

Introduction

- Post-operative radiotherapy has an established role in patients with segmental mastectomies, decreasing risk of local recurrence.
- Whole breast radiotherapy (WBRT) is associated with a significant time commitment, along with potential toxicity to adjacent structures.
- Partial breast irradiation (PBI) techniques are currently being studied in hopes of improving patient convenience and reducing radiation toxicity.
- These novel breast radiotherapy techniques, such as 3-D conformal external beam PBI, depend on accurate tumor bed definition for accurate treatment delivery.
- No standard exists as to how to best delineate the target volume (the tumor bed) post segmental resection.

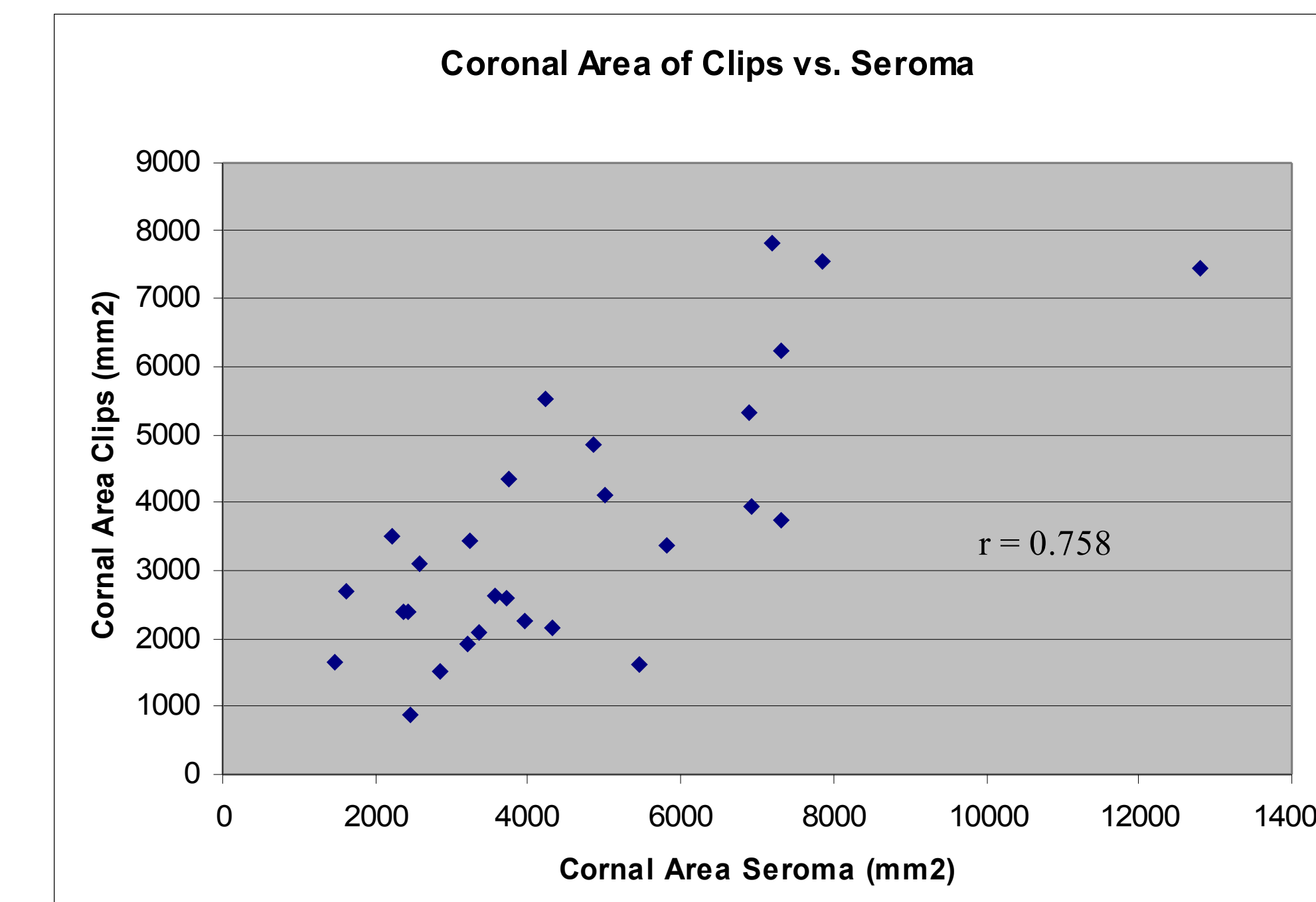
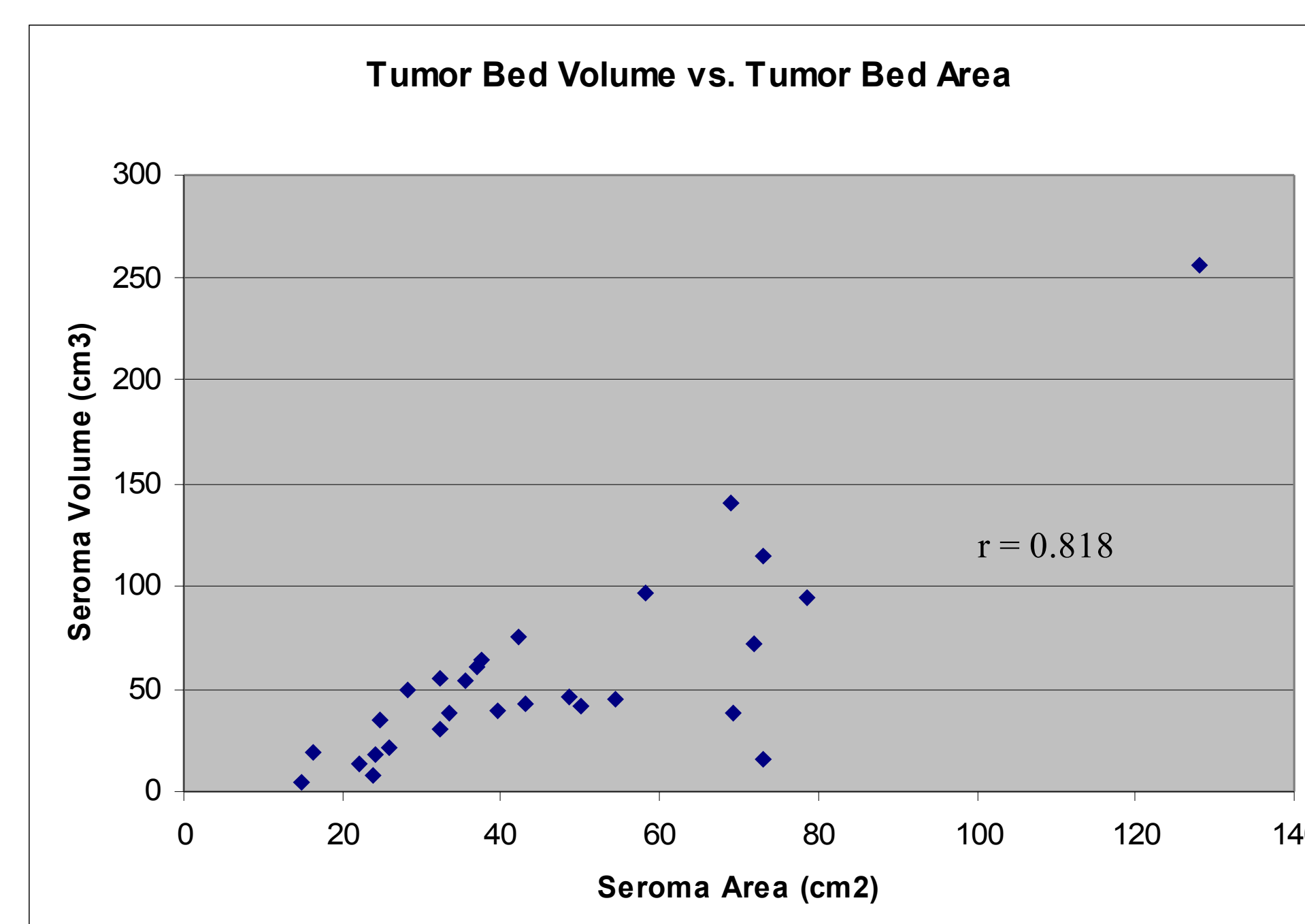
Objectives

- To compare the location and extent of the tumor bed as defined by surgical clips and seroma formation on CT scan, after lumpectomy.

Methods

- Planning CT scans of 28 patients with multiple surgical clips were reviewed after lumpectomy.
- Clinical data including age, tumor characteristics, stage, size of lumpectomy from pathology reports, interval from surgery to planning CT, and treatment will be collected from the patient chart.
- Image window and level settings were adjusted to optimize contrast in the soft tissues.
- The seroma was contoured to identify the tumor bed. Surgical clips were also identified and contoured to determine surgical clip tumor bed definition.
- The medial-lateral and super-inferior dimensions of the seroma and clip defined abnormalities were measured and recorded by a single physician.
- The tumor bed area in the coronal plane was calculated by multiplying the measured transverse (w) and longitudinal (l) radii by π for each patient, assuming it to be an ellipsoid ($A=\pi wl$).
- The distance between the geometric centers in the two-dimensional coronal plane, as determined by the two methods, will be measured and compared.
- Seroma tumor bed volume, as calculated by the ACQSim treatment planning program (v.4.9.1, Philips), was also recorded.
- Pearson correlation coefficient was generated to establish the relationship between the seroma tumor bed volume, as calculated by the ACQSim treatment planning program, and the tumor bed area in the coronal plane. As well, the correlation coefficient was generated for the tumor bed area as determined by seroma and clips.
- Tumor bed area, as calculated using the seroma and clips, was compared using a paired T-test.

Figure 1: A. Correlation of seroma tumor bed volume, as calculated by the ACQSim treatment planning program, compared to seroma tumor bed area B. Correlation of coronal tumor bed area as determined by clips versus seroma



A

B

	Median	Range
Age	62.5	38-77
Tumor Size (cm)	0.9	0.3-2.4
Nodes Positive	0	0-2
Nodes Extracted	2.5	0-13
Surgery to CT Interval	33	14-56

Table 1. Baseline Patient Characteristics

	Mean	Range
Number of clips	6.25	5 - 17
Extent of Seroma Beyond Clip (mm) - Medial	3.9	-12 - 23
Extent of Seroma Beyond Clip (mm) - Lateral	6.0	-3 - 35
Extent of Seroma Beyond Clip (mm) - Superior	1.5	-15 - 24
Extent of Seroma Beyond Clip (mm) - Inferior	1.1	-12 - 16
Distance Between Geometric Centers (mm)	6.1	0 - 15

Table 2. Results - Negative value represents clip extending beyond seroma

Results

- The studied patient population represents early stage breast cancer, with most frequently node negative disease.
- Most of the patients had sentinel node biopsies.
- PBI would be a consideration in such a patient population.
- All the patients had planning CT scans within an acceptable time frame (14-56 days).
- Calculated coronal tumor bed area (from CT determined measurements) was verified to correlate strongly with tumor bed volume (as calculated by the ACQSim treatment planning program), correlation coefficient 0.818 ($p<0.001$), figure 1A.
- The mean distance between the geometric centers of the seroma and clip defined abnormalities was 6.1 mm (range 0-15 mm).
- On average, the seroma extends beyond the clips in medial/lateral/superior/inferior directions by 3 mm (see table 2 for individual distances).
- The surgical clips correlate better with the seroma in a superior/inferior direction than in a medial/lateral direction.
- Tumor bed areas defined by the two methods correlate strongly (correlation coefficient 0.758, $p<0.001$).
- The mean coronal tumor bed area calculated from seroma measurements is 46.0 cm².
- The mean coronal tumor bed area calculated from clip measurements is 36.1 cm².
- This difference in areas of 9.9 cm² is significantly different ($p=0.003$).

Conclusions

- Calculating tumor bed area is a valid surrogate for tumor bed volume, with very good correlation between the two ($r=0.818$, $p<0.001$).
- Tumor bed definition post lumpectomy, as defined by surgical clips and seroma formation, varies significantly
- Clips appear to underestimate the tumor bed area compared to seroma by approximately 22%.
- As volumes are a function of dimensional measurements to the third power, small differences in these measurements will translate into much larger differences in volumetric measurements.
- As PBI techniques, such as 3-D conformal external beam RT, depend on accurate definitions of tumor bed to potentially avoid geographic misses, radiation oncologists should incorporate the seroma and surgical clips in defining the volume.
- Future studies are underway to define volumetric changes over time.

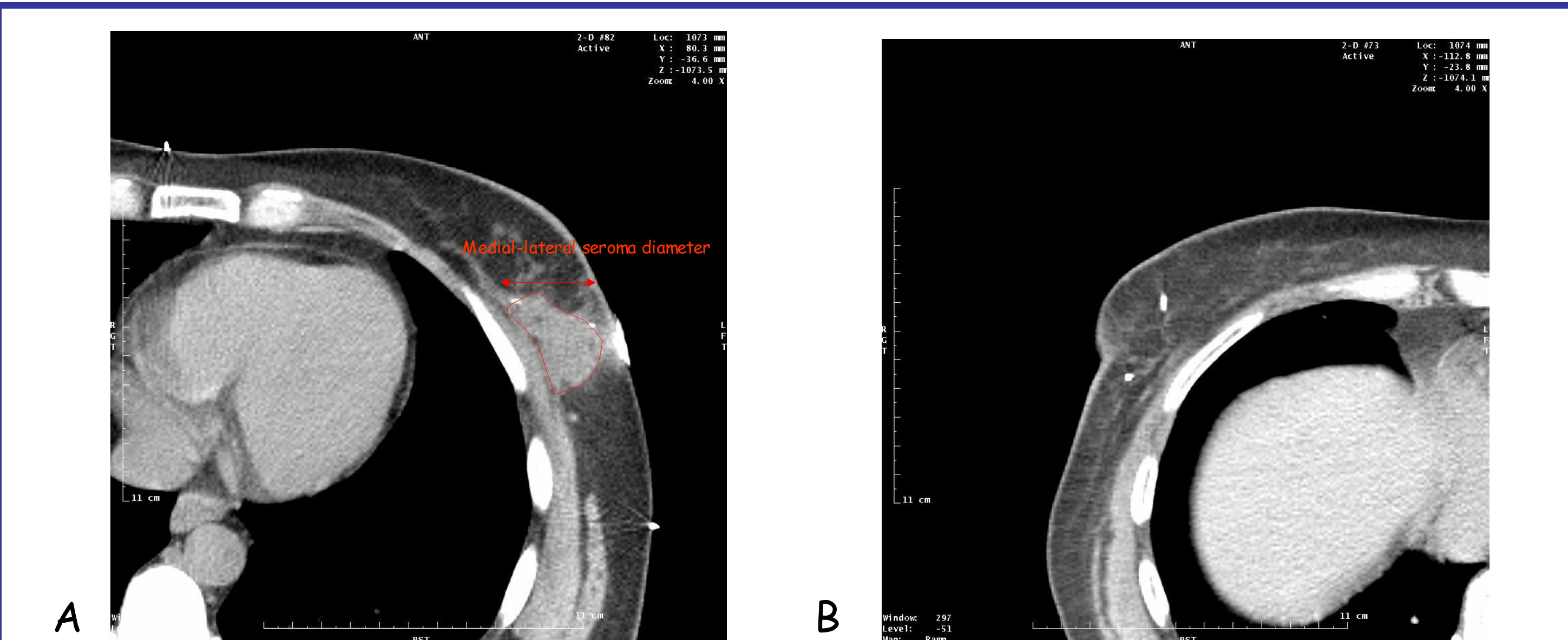


Figure 1. A. Representative CT slice with good correlation between seroma and clips. B. CT slice with clips outside of any visible seroma.