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Using Machine Learning to Generate a Core Set of Echocardiographic Indices for Pediatric Research: A Sub-study in the PCS² Cohort

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Question and Introduction

- With a multitude of echo parameters at a clinician’s disposal and clinical efficiency paramount, what are the most reliably measured and clinically relevant pediatric echo indices?

- No studies have determined the most clinically relevant and reliable groupings echo parameters in pediatric patient populations

- Using the PCS² (Preventing Cardiac Sequelae in Pediatric Cancer Survivors) cohort of childhood cancer survivors and clustering analysis, a machine learning (ML) method, we identify related echo parameters that represent a similar dimension of the variance in a pediatric echocardiographic study

Goal

- Use machine learning to cluster echo parameters by dimensionality of information, assess reproducibility and clinical relevance to identify a core set of echo indices to guide pediatric clinical care and research

Methods

- n=1,284 PCS² participants
- n=1,073 with 94 echo parameters
- 211 removed due to <20% availability of all echo indices
- 33 parameters removed due to not being calculated in >5% of cases
- n=1,073 with 94 echo parameters
- 54 echo parameters for B-A plots and ICC
- Clinical Relevance ranked by cluster
- Core pediatric echo indices
- 61 echo parameters for dendrogram

Results

- ≥73% of all scored parameters had good (0.60-0.74) or excellent (≥0.75) ICC in the inter- and intra-rater analyses
- Using highly reliable (>0.65 ICC) and available (>80% scored) parameters, we presented clusters of parameters to (5) pediatric cardiologists to rank within cluster clinical relevance
- Mean within cluster ranks identified a core set of 10: EF, pulmonary vein S/D ratio, auto EF A4C, tissue doppler mitral valve A-velocity, tissue doppler tricuspid valve S-velocity, mitral valve E/A ratio, mean LV A4C longitudinal strain rate systole, LV end diastolic dimension, m-mode LV posterior wall thickness (end diastole), average global longitudinal strain

Conclusions and Future Directions

- Using clustering analysis, clinical relevance rankings, and reliability we have identified 10 core echo indices that together recapitulate the information generated from the standard study set of 94 parameters.
- We aim to use these 10 parameters to guide pediatric echocardiographic research and clinical care.

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