

Correlation of Gross Tumour Volume and Metabolic Tumour Volume for non-small cell lung cancer patients

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INTRODUCTION

- Lung cancer is the most common cause of cancer related deaths globally accounting for 19.4% of all cancer mortality
- TNM stage is the most significant prognostic factor
- FDG PET is routinely used for staging, planning (contouring) and monitoring
- SUV has been shown to be a prognostic factor for OS and PFS in NSCLC
- Metabolic tumour volume (MTV)
 - Defined as the volume of tumour hyper-metabolic tissue within the region of the gross tumour with an SUV greater than some threshold

QUESTION

- If MTV provides a quantitative measure of tumour burden, does the correlation between MTV and GTV (treated volume) predict outcome?

METHODS

- Retrospective study of 43 NSCLC patients treated between 2006-2011
- MTV defined using a SUV2.5 and then manually edited by consensus using Osirix®
- MTV exported to Focal for registration with planning CT
- All planning DICOM data exported to MATLAB® for analysis
- Geometric analysis included
 - Volume,
 - Centre of Mass(COM)
 - Dimension, DSC

- $DSC = \frac{2|A \cap B|}{|A| + |B|}$

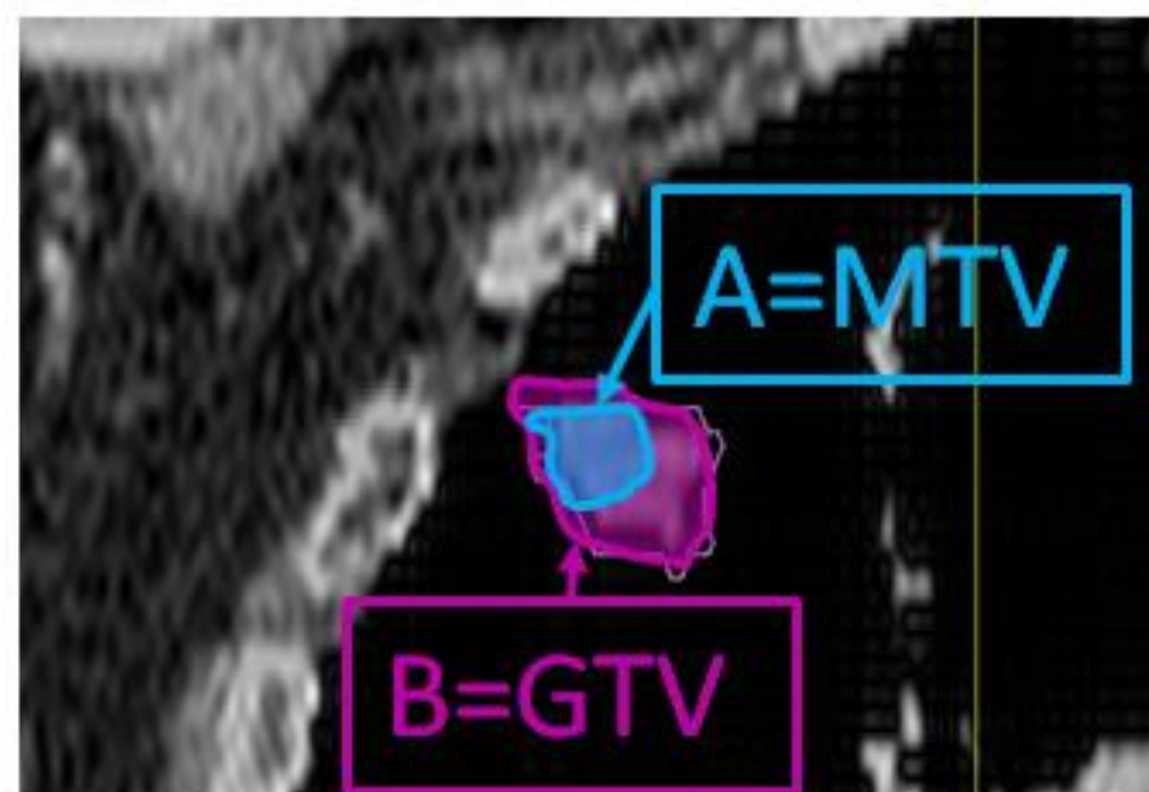


Figure 1. Example of MTV and GTV contours

- Univariate Cox regression to determine whether DSC was associated with Overall Survival (OS) and Progression Free Survival (PFS)

CONCLUSION

- Preliminary results in a small cohort show high degree of geometric overlap between GTV and MTV as calculated using DSC. Although the GTV was on average larger than the MTV.
- The results of this study were limited by the small number of patients and the 3DCRT planning technique used ensured the MTV and GTV received similar doses which may not be the case with modern SBRT
- Further investigation with modern planning techniques and more patients may aid in clarifying the relationship between prognostic factors, novel metabolic parameters and the end-points of PFS and OS

REFERENCES

- Wang et al. Asia Pac J Clin Onco 2016 (in press)
- Dice. Ecology 1945: 297-302
- Konert et al. Radioth Oncol 2015

RESULTS

Outcome Data

With median follow-up of 1.8 years (0.6-6.1), 18 patients (42%) experienced isolated locoregional relapse, 10 (23%) distant relapse, one (2%) locoregional and distant relapse. There were 13 (30%) patients who were alive and 30 (70%) deceased. Median OS and PFS were 1.4 years (0.6-5.1) and 0.9 years (0.4-3.6) respectively.

Table 1. Clinicodemographic information for the 43 patients in the study

Variable	N
Median Age (years)	69 (51-91)
Stage N (%)	
I	10 (23%)
II	7 (16%)
III	26 (60%)
Sex (%)	
Male	31 (72%)
Female	12 (28%)
Histology	
Adenocarcinoma	11 (26%)
Squamous Cell	21 (49%)
Large Cell	11 (26%)

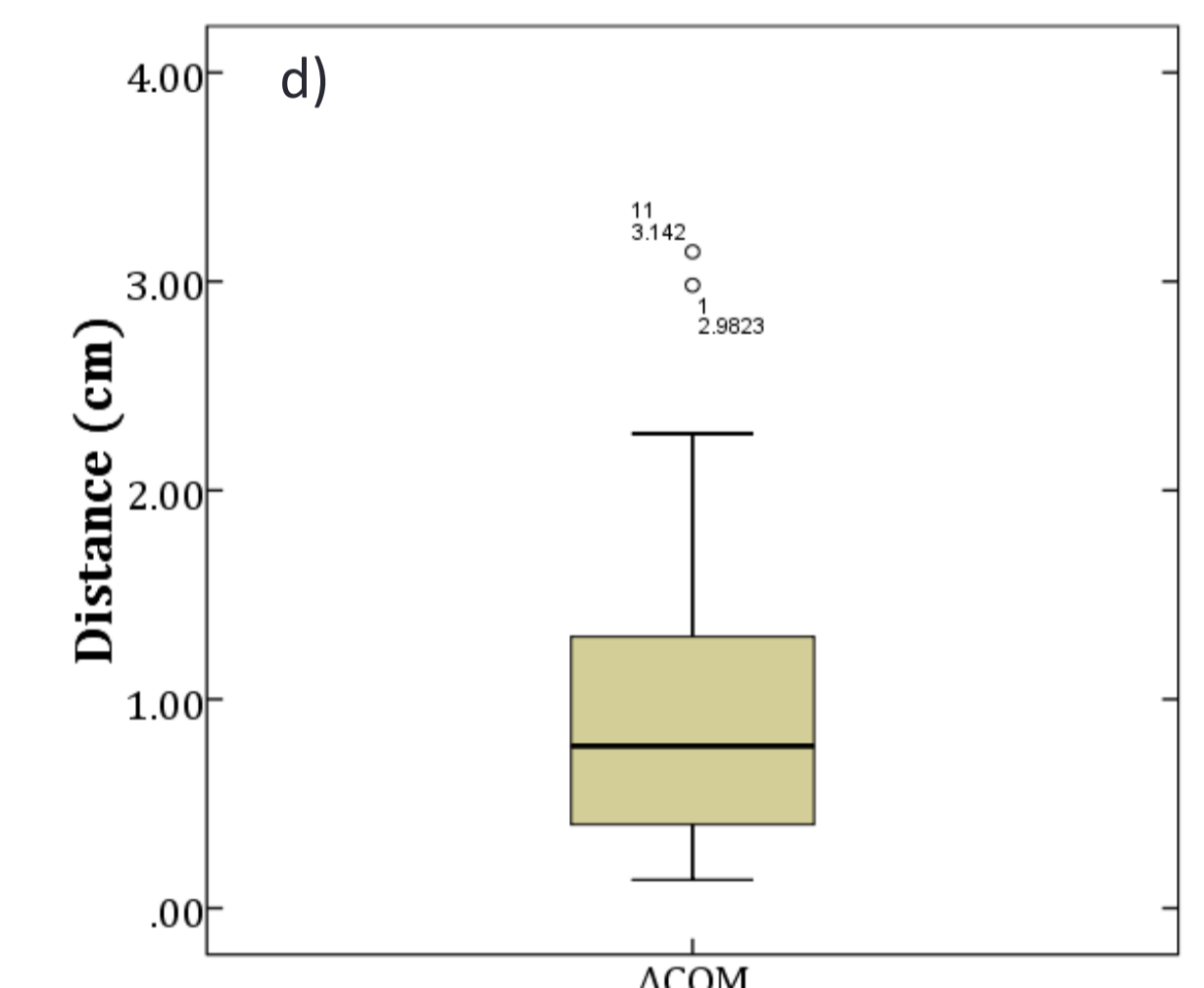
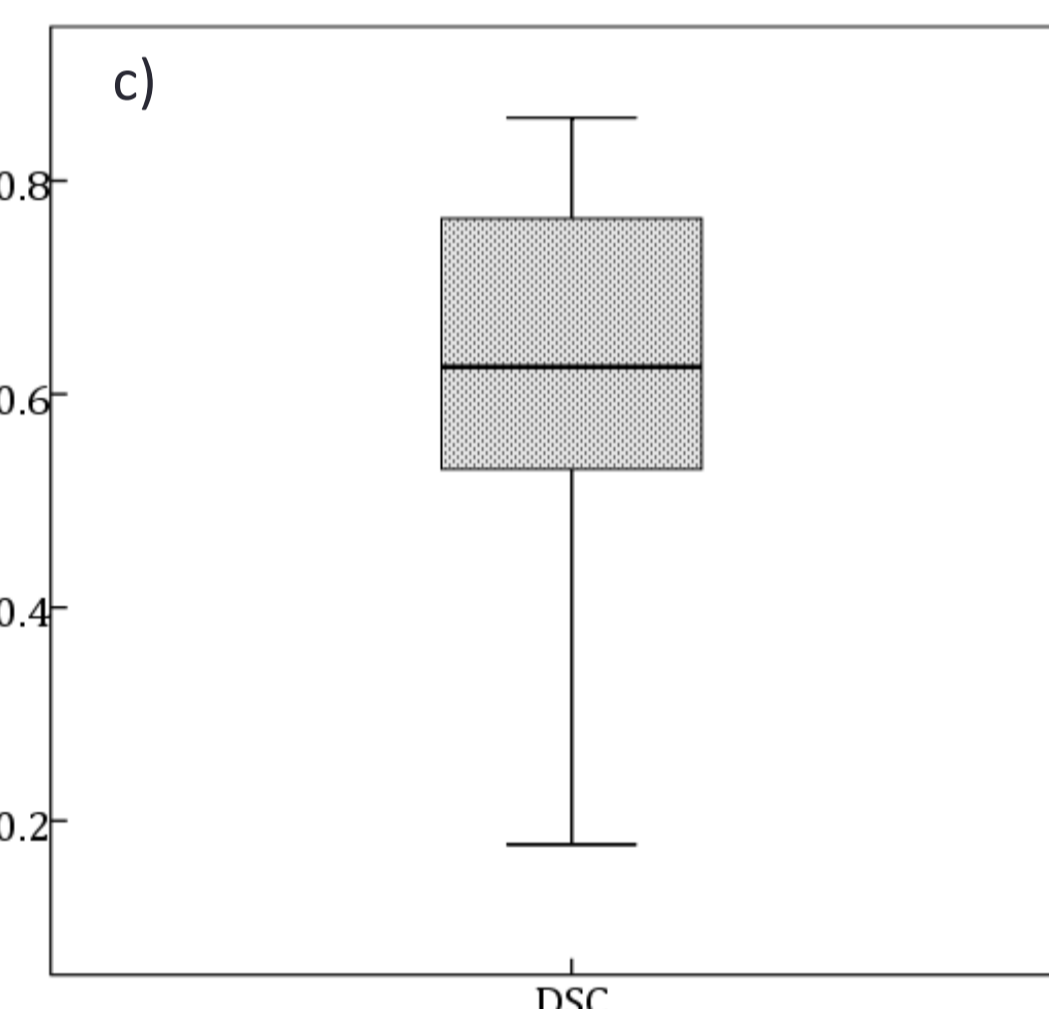
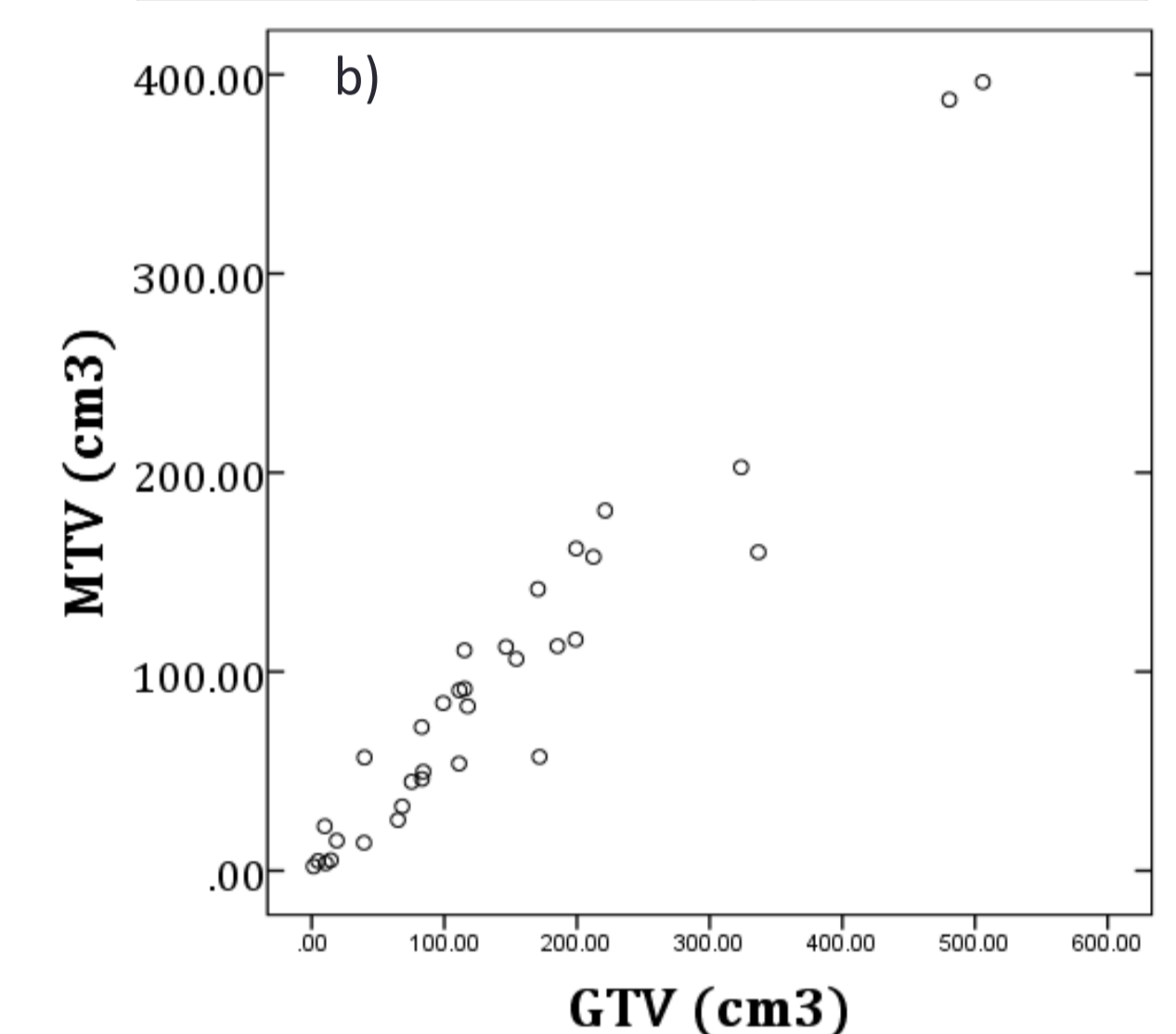
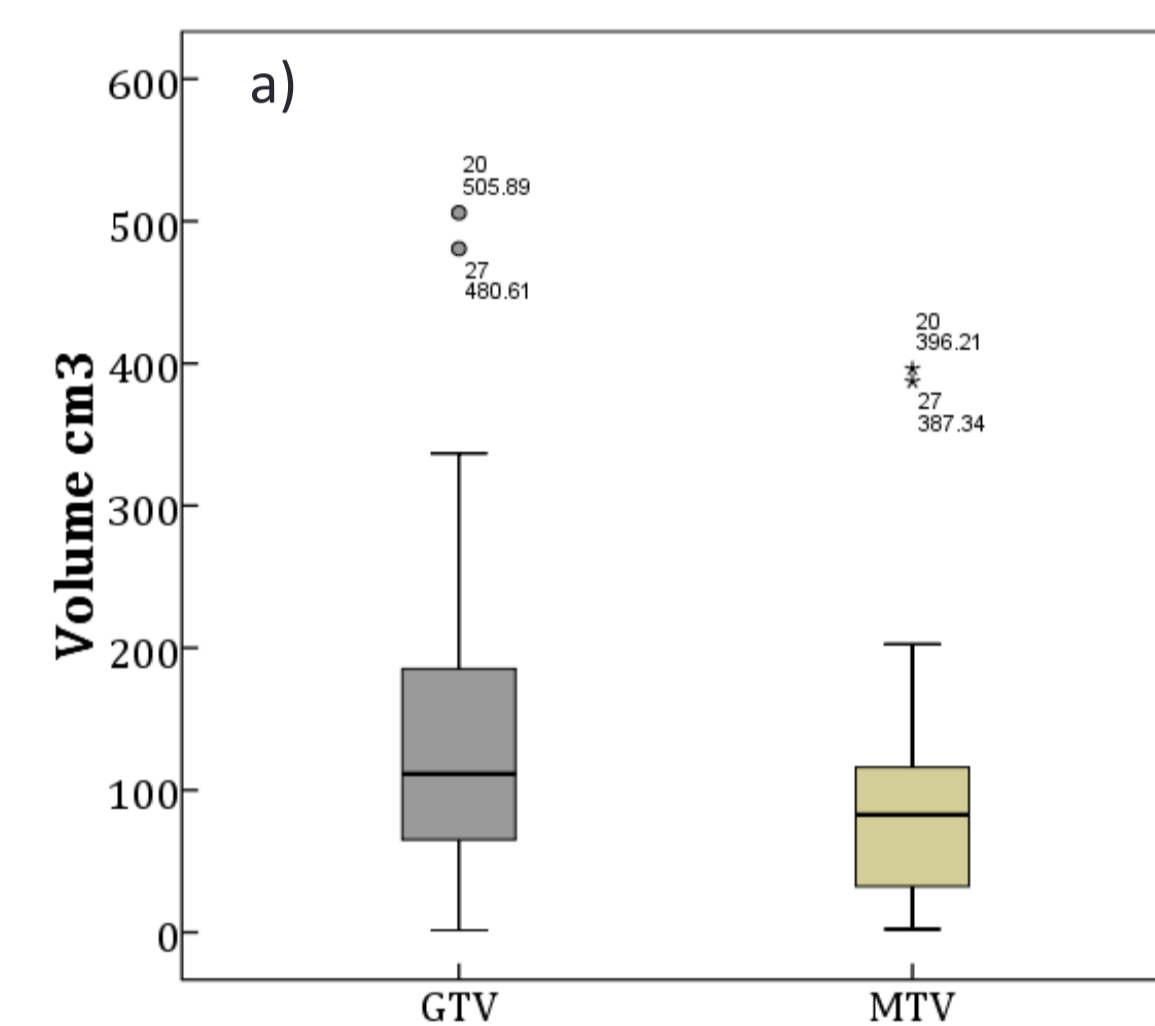


Figure 2. a) box plots comparing absolute volume of GTV and MTV contours b) scatter plot displaying the relationship between MTV and GTV volume c) box plot of DSC between MTV and GTV and d) box plot of distance between COM for GTV and MTV

Geometric relationship between MTV and GTV

The mean GTV and MTV volumes were 138.64 ± 124.59 and 97.01 ± 94.16 cm³ respectively. The mean distance between COMs for the GTV and MTV contours was 1.01 ± 0.77 cm. The size of MTV did increase in line with GTV with a Pearson correlation of 0.962 ($p = 0.01$)

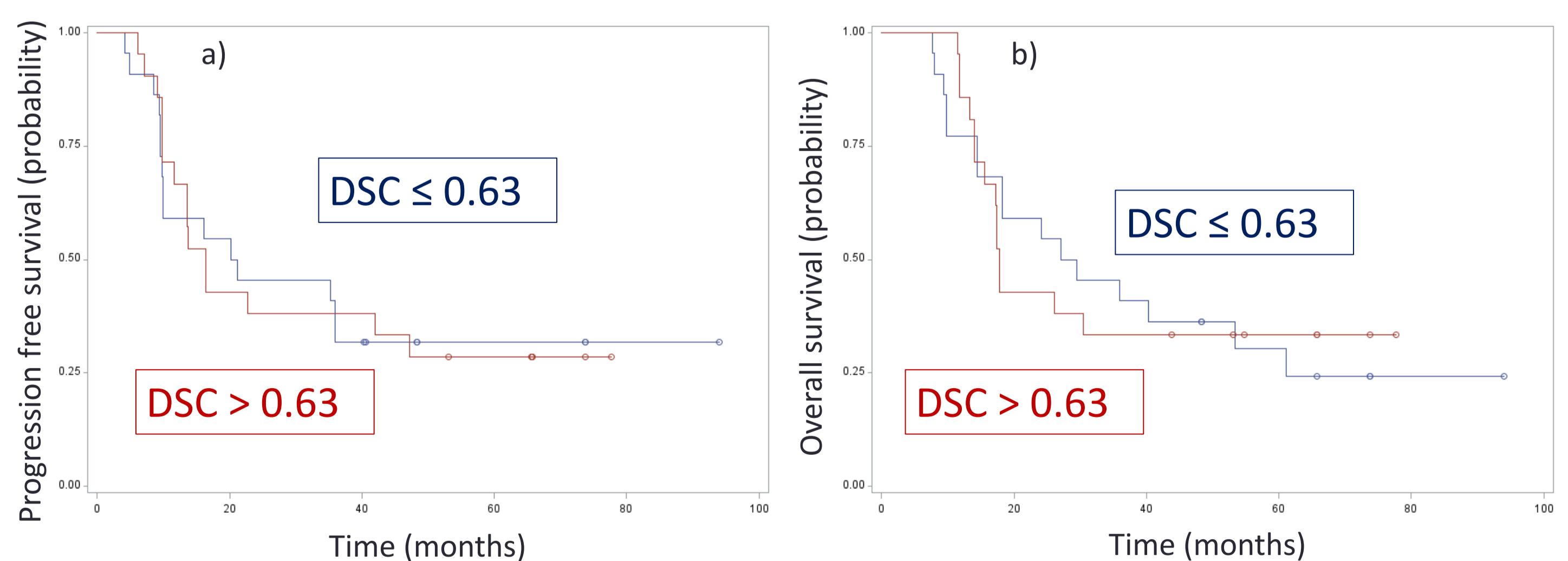


Figure 3. Kaplan Meier curves showing a) progression free survival and b) overall survival for the 43 patients split into two groups above and below median DSC of 0.63

DSC correlation with PFS and OS

Given the moderate degree of overlap, relatively small sample size and number/sites of relapse, the DSC was not found to be associated with PFS ($p=0.85$) or OS ($p=0.70$).

