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CT-Radiomics May Predict Cardiac Toxicity After Radiation Therapy for Localized Breast Cancer in Women

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INNOVATION

This study introduces a new approach for improving the quality of life after radiation treatment of women with localized breast cancer. The ability of predicting an organ-specific post treatment toxicity would impact the overall treatment outcome. Being aware of the specific post treatment toxicity will lead to a better treatment options and better planning for higher risk patients.

INTRODUCTION

Breast cancer is the second leading cause of cancer-related mortality among women after lung cancer. Women treated for localized breast cancer are expected to live longer, and thus it is very important to maintain better quality of life for those patients. Cardiac toxicity associated with radiation therapy could reduce the quality of life after treatment, and even result in death, and therefore the ability of prediction of that toxicity would greatly increase the chances of having better outcome. In this preliminary work we hypothesize that imaging features, extracted from pre-treatment CT, can be used to predict the possibility of post-treatment cardiac toxicity.

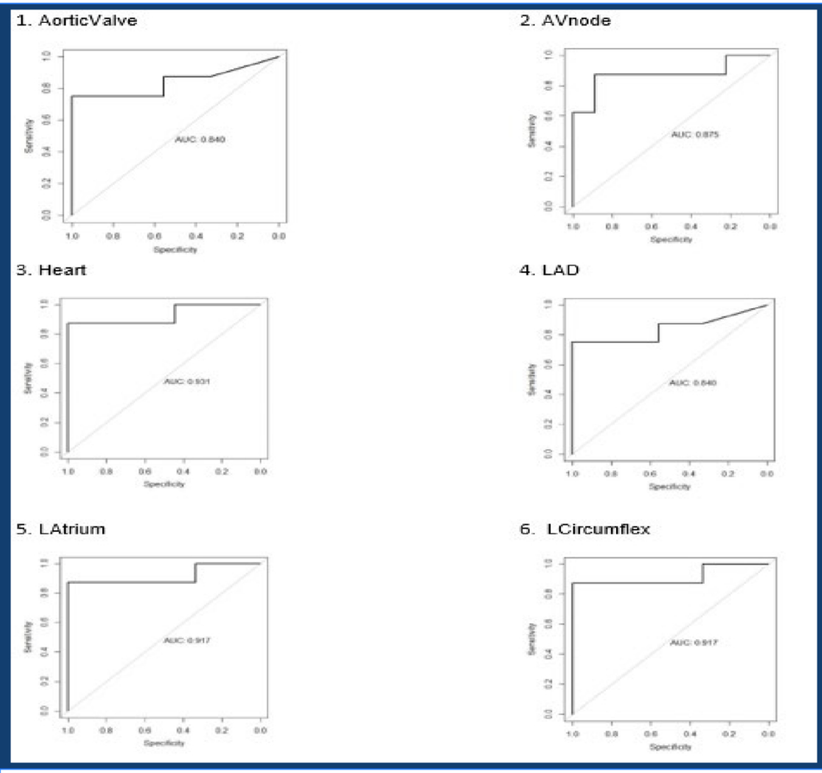
METHOD

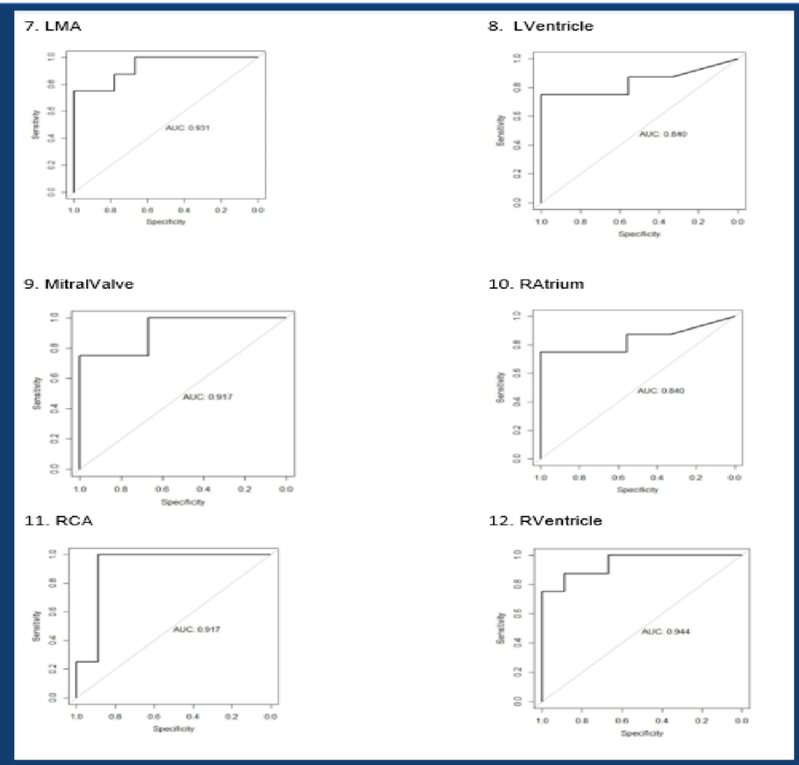
We retrospectively studied seventeen patients who received standard radiation treatment for localized breast cancer. Eight of those patients developed post-radiotherapy cardiac toxicity. Delineation of left atrium, right atrium, left ventricle, right ventricle, left main coronary artery, left anterior descending coronary artery (LAD), right circumflex artery (RCA), right coronary artery, atrioventricular (AV) node, ascending aorta, and pulmonary artery were performed according to published guidelines. For each of the contoured structures 92 geometric, first-, second-, and third-order texture features were calculated for the planning CT. Odds ratio (OR) and p-value were estimated for each structure and pertinent imaging feature.

RESULTS

Area under the receiver operating characteristic curve (AUC) was 0.875, and 0.917 for AV node and left atrium, respectively. The first relevant variable was one texture feature for the AV node which was border-line significant but with large OR (OR: 38.78, p=0.07). The second relevant feature was the left atrium volume which was significant and again with large OR (OR: 39.89, p=0.037).

Figures below represent the Receiver Operating Characteristic curves (ROC) associated with each cardiopulmonary structure along with values for area under the curve (AUC). All the values are high (above 0.8) which indicates better accuracy.





CONCLUSIONS

Post-treatment cardiac toxicity in breast cancer patients was associated with imaging features of the left atrium and the AV node. Future work would explore the expansion of the current database to include more patients, systemic therapy, and comorbidities.

CONTACT INFORMATION

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