

Letter to the Editor

Feasibility of electrical impedance tomography-guided PEP in children with CF and TBM

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DEAR EDITOR,

We read with interest the study by Depiazzi et al., evaluating the feasibility of using electrical impedance tomography (EIT) to guide positive expiratory pressure (PEP) airway clearance in non-sedated children with cystic fibrosis (CF) and tracheobronchomalacia (TBM).¹ The authors address a clinically relevant gap, as objective and radiation-free tools to individualize airway clearance in pediatric populations remain limited, particularly in younger children.

A major strength of this work is its pragmatic clinical design and structured feasibility framework. High tolerability and intervention completion rates, along with the ability of EIT to visualize regional ventilation changes across varying PEP levels, support its potential utility in pediatric respiratory physiotherapy.¹ Inclusion of infants and toddlers, a group often excluded from physiological imaging studies, further enhances the relevance of these findings to routine clinical practice.

Several methodological and interpretive issues warrant discussion. First, the small convenience sample recruited from a single tertiary center limits generalizability. Although acceptable for a feasibility study, recruitment of children known to the investigators may introduce selection bias toward families with high adherence to airway clearance regimens. Multicenter recruitment and inclusion of children with varying disease severity and adherence profiles would strengthen future studies.

Second, feasibility success was defined using a $\geq 70\%$ threshold based on clinician consensus. While pragmatic, this cutoff is not validated and may limit reproducibility. Explicit justification of this threshold or alignment with predefined progression criteria for subsequent efficacy trials would improve interpretability. Additionally, clinician time burden was substantial, with investigator involvement ranging from 2.5 to 5 hours per participant.¹ This finding raises concerns regarding scalability and routine clinic implementation, which deserve greater emphasis given the realities of pediatric respiratory services.

Interpretation of EIT-derived recommendations for optimal PEP also requires caution. Although higher PEP levels were often associated with improved compliance metrics on software analysis, these pressures were clinically intolerable for several children due to increased work of breathing.¹ Similar concerns have been raised in prior EIT studies involving spontaneously breathing patients.^{2,3} This highlights a key limitation: automated EIT outputs cannot be used in isolation to guide PEP prescription in pediatric populations, and clinical assessment must remain central to decision-making.

Movement artifact and variability in spontaneous breathing, particularly in younger children, remain unresolved challenges. While acknowledged by the authors, the extent to which belt positioning and motion influenced regional ventilation patterns is difficult to determine. Validation studies comparing EIT outputs with established physiological or imaging markers would help clarify the clinical significance of observed ventilation changes.^{2,4}

Finally, the absence of comparator groups, such as children with CF without TBM or healthy controls, limits interpretation. It remains unclear whether the heterogeneous ventilation patterns observed at rest reflect TBM-specific physiology, CF lung disease, or normal pediatric ventilation distribution. Inclusion of comparator cohorts would help determine the specificity of EIT findings and support its role in individualized airway clearance strategies.⁵

In summary, Depiazzi et al provide valuable preliminary evidence that EIT is feasible and well tolerated during PEP airway clearance in children with CF and TBM. At present, its greatest utility appears to lie in qualitative assessment and visual biofeedback rather than prescriptive pressure titration. With further validation, refinement of software algorithms for spontaneous breathing, and careful integration with clinical judgment, EIT may become a meaningful adjunct in pediatric respiratory therapy research and practice.

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