Quantitative Imaging Biomarkers of Respiratory Viruses in Children

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Bronchiolitis is one of the leading causes of hospitalization during infancy in the US with almost 150,000 admissions per year; it is mainly caused by rhinovirus (RV) and human metapneumovirus (hMPV). In addition to viruses causing bronchiolitis in early life, respiratory viruses are the leading cause of asthma exacerbations in all ages along with promoting the chronic progression of asthma. For instance, RV infection in early life is associated with a 10-fold increase in asthma risk beyond childhood. This retrospective study follows HIPAA compliance standards and was approved by the Institutional Review Board at Children's National Health System. This investigation uses clinical and imaging data from a sample of 226 chest X-rays of children under the age of 2 years to determine if there is a significant difference between quantitative biomarkers in the data of young patients infected by RV and hMPV for early and non invasive diagnosis. For each X-ray set, we computed the area of the left and right lungs, area of air trappings (if present) and curvature of the diaphragm. Using the Mann-Whitney U statistical test, we found that there was a significant difference between the curvatures of the left diaphragm between the types of viruses (Rhino virus and hMPV). There was also significant difference between the severity of the air trapping between the two viruses. Next, using the Spearman's rank correlation coefficient, the statistical dependence between the amounts of air trapping in the lungs to the curvature of the diaphragm was computed. The test found that there was weak correlation between the two variables. We conclude that the left lung curvature and severity of air trapping are useful imaging biomarker for differentiating the type of respiratory virus.

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