Association of MRI morphologic phenotype from unsupervised learning with breast cancer subtypes and treatment response

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METHODS

Radionics shape features
• 17 shape features are defined by ISBI (Image Biomarker Standardization Initiative)1.
• They were extracted by using PyRadiomics and measured within the FITV masks from DCE-MRI.

Statistical analysis
• MRI morphologic phenotypes: unsupervised hierarchical (Pearson correlation, agglomerative ward linkage) on radionics shape features.
• The associations between the unsupervised clusters of radionics features with four IHC subtypes and pCR: χ2 test of independence and Cramer’s V.

RESULTS

Unsupervised clustering
• Optimal number of clusters (k=3) was selected from Consensus Clustering2 method.
• Clusters generated by unsupervised hierarchical clustering in a population of 910 out of 990 patients.

Subtype/Outcome p-value (p-test) Cramer’s V

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pCR rates in MRI clusters at T1 (boxplot)
• Highest in Cluster 1 and lowest in Cluster 3.
• pHR/HER2: the pCR rate in Cluster 1 was 2-fold of Clusters 2 and 3-fold of Cluster 3.
• Statistically significantly different except for the pHR-HER2 sub-cohort.

pCR rates in MRI clusters at T1 (boxplot)

CONCLUSIONS

• Statistically significant association was shown between MRI morphologic phenotype and pCR, with stronger association observed at T1.
• Association differed by HR/HER2 subtype with stronger association observed in HR-HER2+ and triple negative.
• Our results suggest that unsupervised clustering of radionics shape features derived from DCE-MRI may be used to predict the breast tumor response to NAC.

ADVOCATE PERSPECTIVE

MRIs show three-dimensional information such as tumor size and shape. Measuring tumor using an unsupervised learning approach as described in this poster can improve the effectiveness of MRI in measuring treatment response. Early prediction of both responders and non-responders will increase treatment optimization by allowing responders to switch early to their next scheduled trial therapy while allowing non-responders to switch early to a different trial therapy thereby avoiding side effects from a therapy which is not working for them.

CITATIONS


ACKNOWLEDGEMENTS:


The right drug, the right patient, the right time... now.

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