Can 129Xe ventilation MRI guide personalisation of airway clearance regimens in children with Primary ciliary dyskinesia?

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Background: Children with Primary ciliary dyskinesia (PCD) use airway clearance techniques (ACT) to clear airway secretions, but physiotherapists lack sensitive outcome methods to guide ACT regimen personalisation. 129Xe Ventilation MRI (129Xe-MRI) is an imaging method that provides a 3D image of lung ventilation distribution.

Aim: We aimed to establish if providing data from 129Xe-MRI and structural MRI influenced physiotherapists' decision making.

Methods: Children with a confirmed diagnosis of PCD were assessed with structural and 129Xe-MRI pre-, post- and 4-hours post their usual ACT regimen.

During cognitive task analysis interviews, physiotherapists were asked to "think aloud" their clinical decisions whilst reviewing the data of children with PCD under their care: routine clinical information; baseline structural MRI; 129Xe-MRI data.

Results: Five experienced physiotherapists from four NHS trusts reviewed data from a total of 19 children with PCD (age 5-17years). Minimal ACT changes pertaining to positioning during airway clearance were proposed when physiotherapists reviewed the structural MRI scans. 129Xe-MRI data aligned with the physiotherapists' existing clinical impression for nine cases. In these reviews, the 129Xe-MRI either confirmed the physiotherapists' ACT regimen decision or led them to propose modifications. In ten cases 129Xe-MRI challenged the current clinical impression formed from prior knowledge of the patient, routine clinical information, and structural MRI findings. For these cases, the physiotherapist either: re-evaluated their clinical decisions and proposed ACT regimen modifications or; felt unsure what regimen changes to propose during the review, so planned to reassess the patient in light of the 129Xe-MRI findings.

Conclusion: Clinical review of 129Xe-MRI data led physiotherapists to propose ACT regimen changes in most children with PCD. In some cases, physiotherapists reported clinical re-assessment in light of the 129Xe-MRI findings was warranted. 129Xe-MRI provides an intuitive 3D lung ventilation image, which is sensitive to airways obstruction and can inform clinical ACT regimen personalisation.

References:

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