

Assessment of heart substructures delineation in a phase III cardioprotection trial (SAFE2014)



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OBJECTIVES

Patients undergoing adjuvant radiotherapy for breast cancer have an increased risk of cardiovascular comorbidity, especially if left sided [1]. However, no threshold dose have been evidenced in literature, and no data about heart substructures have been collected so far. In our institute, patients undergoing adjuvant treatment for breast cancer are included in a protocol to test a treatment strategy aimed to reduce cardiovascular morbidity (SAFE 2014, NCT2236806). This protocol is based on a periodic follow up with heart speckle tracking US, in order to detect preclinical heart damage [2]. In order to assess dose parameters and develop a dose constraint related to subclinical heart damage, a reliable and validated delineation of heart substructures based on a pre-existing guideline [3] was made.

METHODS

Planning CT scan of 16 left sided breast patients included in SAFE protocol were imported on MIM® software version 6.6. Heart substructures were delineated by 5 different operators (CB, CDP, DP, EO and FT); Overall, 10 different heart substructures were delineated by each operator: whole heart (WH), Right atrium (RA), Left atrium (LA), Right ventricle (RV) and left ventricle (LV), divided in 5 different segments (anterior, inferior, apical, septal and lateral). For each substructure of all patients, a multicontour delineation (MCD) based on a majority vote algorithm was then created. A consensus based delineation (CBD) of all substructures was then developed by an independent team of two blinded operators (ID and GF). Dice similarity coefficients (DSC) between volumes delineated by each different operator and multicontour delineation were collected and reported, as well as DSC between independent CBD and MCD.

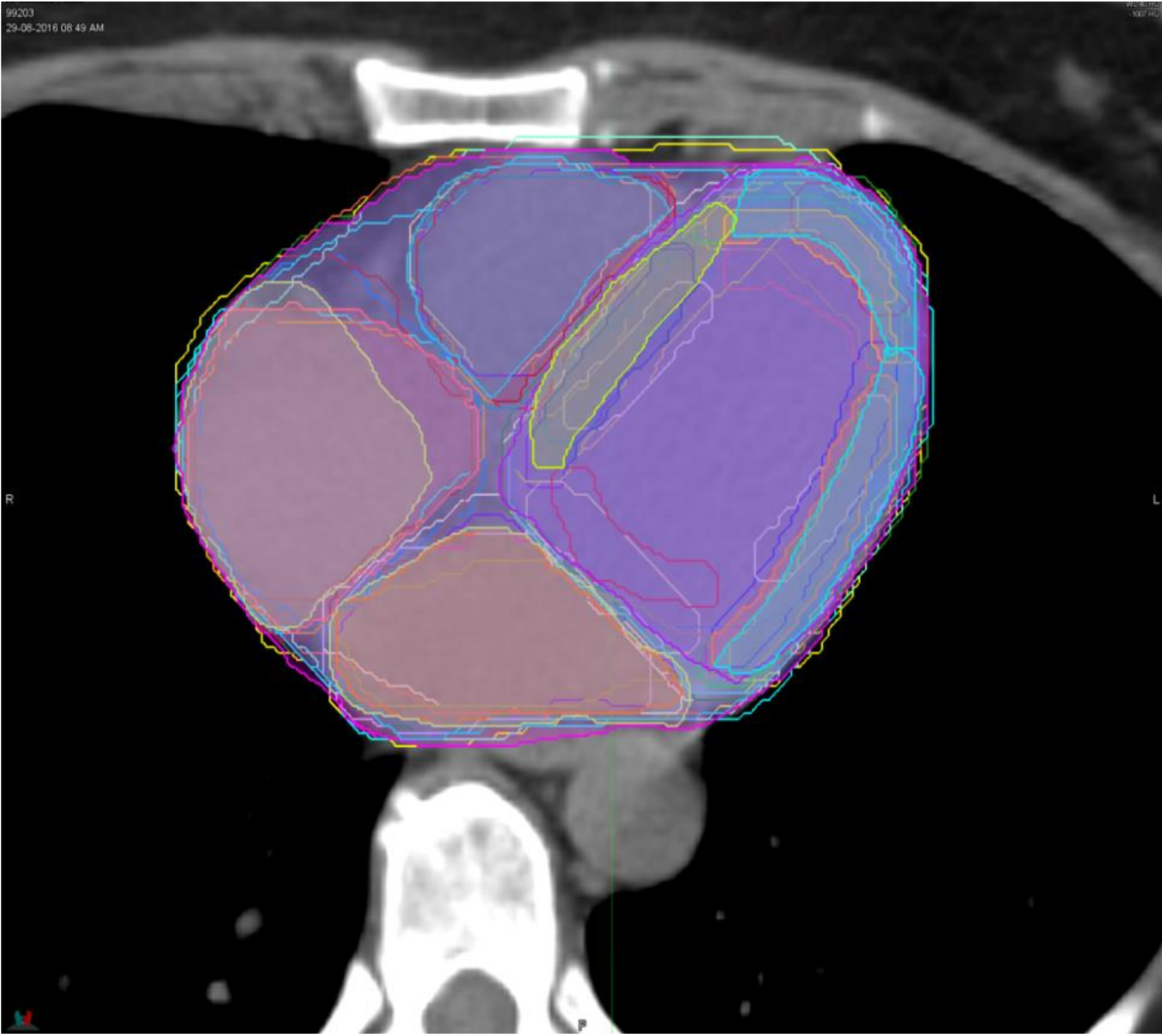
RESULTS

Considering WH, RA, LA, RV and LV, mean DSCs between single substructures delineated by each operator and corresponding MSCs ranged between 0.78 and 0.96. Furthermore, analyzing each delineated patient, mean DSC between substructures delineated by all single operators and corresponding MSC ranged between 0.84 and 0.94. For all these heart substructures, mean DSC between CBD and corresponding MSC ranged from 0,89 to 0,97. Considering LV segments, mean DSC between single segments delineated by each operator and corresponding MSC ranged from 0,38 to 0,77; within each patient, mean DSC between single operator delineation and MSC ranged from 0,54 to 0,72. For LV segments, mean DSC between CBD and corresponding MSC ranged from 0,58 to 0,63.

CONCLUSIONS

Overall, results showed good overlapping between heart chambers contours, both comparing MSC with single operator delineation or CBD; LV segments showed a considerably worse result. However, the current experience showed low inter-observer variability of heart substructure delineation, allowing a reliable dosimetric assessment of these volumes within SAFE2014 trial.

Mean DSC (Single Independent/consensus based delineations vs MCD) Operator						
Struct.	CB	CDP	DP	EO	FT	CBD
WH	.96	.93	.94	.94	.94	.97
RA	.88	.85	.83	.87	.88	.89
RV	.84	.86	.78	.87	.87	.89
LA	.88	.86	.81	.87	.84	.91
LV	.93	.92	.87	.93	.93	.94
Ant	.62	.45	.51	.64	.66	.62
Api	.65	.49	.51	.67	.62	.63
Inf	.59	.48	.38	.64	.64	.58
Lat	.75	.71	.64	.72	.77	.62
Sep	.67	.57	.46	.63	.63	.61



References

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(2)Meattini I *Med Oncol* 2017;34(5):75.
(3)Duane F *Radiother Oncol.* 2017;122(3):416-422.

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