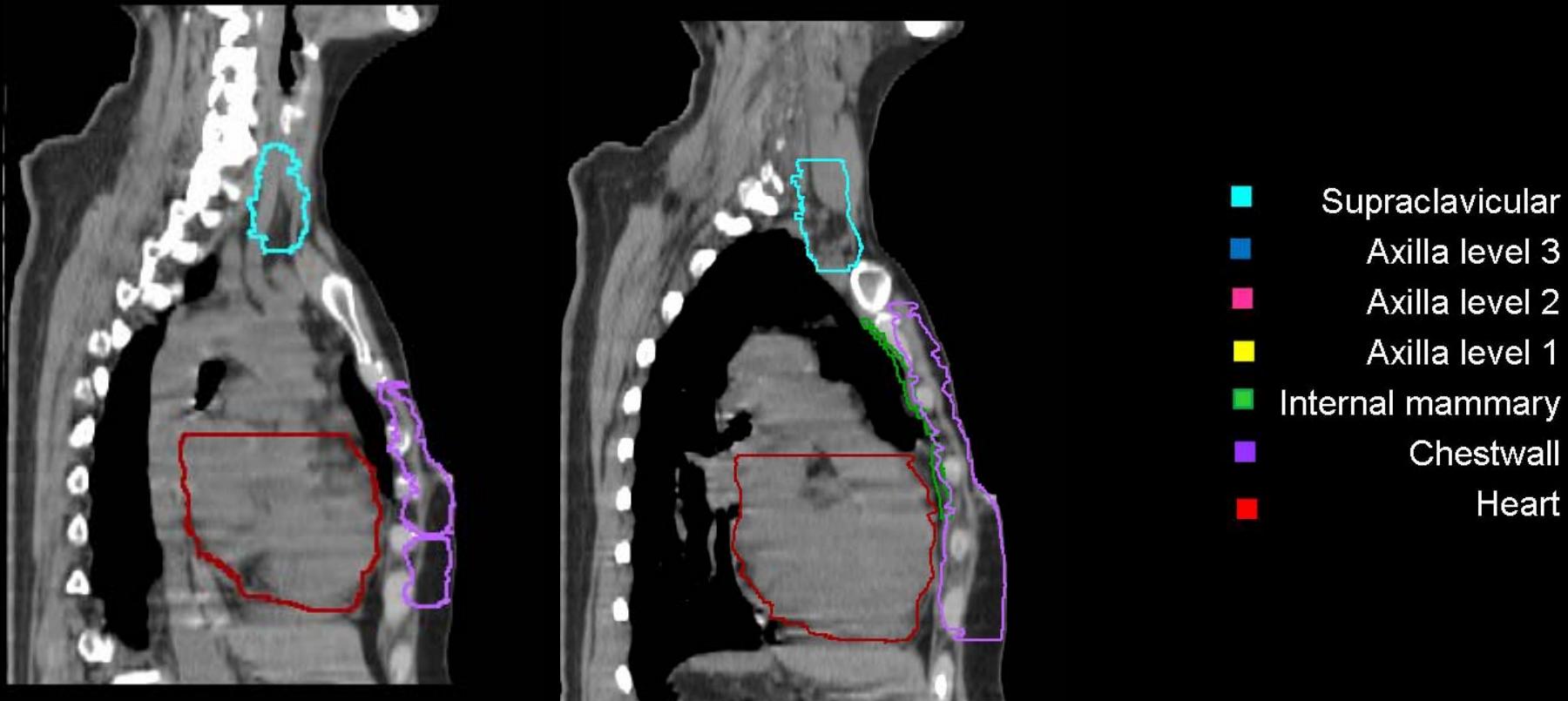
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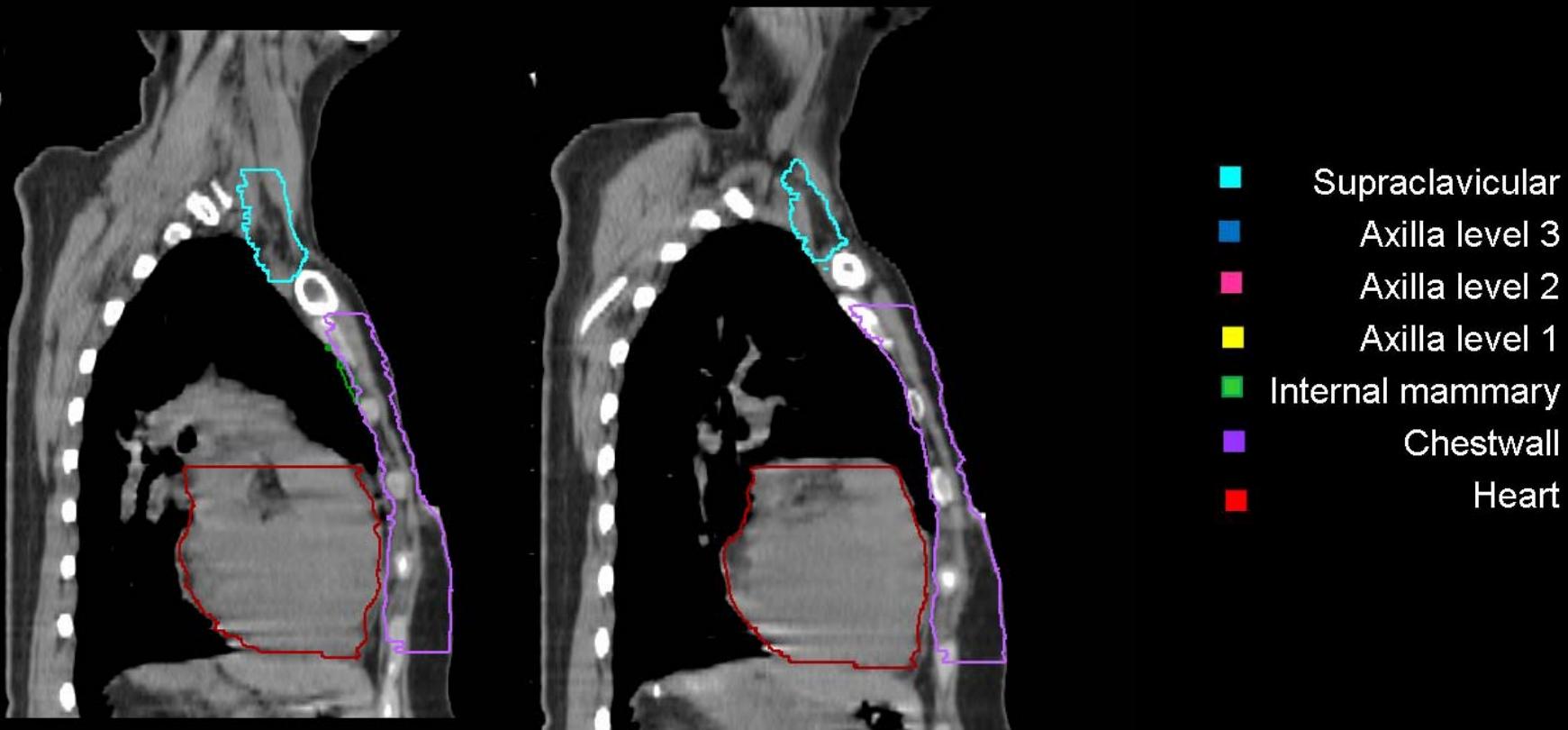


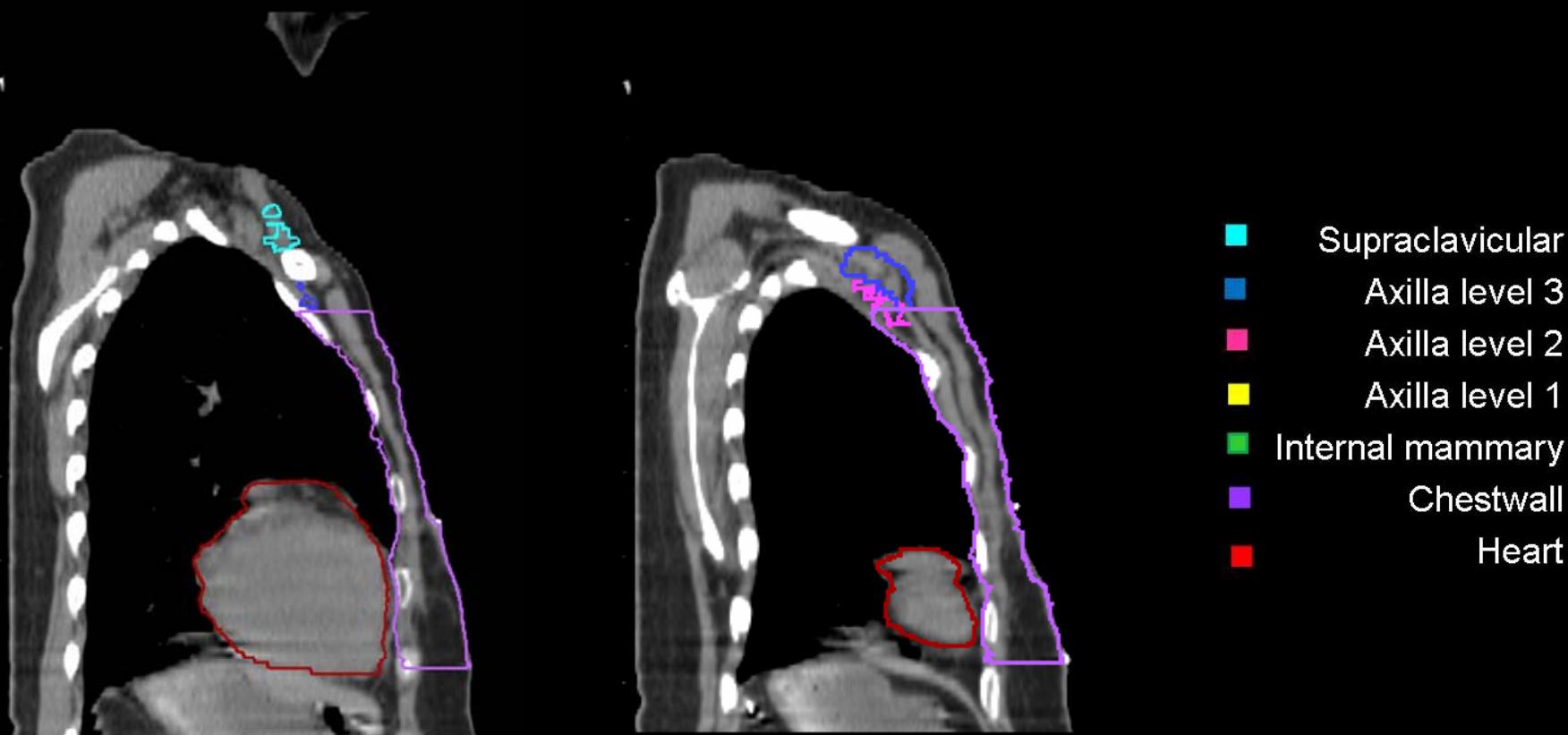


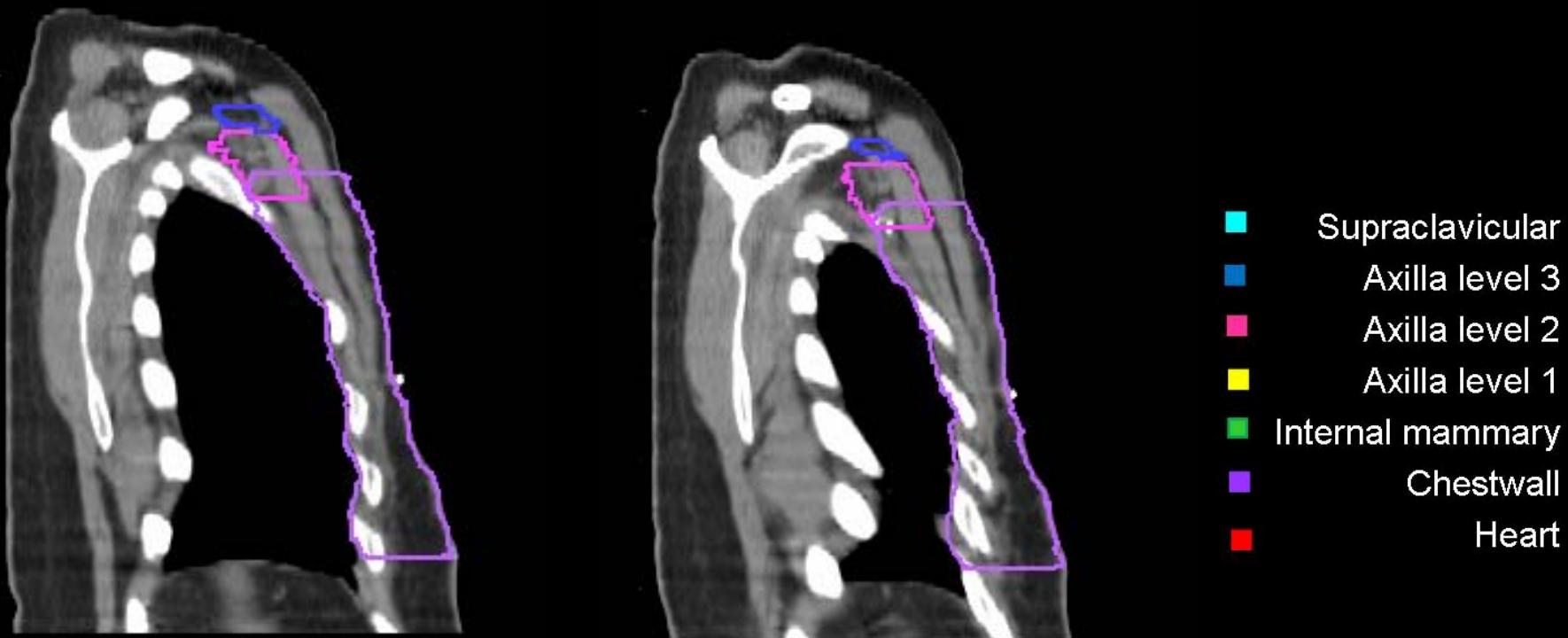
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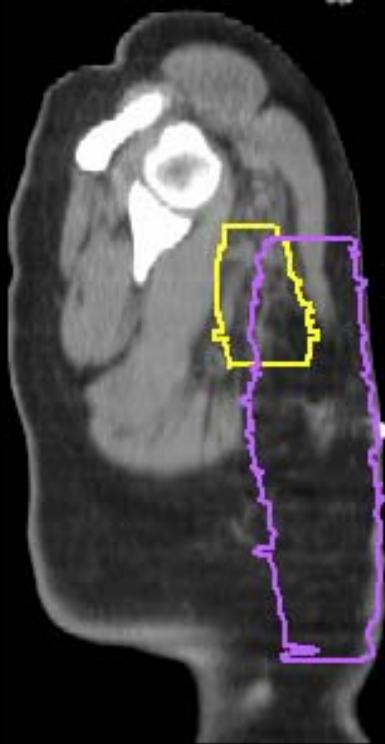








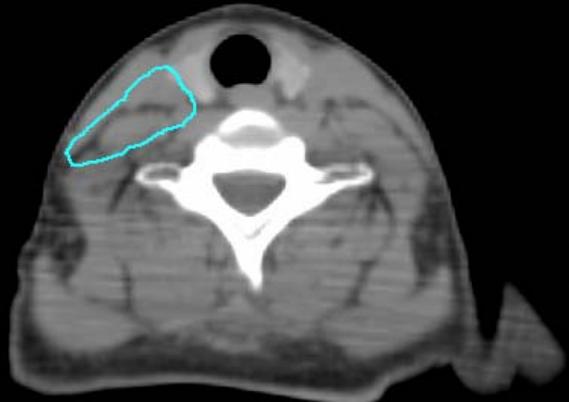
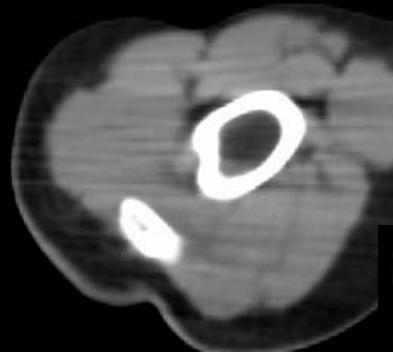
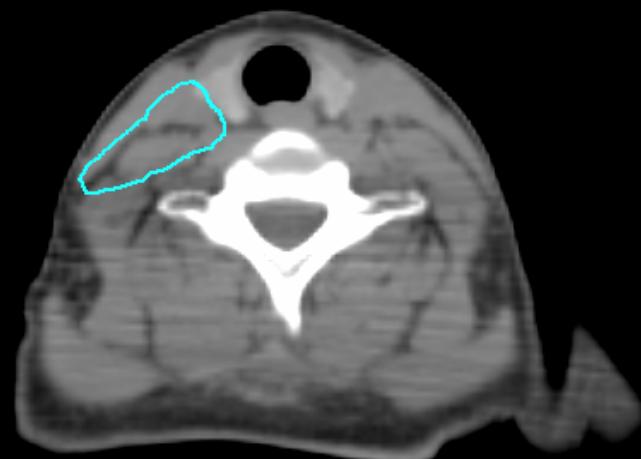
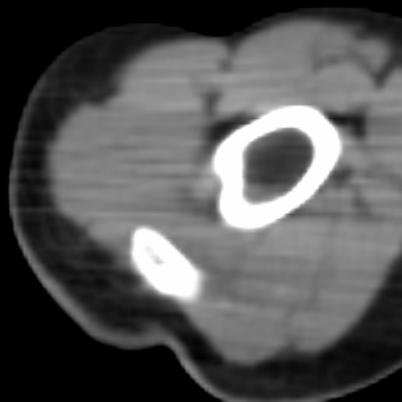


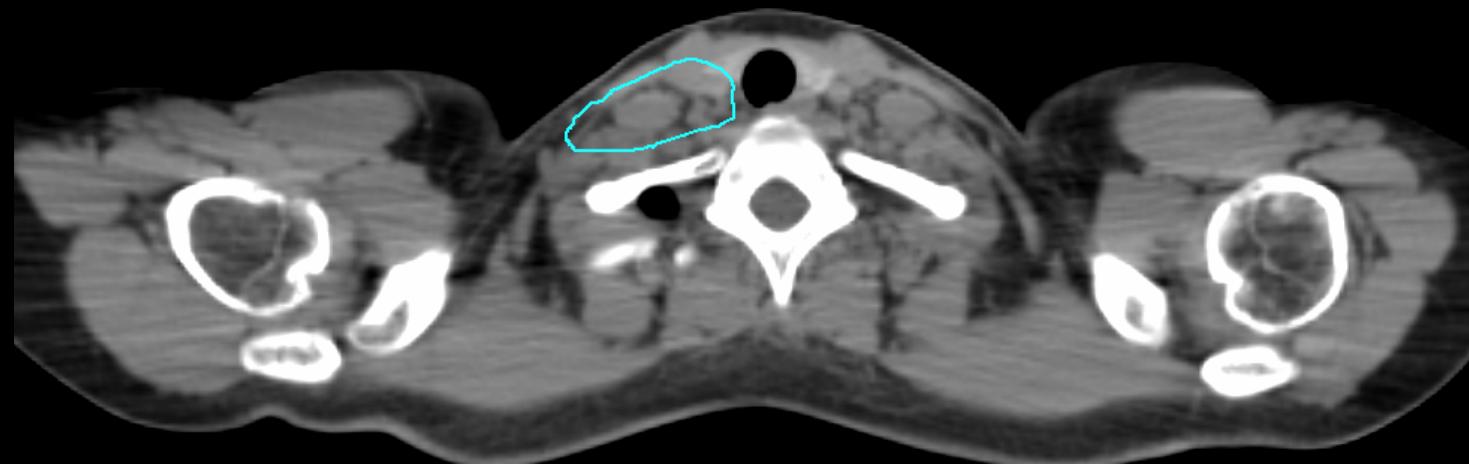


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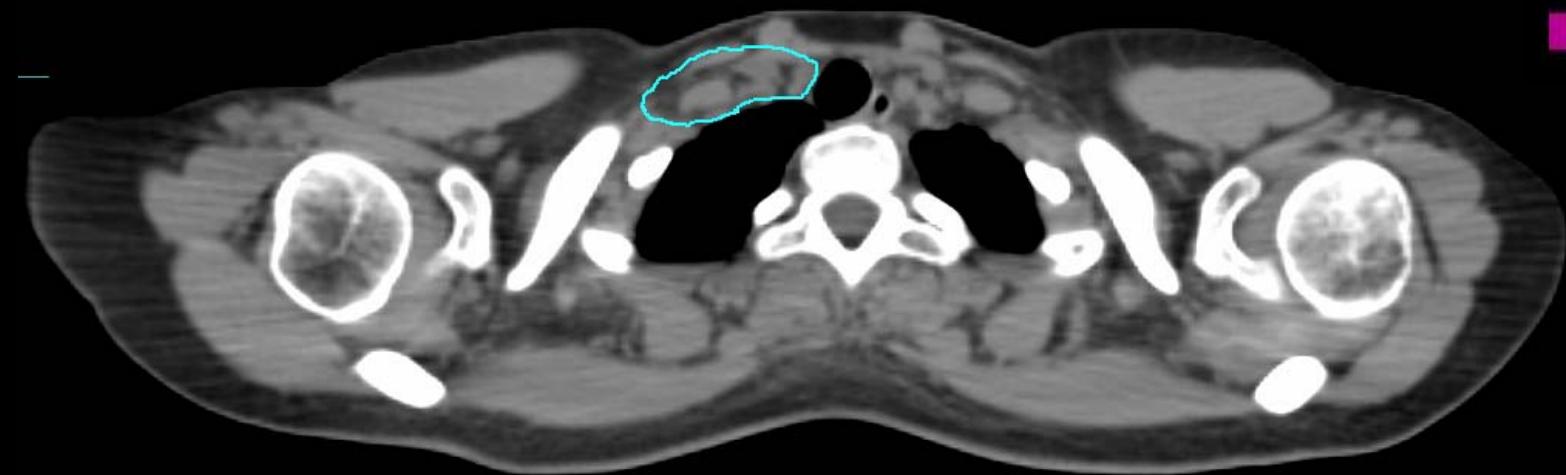
# Case C: Stage III- Intact breast post lumpectomy

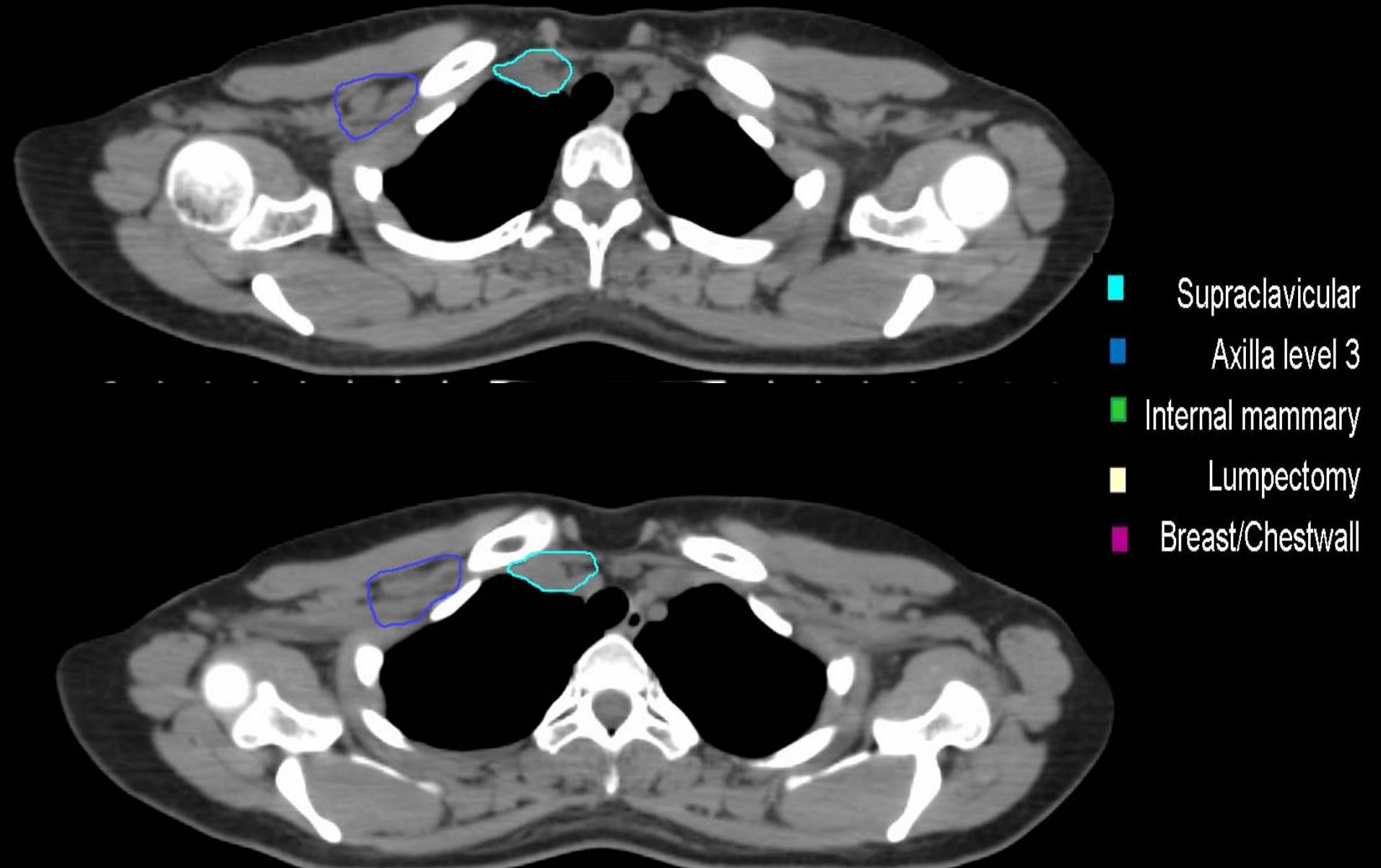
- Stage IIIA (T-2, N-2, M-0) right breast cancer, tumor size 3 cm, 4/18 nodes positive
- Surgery: Lumpectomy and axillary node dissection
- Radiation: Breast, chestwall  $\pm$  regional lymph nodes
- External wires present on CT:
  - Wire on lumpectomy scar
  - BB on AP set-point at clinically estimated level of the match for the supraclavicular  $\pm$  axilla with the chestwall  $\pm$  IMC fields
  - Wire extending from 9-3 o'clock around the infra-mammary fold
  - Wires at lateral and inferior clinically estimated extent of the chestwall

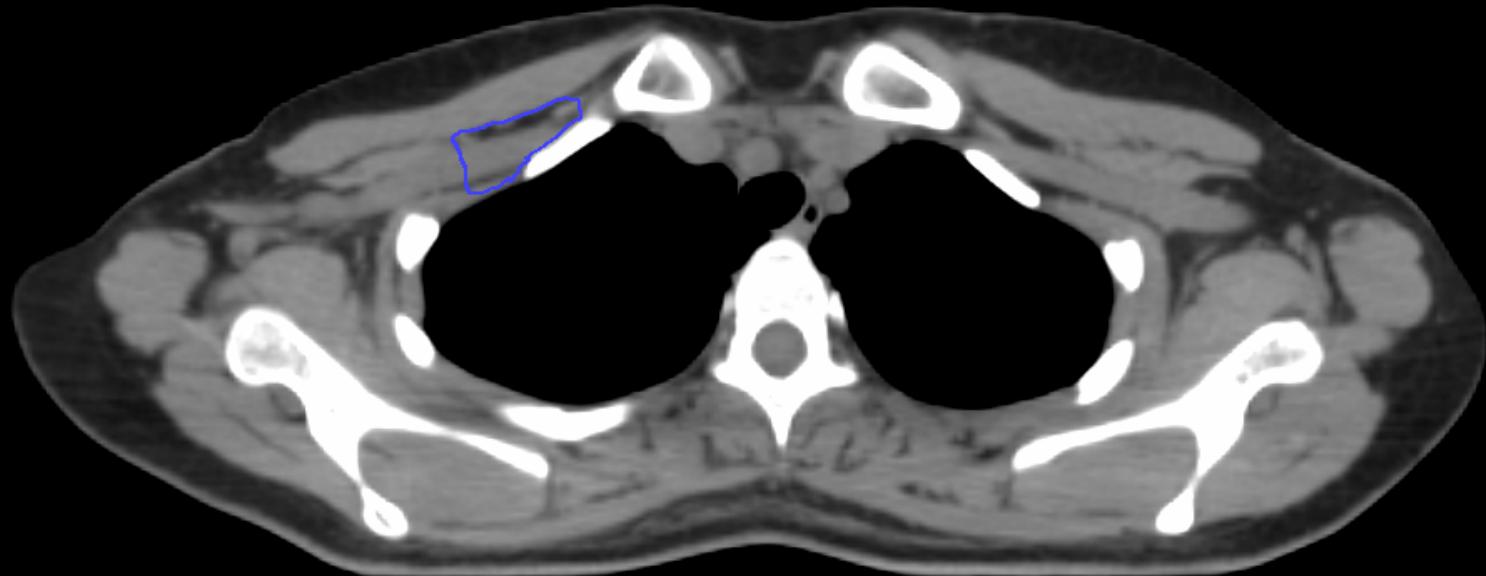
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- Supraclavicular
  - Axilla level 3
  - Internal mammary
  - Lumpectomy
  - Breast/Chestwall



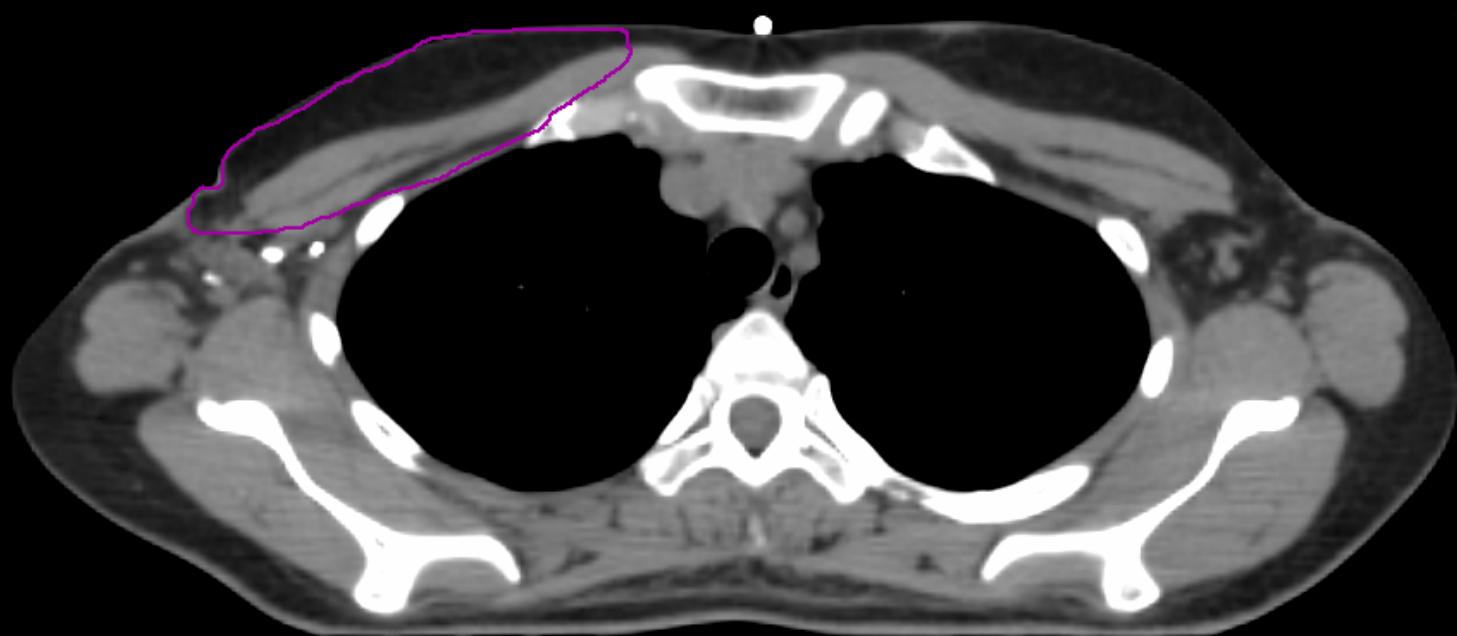
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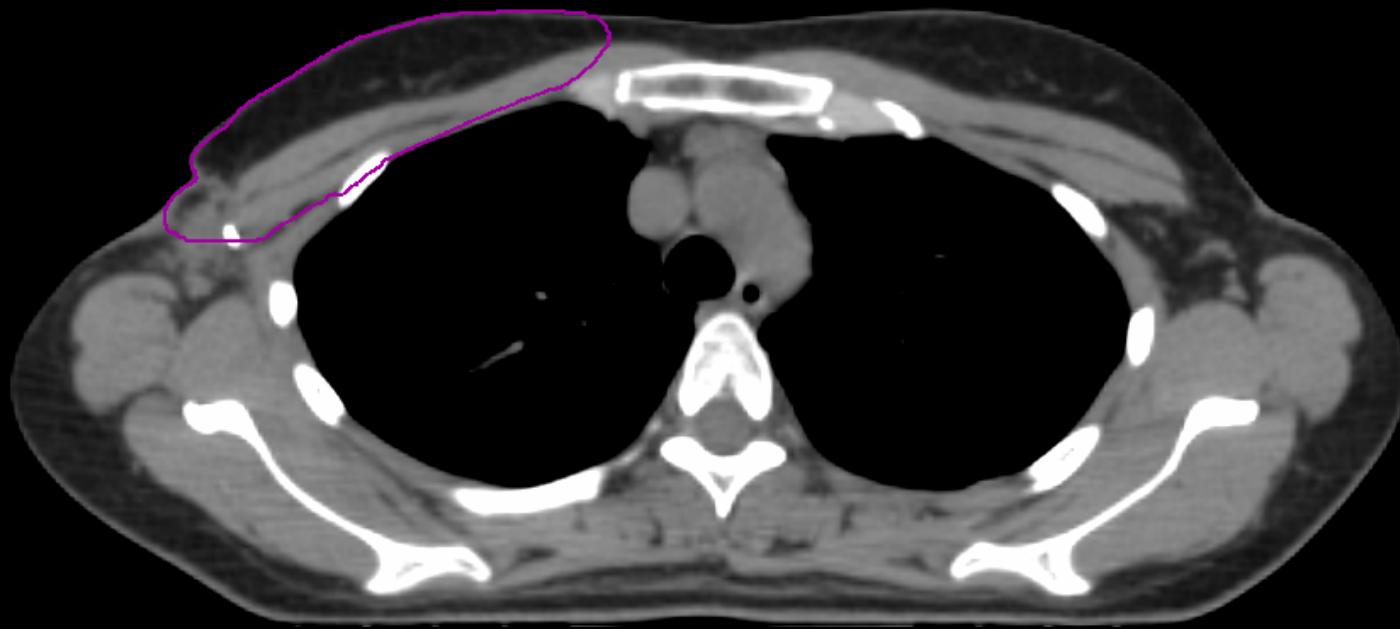




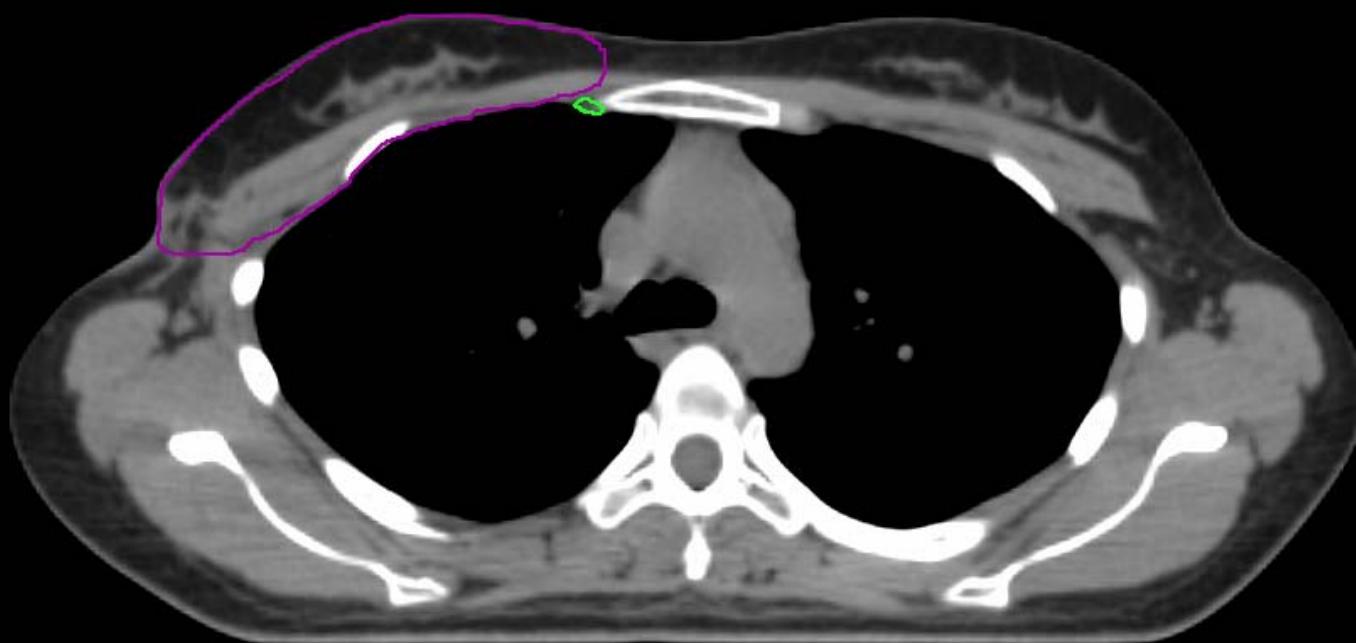


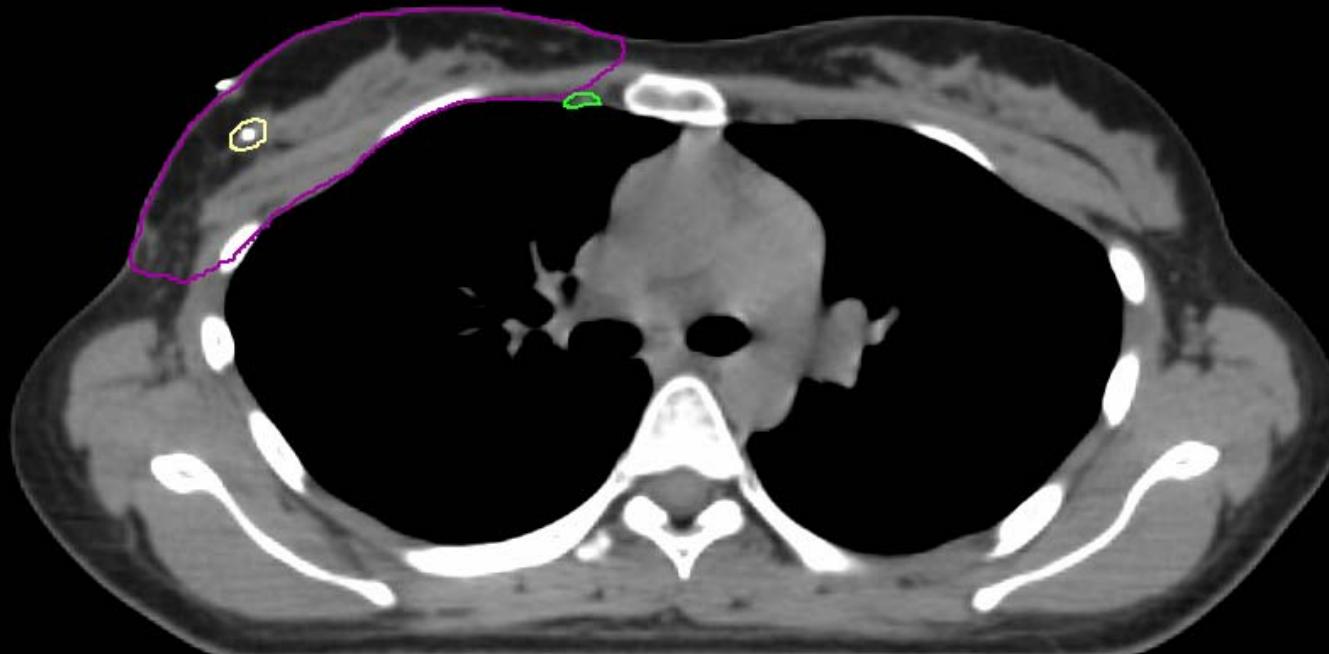
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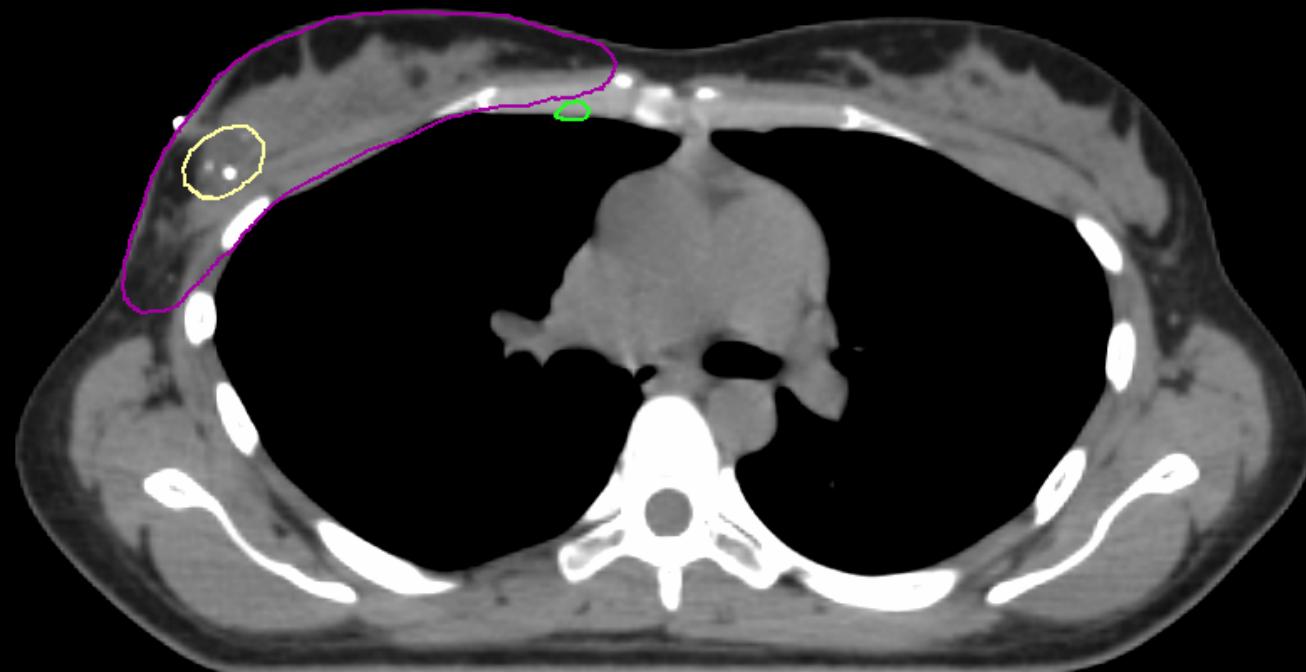


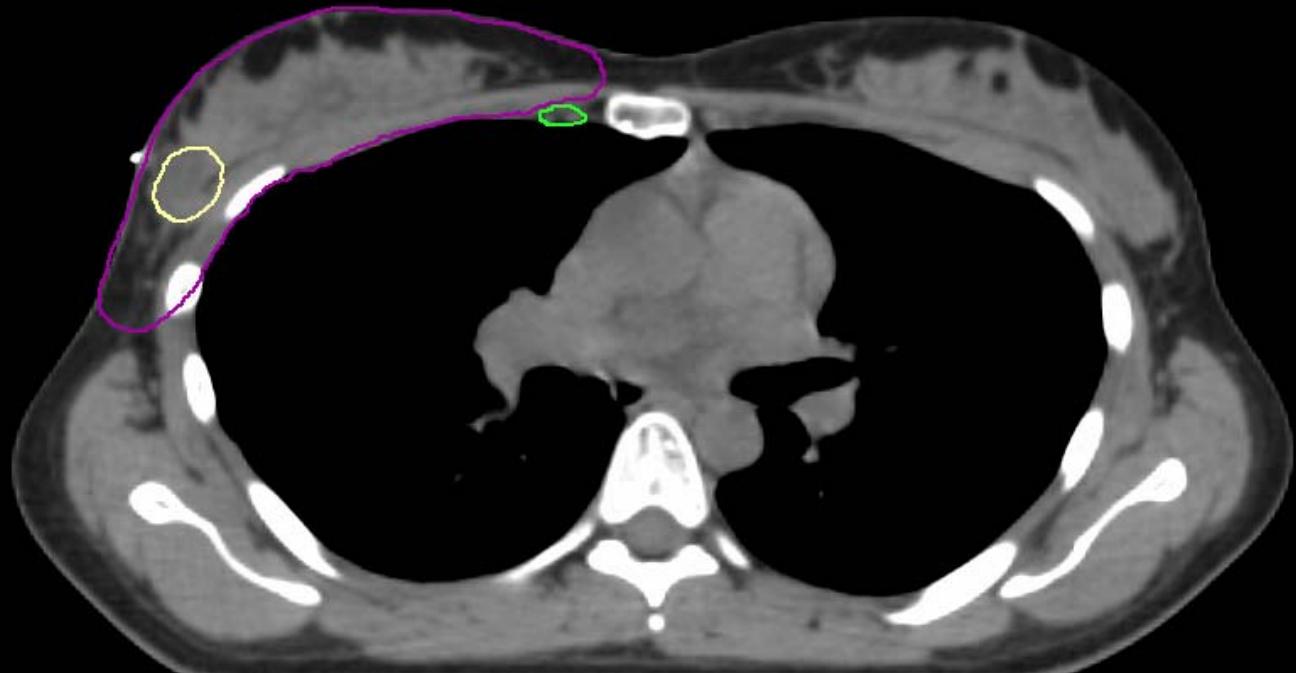
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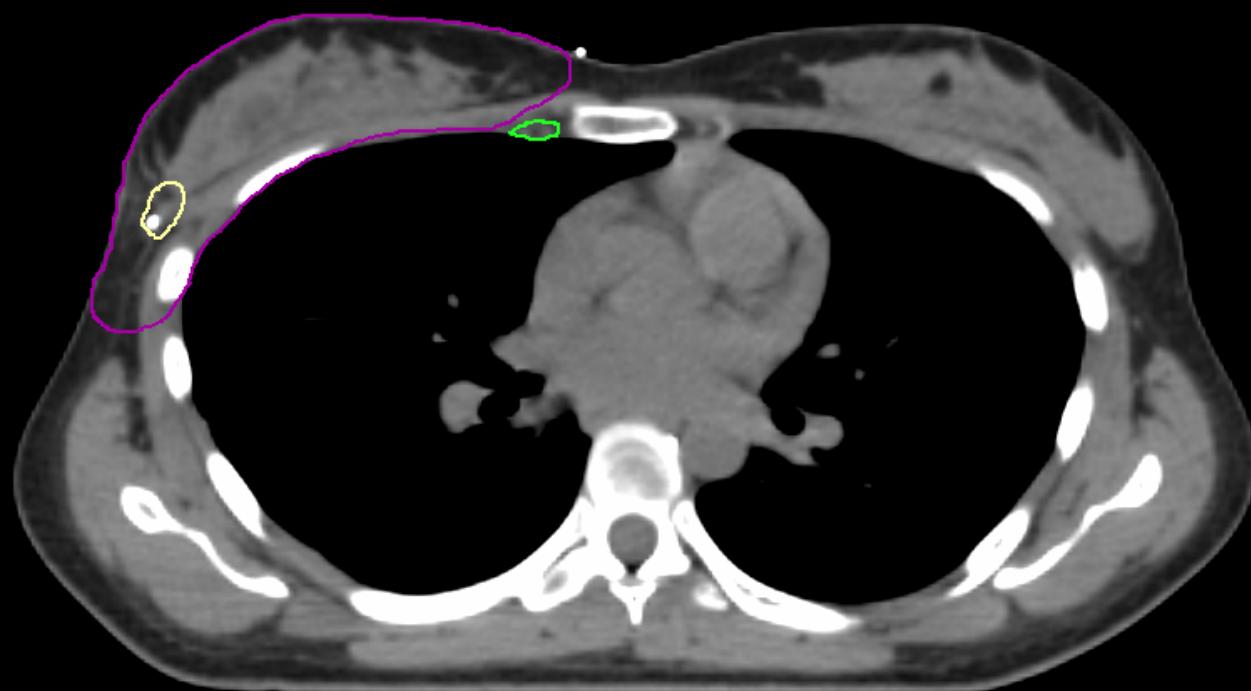


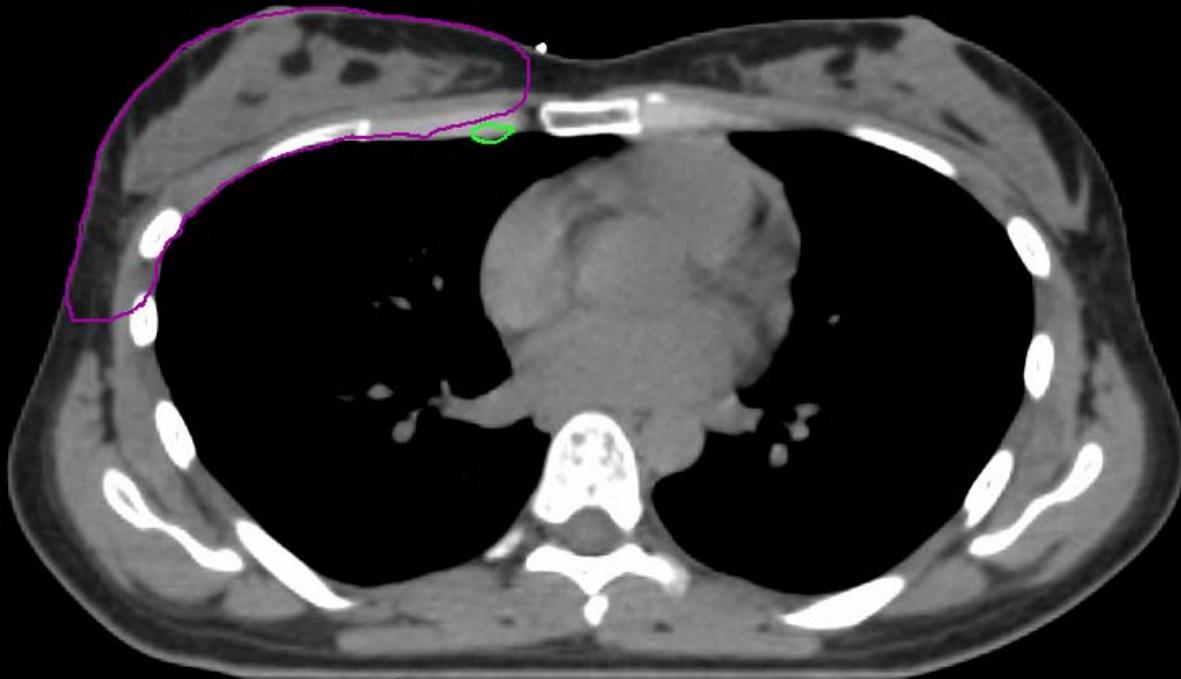
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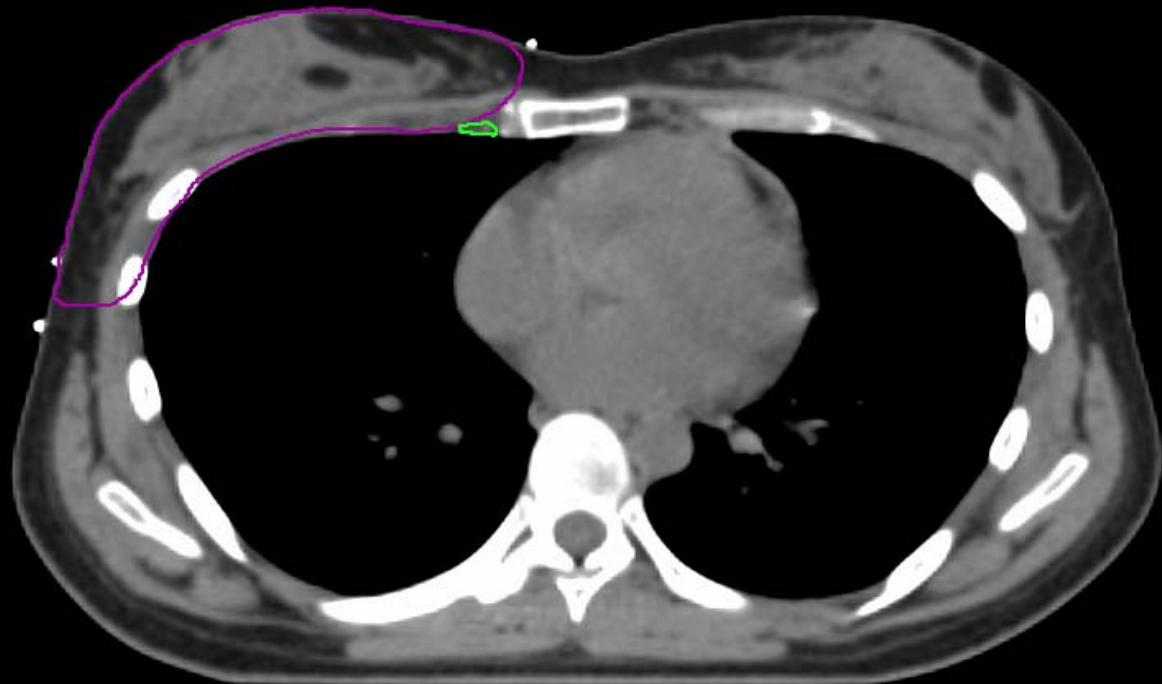


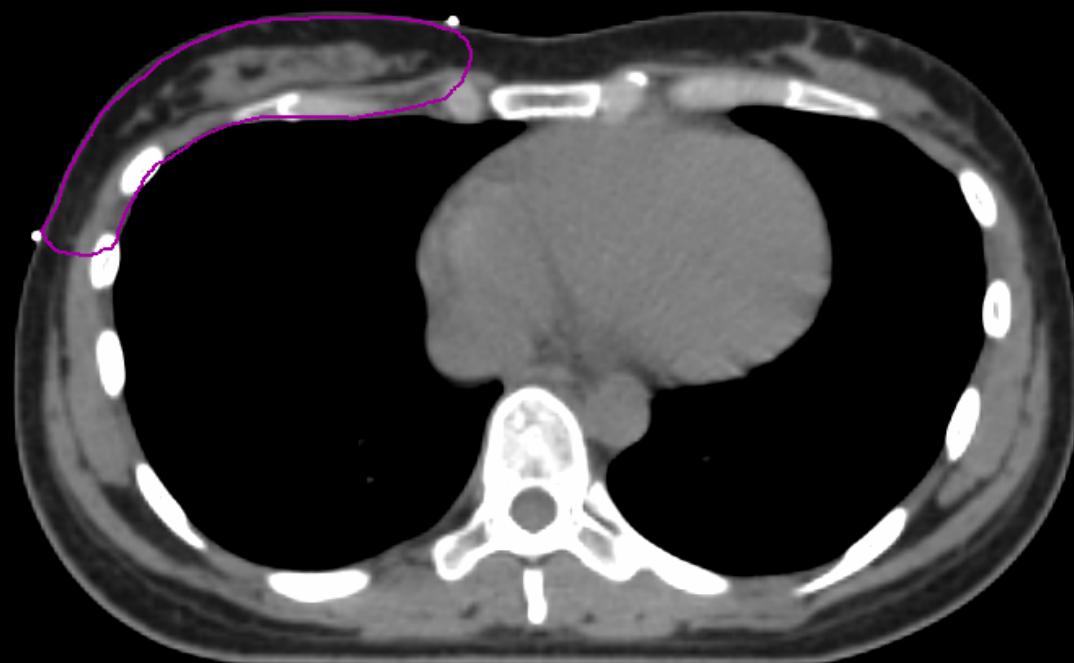
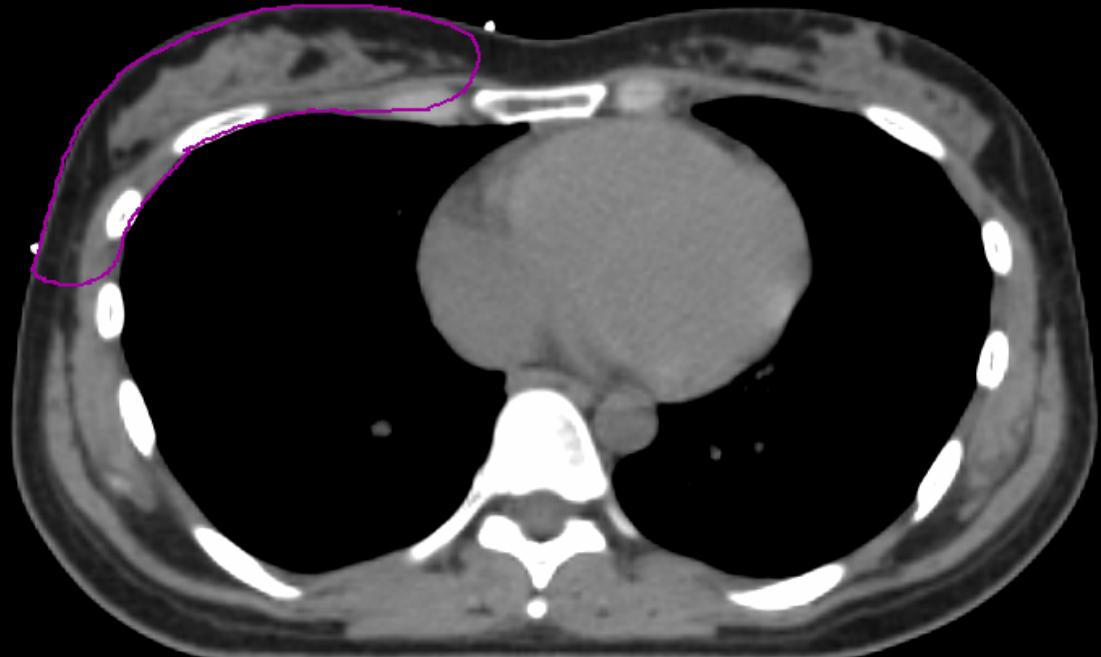
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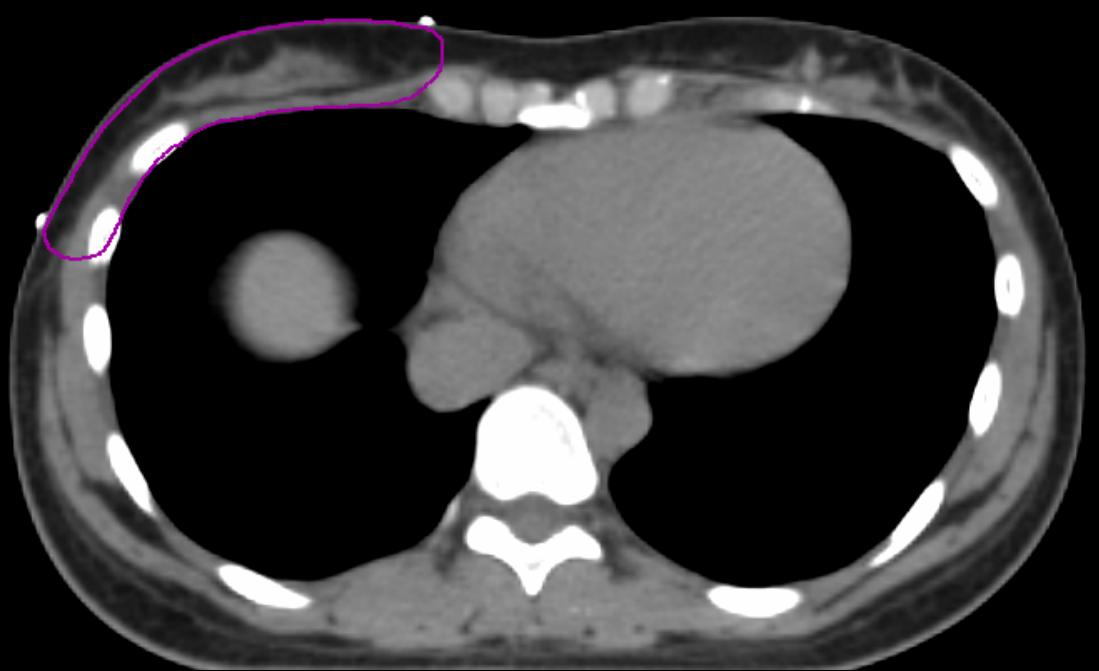


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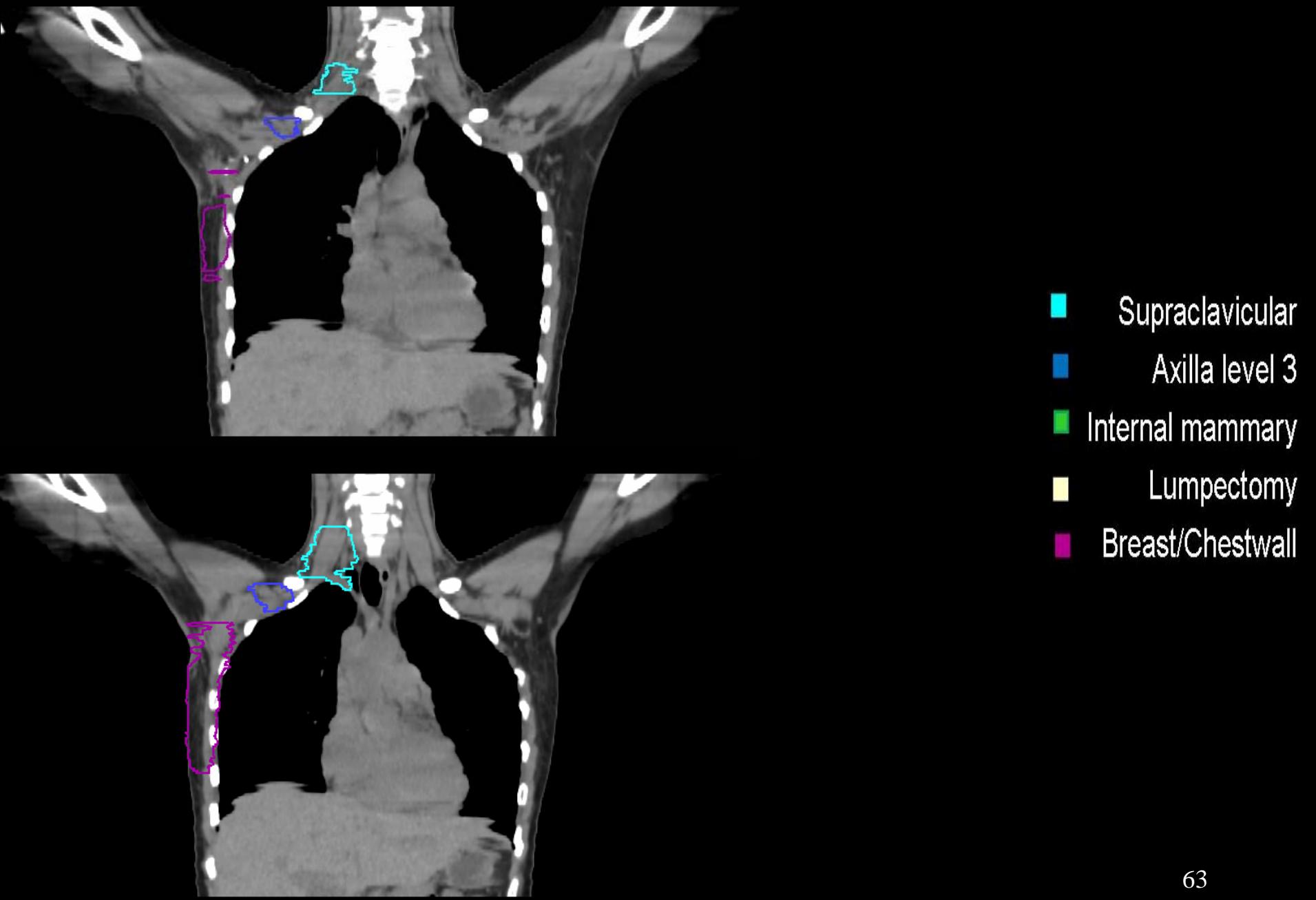




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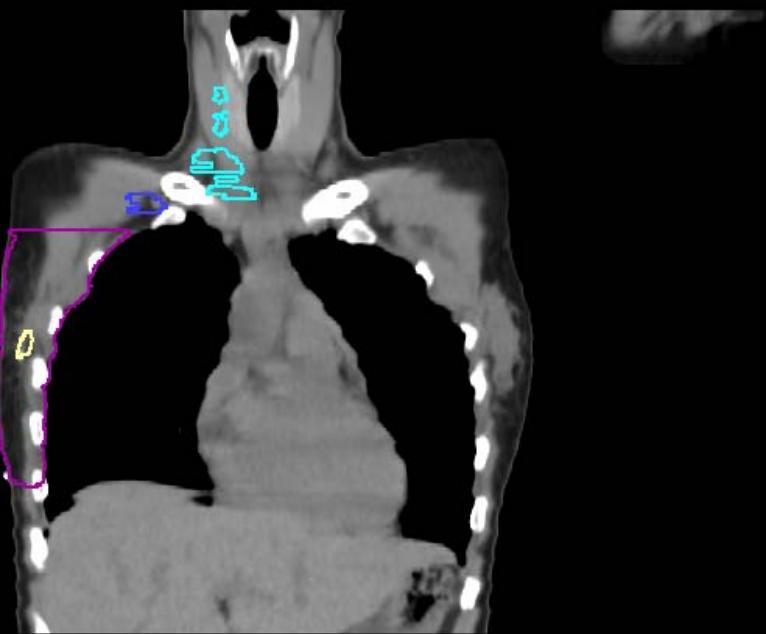


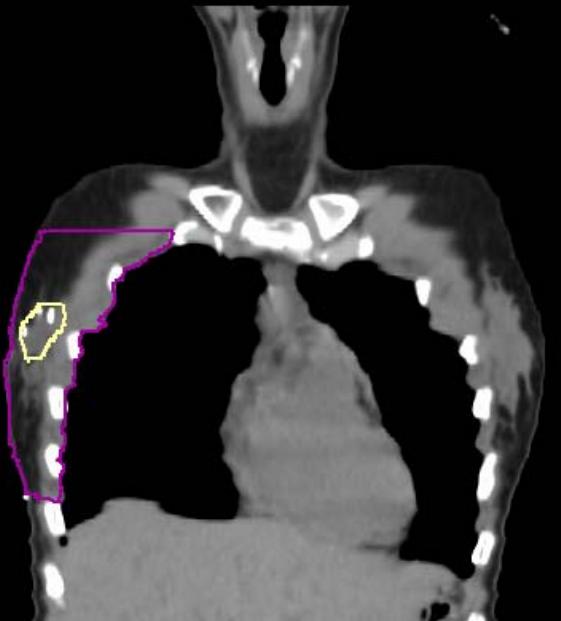
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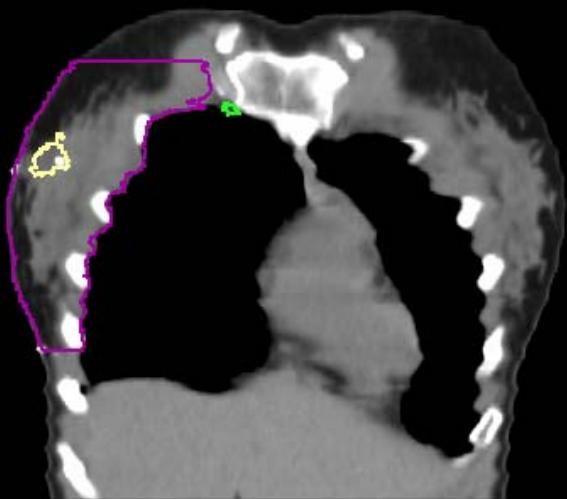


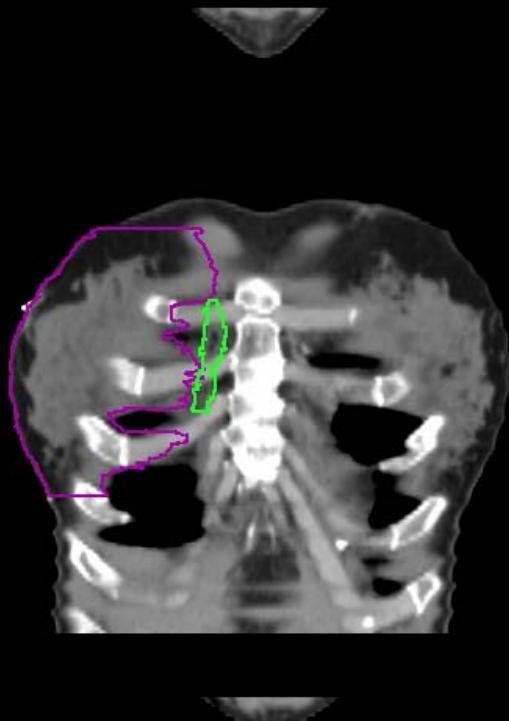
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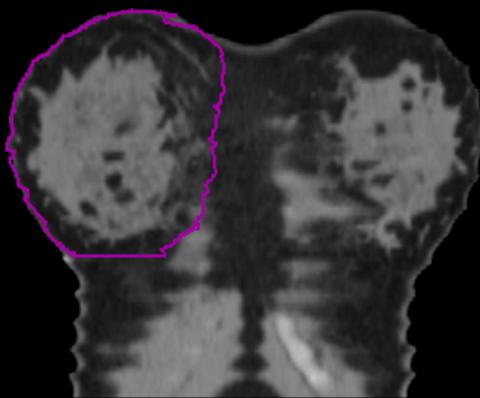


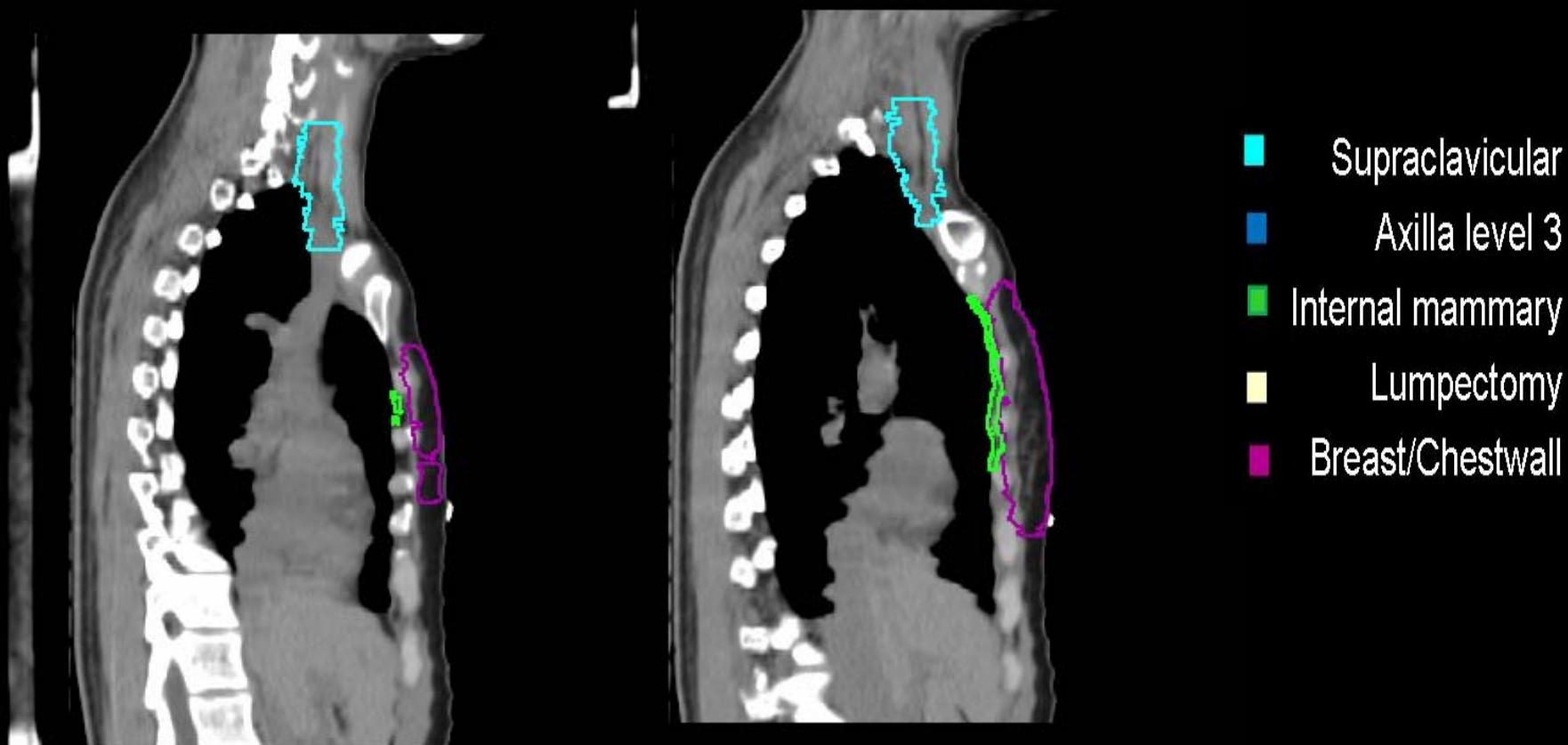
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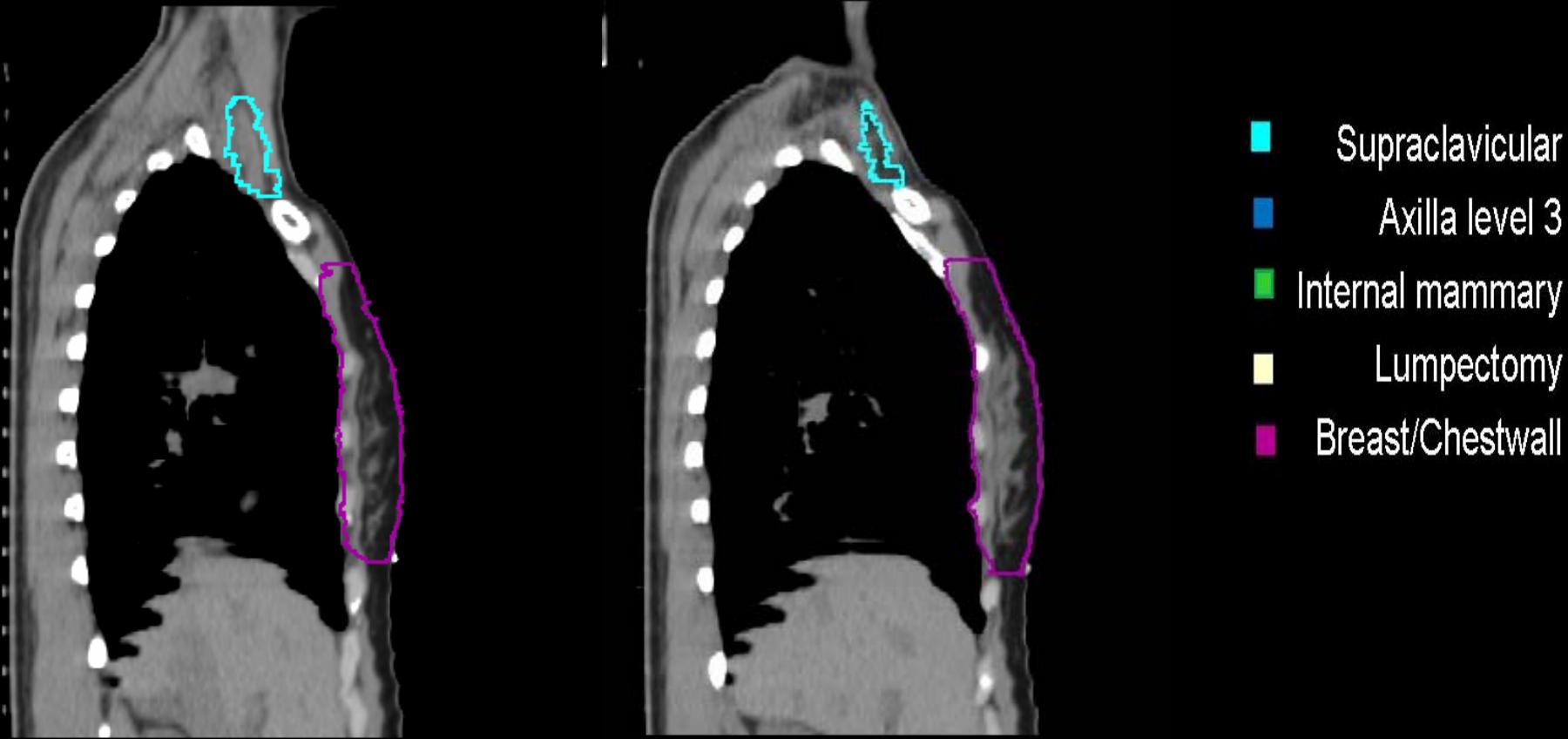


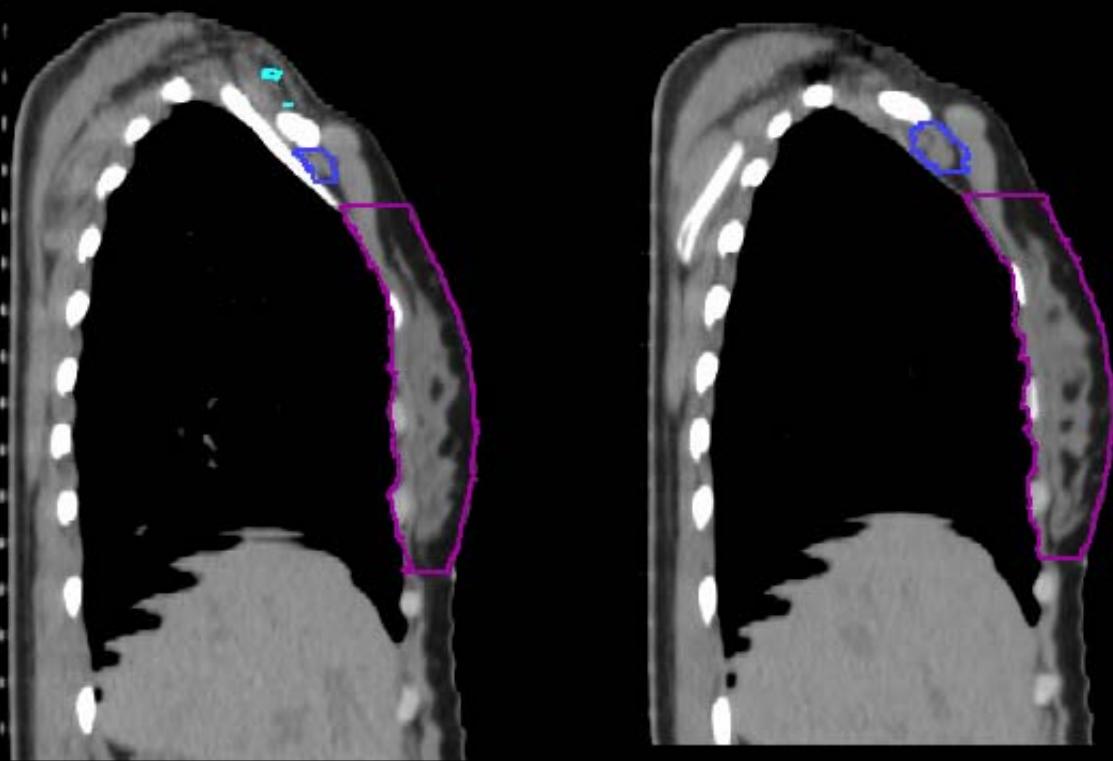


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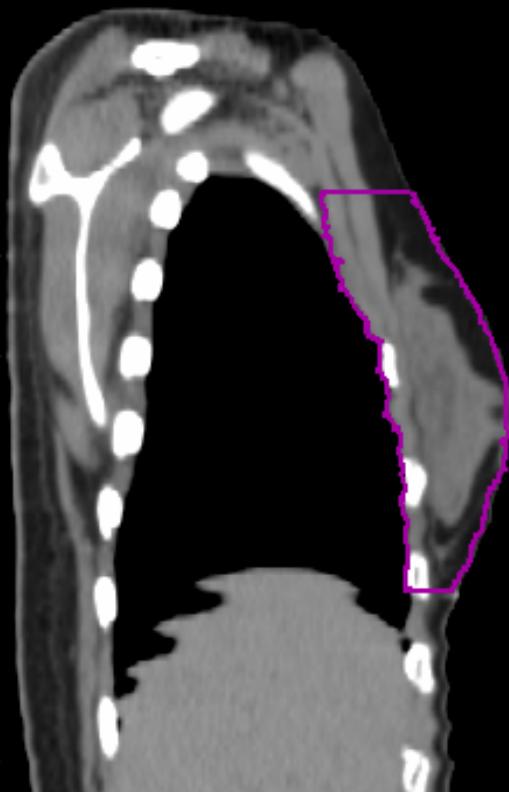
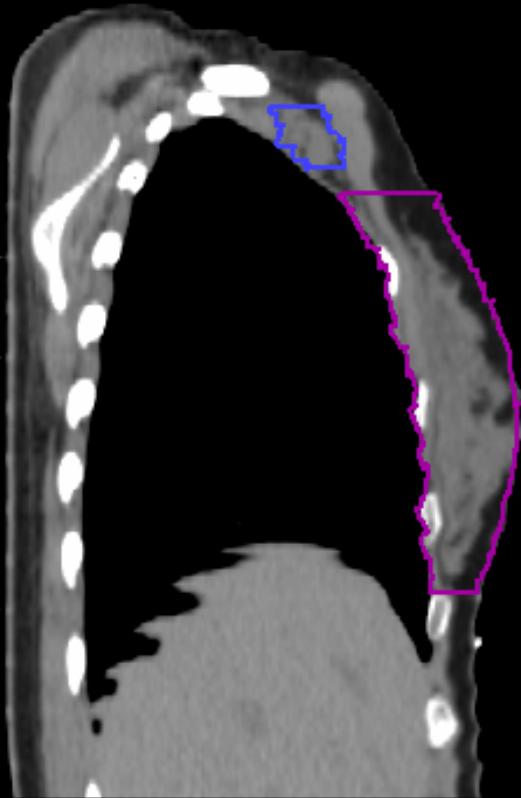








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