# Impact of $^{18}$F-Choline PET scan acquisition time on delineation of GTV in Prostate cancer

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## Introduction

Dose painting radiotherapy requires accurate outlining of primary tumour volumes in the prostate. T2-Weighted (T2W) Magnetic Resonance Imaging (MRI) is the best imaging method for defining the gross tumour volume (GTV). The advantages of Choline positron emission tomography (PET) are currently disputed. Image acquisition differs significantly in published studies. Many used early static imaging. One study found that $^{18}$F-choline PET/CT with late image acquisition has superior accuracy to T2W MR and functional MR alone[1]. We investigate whether increasing $^{18}$F-Choline PET scan acquisition time from 60 (PET-60) to 90 (PET-90) minutes improves GTV target volume delineation (TVD).

## Methods

Fifty patients were scanned as part of the BIOPROP trial. For this preliminary study analysis was performed on 9 $^{18}$F-Choline PET scans. Patients were injected with 370MBq of activity. Three clinicians (C1, C2 and C3) independently and without reference to each other contoured GTVs on each of the T2W-MRI, PET-60 and PET-90 scans at differing times. Scans were registered by a clinician using rigid co-registration. The treating clinicians MRI contour was used as a reference contour. The resulting PET and MRI GTVs were transferred to the PET-60 and PET-90 scans after image registration. The Dice Similarity Coefficient (DSC), Specificity (Sp) and Sensitivity (S) were calculated from contour mask voxel analysis.

## Results

Figures 1 and 2 show the DSC of the clinicians C1, C2 and C3 on PET-60 and PET-90 scans in comparison to the treating clinicians GTV contour derived on MRI. A 2 sampled T-test ($P < 0.01$) showed, no significant difference in the Sp, S and DSC between GTVs on PET-60 and PET-90 scans. Variability in delineation between clinicians is shown in Figures 3 and 4.

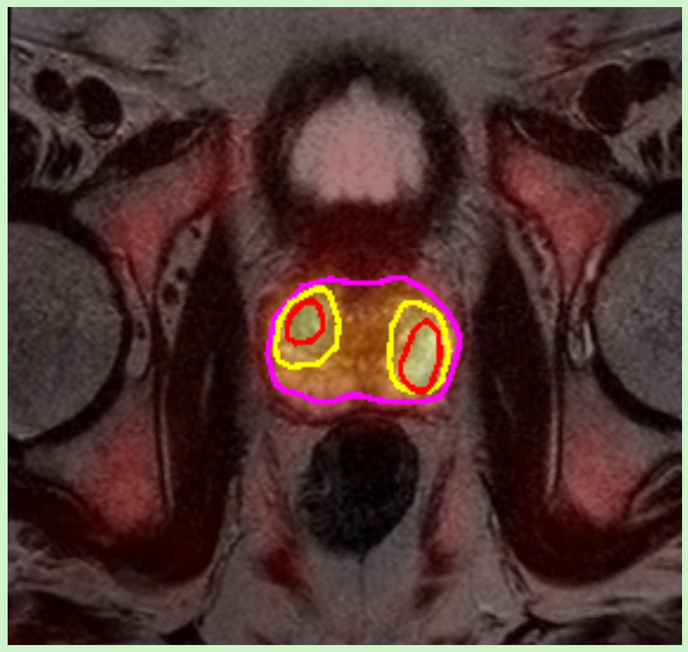

Figure 3: The PET-90 derived contours for c1, c2 and c3 shown on rigid co-registered MRI.

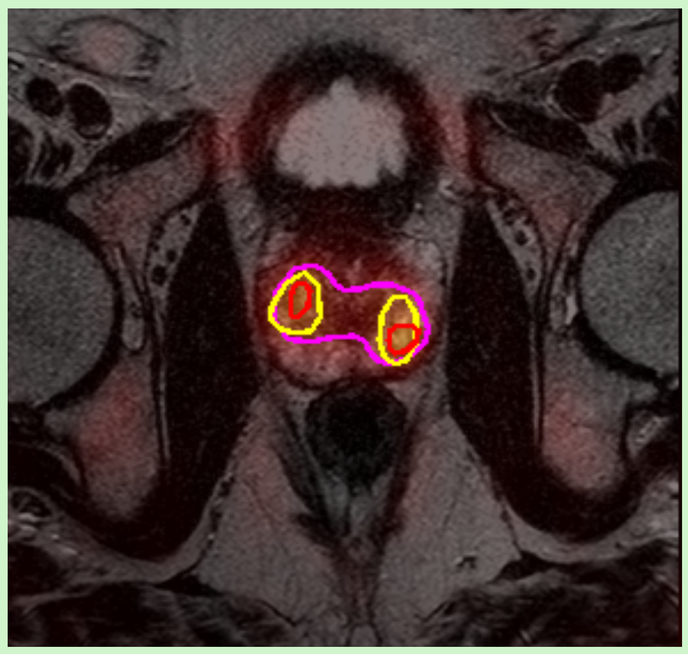

Figure 4: The PET-60 derived contours for c1, c2 and c3 shown on rigid co-registered MRI.

## Conclusion

This study found that increasing the PET scan acquisition time from 60 to 90 minutes did not improve GTV TVD. Further to this, there was not a significant difference in GTV TVD by C1, C2 and C3 however the low statistical power of this study (n = 9) increases the probability of a Type II error occurring. Future work aims to investigate the impact of PET automated segmentation algorithms on TVD in PET-60 scans.

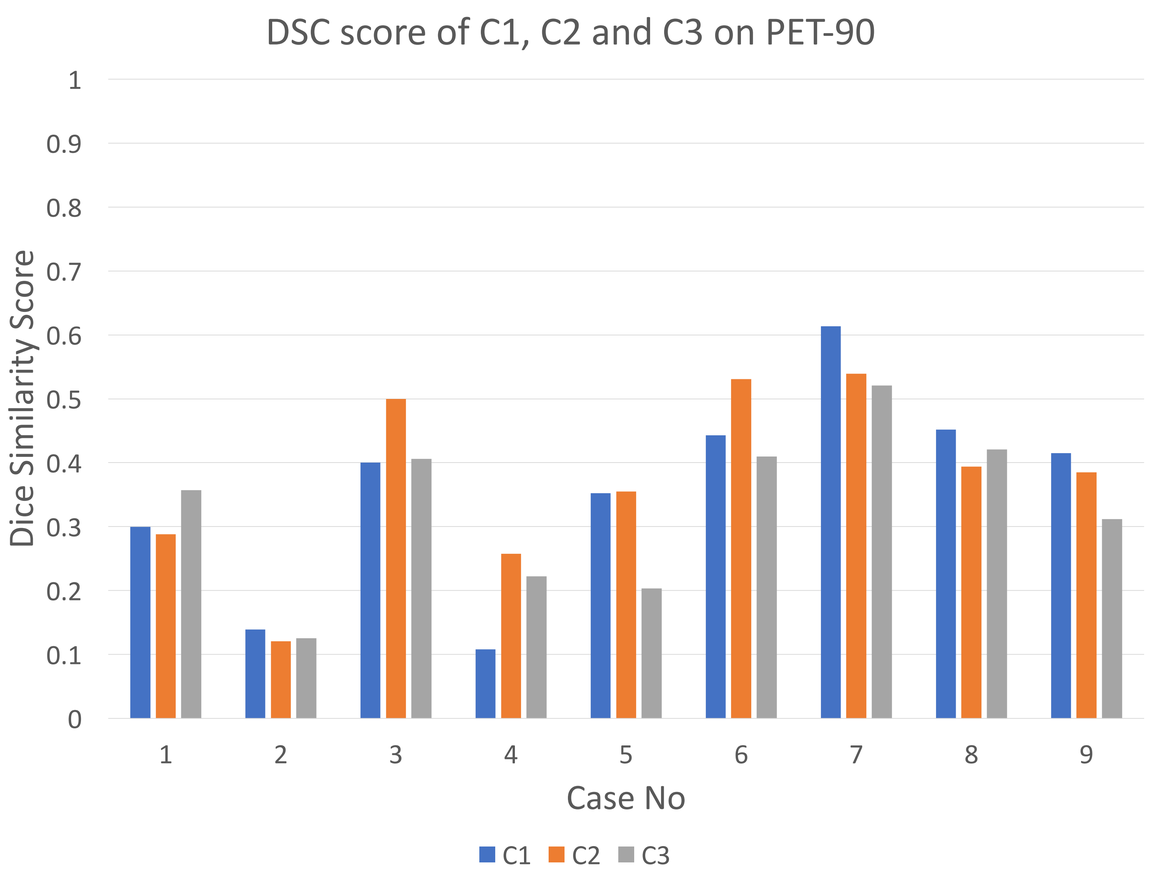


Figure 1: The DSC score of C1, C2 and C3 on PET-90 imaging in comparison to a MRI derived GTV

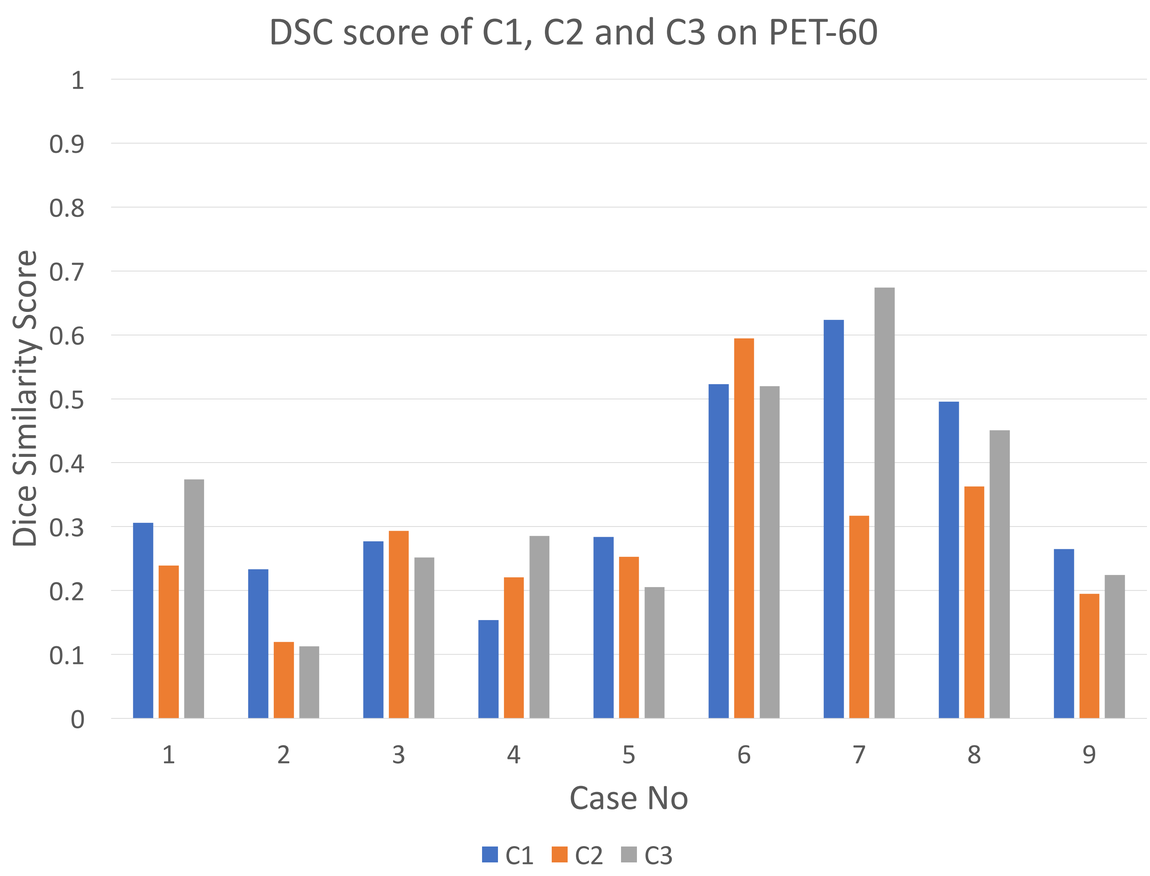


Figure 2: The DSC score of C1, C2 and C3 on PET-60 imaging in comparison to a MRI derived GTV

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