Autocontouring versus manual contouring.

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Regarding Autocontouring and Manual Contouring: Which Is the Better Method for Target Delineation Using 18F-FDG PET/CT in Non–Small Cell Lung Cancer? By K. Wu et al

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To the editor: We read with interest the study of Wu et al *(1)* regarding autocontouring methodologies for target delineation in PET/CT for NSCLC. 17 NSCLC tumors were delineated with both automated and manual approaches, using either combined PET/CT or CT and PET independently. As expected, the manual contouring of the PET uptake provided a better correlation with the maximum diameter of the primary tumor compared to auto-contouring using a fixed threshold at 50% of the tumor maximum uptake. We believe that this result is largely associated to various shortcomings of using fixed threshold approaches, a point that needs to be clearly emphasized.

The authors have previously demonstrated that the best correlation between the maximum tumor diameters derived from histo-pathological examination in comparison to the image derived ones was obtained using a 50% fixed threshold *(2)*. This conclusion was reached by comparison to the results obtained using other fixed threshold values (from 20% to 55%), with a modest correlation of 0.77 and non-statistically significant differences with the other fixed threshold values tested. Most significantly the use of a 50% fixed threshold led to differences larger than 1cm in half of the tumors considered. Such differences in terms of the maximum tumor diameter will most certainly lead to larger differences in the overall 3D volume. Considering similar comparisons based on 3D NSCLC tumor volumes determined by histo-pathology, other authors have demonstrated that an "optimal" threshold value cannot be determined, showing considerable variability ranging from 20% to 42% (31%±11%) of the maximum, while CT-based volumes significantly overestimated the pathologic volume *(3)*.

It is therefore important to emphasize that a fixed threshold (irrespective of its absolute value) is not an adequate methodology to address the delineation of elevated uptake signal in PET, due to its binary, deterministic nature and lack of robustness versus varying contrast and noise conditions *(4,5)*. In order to account for these widely documented literature findings concerning tumor target delineation incorporating PET uptake information, fixed thresholding should be avoided and at the very least, methodologies considering target-to-background ratios such as adaptive thresholding *(5,6)* should be favored. Eventually, the wider availability of automatic segmentation approaches *(7-10)*, some of which allow accounting for the presence of heterogeneous tumor uptake distributions *(7)*, may allow improving the accuracy and reproducibility associated with adaptive thresholding *(11)* for functional tumor volume determination.

Considering all these facts we do agree with the authors that manual contouring should be preferred to autocontouring at 50% threshold for functional tumor volume delineation. On the other hand, one should consider that manual delineation of the PET uptake is not the ideal approach either for multiple reasons. Most importantly it represents a long process particularly when it has to be performed in 3D and it is inherently of very low reproducibility *(11)*.

We therefore recommend that future studies investigating this issue include the use of advanced image segmentation approaches *(4-10)* which have demonstrated improved performance in comparison to fixed threshold, and may therefore lead to alternative / complementary conclusions

regarding the role of manual contouring. Irrespective of the performance of a segmentation algorithm, operator intervention will always be necessary in order to appropriately identify the functional uptake of interest and avoid the inclusion of non-tumor specific activity uptake.

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