

# PATHOLOGIC CORRELATION OF PET-CT BASED AUTO CONTOURING FOR RADIATION PLANNING IN LUNG CANCER

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## BACKGROUND

Radiation therapy is used to treat lung cancer and relies on CT and functional imaging (FDG-PET) to delineate gross tumor volume (GTV). Various methods have been used to delineate FDG-positive signal including visual interpretation which may be prone to inter-observer bias and intrinsic differences in imaging equipment. Semi-automatic contouring tools have been developed to improve contouring. A common method involves using a threshold method using a given percentage of the maximal activity, which may be less accurate with smaller tumors and tumors with low source to background ratio. In an attempt to overcome this, a gradient algorithm, which detects changes in image counts at the border of the tumor, has been developed. Few studies have correlated these methods to pathological specimens. We conducted a retrospective study in order to determine which contouring technique method was most strongly correlated with gross pathology.

## METHODS

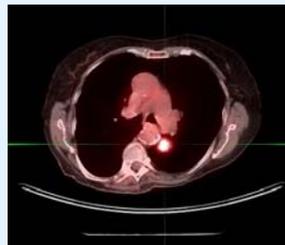
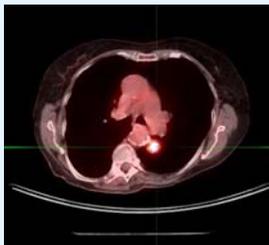
The subjects of this single-institution retrospective study included sixty-eight patients with Stage I and II non-small cell lung cancer who underwent lobectomy at Thomas Jefferson University between 2006 and 2007, 18 of which had PET or PET/CT imaging prior to resection available for our review. We retrospectively contoured lung tumors using 1) a constant threshold algorithm which delineated the structure by including all voxels within a defined region that have counts greater than a fixed percent of the maximum count level (34%) in that region. and 2) a commercially-available gradient-based "PET edge" tool (Mimvista Inc, Cleveland, OH). Largest resected tumor diameters were recorded from gross pathology reports and were compared to the largest tumor diameter measured by either PET contouring method. The longest diameter from the PET contours was found from the axial, sagittal, and coronal planes. Pearson's correlation coefficient (CC) was used to compare the diameters.

### VOLUME OBTAINED USING GRADIENT METHOD

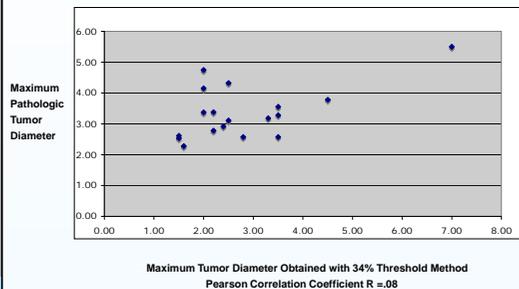
GTV = 3.09 ml

### VOLUME OBTAINED USING 34% THRESHOLD METHOD

GTV = 6.1 ml



## CORRELATION BETWEEN PATHOLOGIC MAXIMUM TUMOR DIAMETER AND MAXIMUM DIAMETER OBTAINED WITH THE 34% THRESHOLD METHOD



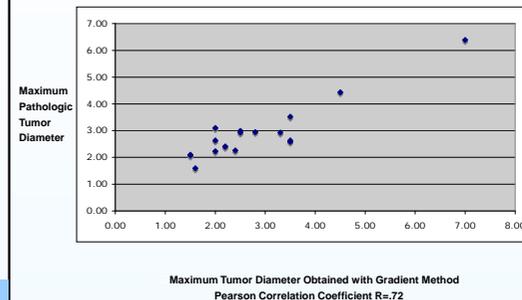
## RESULTS

- Twelve patients presented with T1 tumors, five patients with T2 tumors and one patient with a T3 tumor.
- The median largest tumor diameters were as follows: from pathology reports, 2.5 cm (range 1.5-7.0 cm); from 34% threshold method, 3.4 cm (range 2.3-5.5cm); from gradient tool, 2.9 cm (range 1.6-6.3 cm).
- Pearson's correlation coefficient between maximal diameter contoured with the gradient tool or 34% percent threshold and the actual tumor maximal diameter was .72 and .08, respectively. Average tumor volume using the threshold method was 9.85 ml and 9.56 ml with the threshold method. It was not possible to retrospectively obtain volumetric information from the pathologic specimens.
- Of note, the threshold method grossly overestimated the tumor volume in three patients with low SUV levels (2.5-3.0). When these patients were removed from the analysis, the CC for the 34% threshold improved to .45.

## REFERENCES

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## CORRELATION BETWEEN PATHOLOGIC MAXIMUM TUMOR DIAMETER AND MAXIMUM DIAMETER OBTAINED WITH THE GRADIENT METHOD



## CONCLUSION

- As radiation treatment techniques for lung cancer have improved with the introduction of three dimensional conformal therapy, accurate definition of tumor volume is imperative. Semi-automatic PET contouring tools threshold techniques may help decrease intra and inter-observer bias as well as intrinsic differences in imaging equipment.
- Based on our results, maximal diameter obtained with the gradient method was more closely correlated with maximal pathologic diameter compared to the constant threshold method.
- The gradient method was consistent across varying SUV levels while the percent threshold method grossly overestimated tumor volume in tumors with lower SUV levels.
- A prospective study is needed to clarify these questions as well as to obtain volume and three dimensional tumor information from pathological specimens in order to obtain a more accurate correlation between these contouring tools and the true tumor size.
- To our knowledge this is the only study to compare lung pathology to both threshold and gradient semi-automatic contour methods.

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