Lung airway geometry as an early predictor of autism: A preliminary machine learning-based study.

Radiology

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Introduction

This study aimed to determine whether there is a measurable difference in conductive airway geometry between a control population and children with autism spectrum disorder using reformatted chest computed tomography images, with the goal of identifying a biomarker for autism spectrum disorder.

Design/Sample

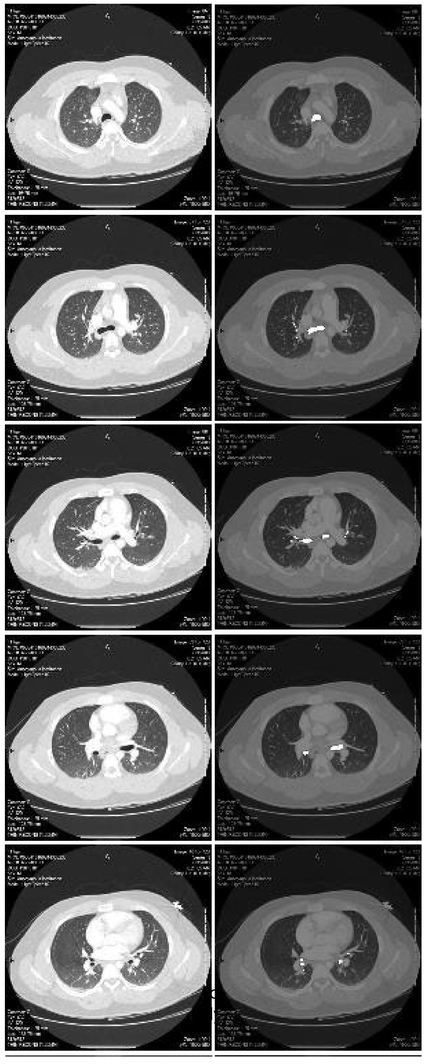
Following IRB approval, we identified chest CTs in 31 children with with autism spectrum disorder and 23 healthy controls from UCDMC and other cooperating hospitals.

Analysis

Principal component analysis and support vector machine identified branching angles in the 3rd and 4th generations as biomarkers for autism. Manual measurements of these airway angles from multiplanar reconstructed chest computed tomographic images were also performed. .

Results

The combined principal component analysis and support vector machine approach achieved an accuracy of nearly 89% using a feature set of 8 airway branching angles. Sensitivity was 94%, but specificity was only 78%. The decision rule derived from this approach was tested on manual angle measurements to assess clinical feasibility



Summary

Early diagnosis and treatment of autism spectrum disorder is a clinical and public health challenge. Given the pervasiveness of autism spectrum disorder and improved effectiveness of early interventions, biomarkers are needed for early detection. Non-behavioral diagnostic biomarkers have been proposed but have insufficient sensitivity and specificity for use as a clinical diagnostic tool.

In a recent study, lung airway anomalies (symmetric double branching of bronchi in generations 3 and 4) were associated with autism, but these anomalies have not been quantified as biomarkers. Our study provides quantitative, statistical analysis of airway geometric parameters predicting autism, derived from chest computed tomography images. This is the only other study evaluating anatomic airway anomalies in association with autism spectrum disorder.

Conclusions/Further study

There is probably a detectable difference in airway branching angles between children with with autism spectrum disorder and healthy controls. We detected airway anomalies in the same airway generations as prior researchers. However, the significance and clinical applicability of this difference is uncertain. Further investigation is needed to evaluate airway anomalies in children with with autism spectrum disorder and determine feasibility of this as a biomarker to identify disease.

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