

Comparison of Gradient PET Segmentation from a Multi-Modality PET/CT Measurement Tool to Gradient PET Segmentation Alone

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Purpose

Recent research has shown the value of PET tumor statistics such as Total Lesion Glycolysis (TLG), Metabolic Tumor Volume (MTV) and SUVpeak for assessing response to therapy or prognosis. To derive these statistics separate measurements must be made on the PET in addition to making measurements on the CT. Therefore, we developed a multi-modality PET/CT measurement tool to run a gradient PET segmentation method automatically from manually drawn linear RECIST measurements on the CT (Auto-GRAD). Comparison was made to PET tumor statistics derived from directly segmenting lesions on the PET using a gradient segmentation tool (GRAD).

Methods & Materials

61 tumors of varying size, shape, and location were segmented by one experienced clinician on 12 head and neck, 11 lung, 1 rectum, 1 liver, and 1 cervical PET/CT scans using GRAD and Auto-GRAD. The observer first used Auto-GRAD by making manual RECIST measurements on the CTs for each lesion which automatically ran the gradient segmentation on the fused PET. At a later time the lesions were segmented directly on the PET using GRAD, independent of the CT. Comparison was made between the methods for MTV, TLG, SUVpeak, and SUVmax using correlation, mean absolute % difference, and mean % difference (abs% difference and % difference).

Figure 1
Comparison of Measurement Steps

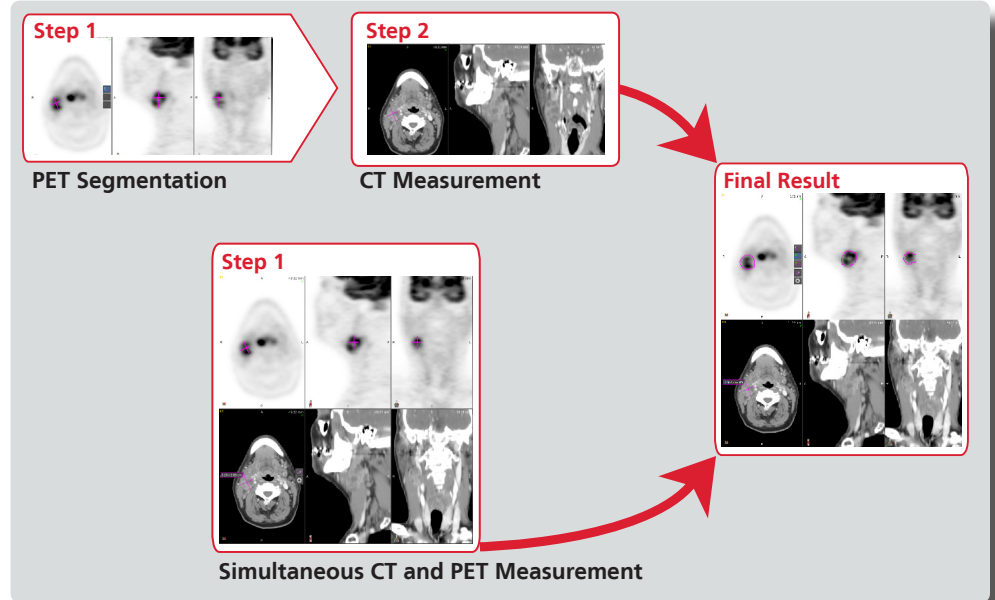


Table 1
Comparison of GRAD and AUTOGRAD

	<i>Abs % Difference</i>	<i>% Difference</i>
<i>SUVmax</i>	0.5 ± 2.4	0.3 ± 2.4
<i>SUVpeak</i>	0.2 ± 0.7	0.1 ± 0.7
<i>TLG</i>	9.5 ± 19.6	5.9 ± 21.0
<i>MTV</i>	11.1 ± 21.7	6.9 ± 23.4

Results

The %differences were: Volume (6.9 +/- 23.4), TLG (5.90 +/- 21), SUVpeak (0.1 +/- 0.7), and SUVmax (0.3 +/- 2.4). No significant differences existed between methods for any statistic.

Conclusion

No significant difference was found between PET tumor statistics derived from Auto-GRAD and GRAD. Auto-GRAD is a multi-modality PET/CT measurement tool with the potential to accurately delineate PET volumes while offering time savings by providing simultaneous PET and CT tumor statistics from a single measurement.

References

1. Nelson AS, Werner-Wasik M, Choi W, Yoshio A, Faulhaber P, Ohri N, Kang P, Almeida F, Pirozzi S, Nelson D. Evaluation of gradient PET segmentation for total glycolysis compared to thresholds and manual contouring. *J Nucl Med*. 2011; 52 (Supplement 1):2077
2. Shen G et al. PET Tumor Segmentation: Comparison of Gradient-Based Algorithm to Constant Threshold Algorithm. *Medical Physics* June 2007;34(6):2395
3. Fogh S, Karancke J, Nelson AS, McCue P, Axelrod R, Werner-Wasik W. Pathologic Correlation of PET-CT Based Auto-contouring for Radiation Planning in Lung Cancer. Presented at World Conference on Lung Cancer Meeting in 2009
4. Werner-Wasik M, Nelson A, Choi W, et al. What is the best way to contour lung tumors on PET scans? Multiobserver validation of a gradient-based method using a NSCLC Digital PET Phantom. *IJROBP* 82; pp1164-1171, 2012.2. Shen G et al. PET Tumor Segmentation: Comparison of Gradient-Based Algorithm to Constant Threshold Algorithm. *Medical Physics* June 2007;34(6):2395