

Thoracic fluid content as a predictor of ventilatory weaning and postoperative pulmonary complications in infants undergoing open heart surgery: A prospective observational study

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ABSTRACT

Background and Aims: Infants undergoing open heart surgery (OHS) are at potential risk of postoperative pulmonary complications due to fluid overload following cardiopulmonary bypass (CPB), which may delay weaning from mechanical ventilation. Therefore, this study aimed to evaluate the postoperative thoracic fluid content (TFC) by electrical cardiometry in predicting successful weaning from mechanical ventilation in infants undergoing OHS. **Methods:** A prospective observational study was conducted in a tertiary referral cardiac centre over a 1-year period, from July 2022 to June 2023, and 100 infants undergoing elective OHS were analysed. Postoperatively, TFC was evaluated for prediction of extubation and pulmonary complications. Also, conventional lung ultrasound (LUS) and chest radiographs were correlated. The association with CPB duration, aortic clamp time, and postoperative clinical variables were assessed for ventilatory duration, intensive care unit, and hospital length of stay in this cohort of infants. **Results:** In this study, 64 patients underwent successful weaning from mechanical ventilation (Group SW) within 12 hours following surgery ($n = 64$), while 36 infants required prolonged mechanical ventilation, hence delayed weaning (Group DW) ($n = 36$). The TFC was significantly higher in Group DW than in Group SW. $TFC > 45 \text{ k}\Omega^{-1}$ can be considered as a predictor of delayed weaning (Area under curve = 0.94, P value < 0.001) with 91% sensitivity and 97% specificity. LUS score > 14.5 and chest radiograph score > 2.5 can predict delayed weaning. $TFC > 37 \text{ k}\Omega^{-1}$ was associated with postoperative pulmonary complications in our study. **Conclusion:** $TFC > 45 \text{ k}\Omega^{-1}$ was associated with delayed weaning in infants following OHS. Additionally, electrical cardiometry can be used as an objective bedside trend monitor for assessing postoperative pulmonary complications in this cohort.

Keywords: Cardiac surgery, extravascular lung water, infant, mechanical ventilation

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INTRODUCTION

Infants undergoing open heart surgeries (OHSs) are at risk of fluid overload and profound systemic inflammation, which impairs lung function postoperatively.^[1] Extracorporeal-related pulmonary complications occur in 12–50% of children following OHS.^[2] Subsequently, fluid overload leads to cardiopulmonary complications and prolonged mechanical ventilation (MV), thereby increasing duration of hospitalisation.^[3] Conventionally, chest

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radiograph and lung ultrasound (LUS) are used to detect fluid overload and pulmonary dysfunction in infants following cardiac surgery.^[4] However, both the modalities are subjective and operator-dependant.

Thoracic fluid content (TFC) is a new modality measured by thoracic bioimpedance technique, which can detect fluid overload.^[5] Intravascular, intra-alveolar, and interstitial fluid contained within the thoracic cavity can be easily estimated using TFC. Also, it can assess fluid status in infants and predict pulmonary complications in critically ill children.^[5] A good correlation was demonstrated between fluid balance and TFC during cardiac surgery by Elbagoury and colleagues.^[6] Furthermore, TFC was shown to predict postoperative pulmonary complications and probability of ventilatory weaning in adult mechanically ventilated patients following cardiac surgery.^[6] However, TFC as a surrogate of pulmonary function and a guide for successful ventilator weaning in infants following OHS has not been explored previously.

Therefore, this study was planned with the aim to evaluate TFC by thoracic bioimpedance in predicting postoperative pulmonary complications and length of ventilatory support in infants undergoing OHS. We hypothesised that TFC may serve as a predictive marker for postoperative pulmonary complications and the duration of ventilatory support in infants undergoing OHS. The primary objective was to evaluate TFC in predicting weaning outcomes from mechanical ventilation. The secondary objective was to compare TFC with other conventional techniques like LUS score and chest radiograph score in predicting postoperative pulmonary complications and duration of postoperative MV in these cohorts of infants.

METHODS

A single-centre, prospective, observational study was conducted at a tertiary care referral cardiac centre as per good clinical practice. The study was conducted in accordance with the ethical principles outlined in the 2013 revision of the Declaration of Helsinki. After approval by the institutional ethics committee (IECPG-384/26.5.2022), the study procedure was elaborated to the guardians of the infants and their written consent was taken for participation in the study. All consecutive elective cardiac operations in patients aged less than 1 year of either gender scheduled during a 1-year period from

July 2022 to June 2023 were included. Children with radiological signs of preoperative pulmonary disease, preoperative mechanical ventilation, surgical access by thoracotomy, undergoing emergency surgeries, redo surgeries, with intraoperative complications (airway bleeding, cardiac arrest), and requirement of postoperative extracorporeal support were excluded.

This study abides with the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) 2023 statement guidelines. All surgeries were carried out through a median sternotomy in a protocolised technique. The anaesthetic, cardiopulmonary bypass (CPB) and postsurgical care were done in accordance with institutional policies.

In infants, CPB requires special consideration because of their limited blood volume, immature organ systems, and high susceptibility to haemodilution and inflammation. Therefore, the bypass circuit was primed with packed red blood cells to maintain haematocrit around 30–35% for adequate oxygen transport, while albumin was added to preserve colloid osmotic pressure and minimise interstitial oedema. To mitigate fibrinolysis and inflammatory activation, epsilon-aminocaproic acid was added. Perfusion flow was maintained at 150–200 mL/kg/min with the targeted mean arterial pressure between 30 and 50 mmHg. Moderate hypothermia (28–32°C) was applied to reduce metabolic demands, with gradual rewarming to avoid neurologic injury. Anticoagulation was achieved with heparin to keep the activated clotting time above 480 seconds, and protamine was administered for reversal. Conventional ultrafiltration was employed during CPB, whereas modified ultrafiltration was performed to increase haematocrit, remove excess fluid, and decrease inflammatory mediators after CPB.

After surgery, the infants were shifted to the intensive care unit (ICU) for postoperative care. Infants were ventilated mechanically with 6–8 mL/kg tidal volume, respiratory rate as per age, and 3–5 cmH₂O positive end-expiratory pressure to keep the peak inspiratory pressure less than 20 cmH₂O and mean airway pressure 7–10 cmH₂O. Thereafter, the ventilatory support was decreased in a gradual fashion as per the institutional protocol of ventilator weaning. Endotracheal extubation within 12 hours of mechanical ventilation was considered as successful weaning, and if it was >12 hours, it was considered as delayed weaning.

Demographic and clinical data like age, weight, gender, cardiac defect, type of surgery, Risk Adjustment for Congenital Heart Surgery (RACHS) score, CPB time, aortic cross clamp time, and duration of ICU stay were collected. Surrogate markers impacting pulmonary gas exchange like values of arterial blood gas (ABG) analysis [partial pressure of oxygen/fraction of inspired oxygen ($\text{PaO}_2/\text{FiO}_2$), lactate] and haemodynamic measurements (mean arterial pressure, central venous pressure, and fluid balance) were recorded. TFC values and LUS scores were measured on the 1st and 2nd postoperative days. Simultaneously, chest radiograph findings and scores were obtained daily.

TFC was obtained via the use of electrical bioimpedance equipment (ICON Cardiometrics, Inc., La Jolla, California; Osyka Medical GmbH, Berlin). The ICON equipment was attached to four electrocardiogram leads that were stuck on the skin of the infants after being sterilised using an alcohol swab: sensor A attached to the forehead, sensor B attached to the left-sided lower neck, sensor C placed on the left side of the lower thorax, and sensor D attached to the left side of the thigh.^[7,8] TFC was evaluated for one minute, and the average value was reported.

LUS was performed by the same experienced individual for all infants with the Nano Max Ultrasound System (Sono Site, Bothell, WA) using a linear probe 6–13 MHz with all aseptic measures. LUS was performed for A-line, B-line, bat sign, lung sliding, seashore sign, bar code sign, lung point, lung pulse, quad sign, sinusoidal sign, tissue-like sign, and dynamic or static air bronchogram.^[9,10] Postoperative pulmonary complications such as endobronchial intubation, lung atelectasis, pneumothorax, interstitial oedema, pleural effusion, pericardial effusion, and diaphragmatic palsy were detected by point-of-care LUS. For determination of LUS score, thorax was categorised into 12 zones: 6 on the right (anterior: upper R1 and lower R2; lateral: upper R3 and lower R4; posterior: upper R5 and lower R6) and 6 on the left side (front: upper L1 and lower L2; lateral: upper L3 and lower L4; rear: upper L5 and lower L6). Then each site was assigned with a score as follows: 0 (0–2 B lines), 1 (>3 separated B lines), 2 (coalescent B lines), and 3 (complete loss of aeration: lung consolidation).^[11] For total LUS, score 0 denotes normal lungs, while 36 is the worst scenario, estimated by adding all site scores.

Similarly, chest radiograph was also scored as 1 if normal image, 2 if patchy area of atelectasis and/or

hyperinflated lungs and/or bronchial wall thickening, 3 if focal consolidation, 4 if multifocal involvement, and 5 if diffuse alveolar pathologies were found.^[12]

The primary outcome of the study was to determine the predictability of TFC using the thoracic bioimpedance technique for delayed weaning from the mechanical ventilator. Secondly, the TFC value was also compared with the postoperative LUS score and chest radiograph score. The association with CPB duration, aortic clamp time, blood lactate level, ventilatory parameters, outcome variables like ICU length of stay, and hospitalisation were also assessed. Postoperative pulmonary complications such as lung atelectasis, pneumothorax, interstitial oedema, and pleural effusion were diagnosed by chest radiograph and LUS along with the clinical findings. Also, predictions of postsurgical pulmonary complications from TFC, LUS, and chest radiograph findings were analysed.

As no previous studies were available in the paediatric population, a purposive sampling method was adopted and all infants undergoing elective cardiac surgery over a 1-year period (July 2022 to June 2023) were included.

Continuous variables were depicted as mean $\pm$ standard deviation (SD), while qualitative variables were described as numbers (*n*) and percentages (%). Percentage of postoperative pulmonary complications and delayed extubation was calculated. Kolmogorov–Smirnov test was used to assess normality. Chi-square test was employed to test the significance of association between risk factors and outcomes, whereas Student's *t*-test was carried out to test the significance of difference in mean values of variables related to both outcomes. The Mann–Whitney U test was used for the analysis of non-parametric variables. Multivariate regression analysis was carried out for confounders like age, gender, CPB time, aortic cross clamp time, CVP, and blood lactate level. *P* value < 0.05 was contemplated as statistically significant. Receiver operating characteristic (ROC) curves were plotted for delayed extubation and postoperative pulmonary complications. Youden Index was used to identify the cut-offs for detecting the two outcomes.

RESULTS

One hundred and forty-six infants undergoing cardiac surgery through midline sternotomy [arterial switch

operation (ASO), aortopulmonary (AP) window repair, bidirectional Glenn, intracardiac repair (ICR), total anomalous pulmonary venous connection (TAPVC) correction, ventricular septal defect (VSD) closure] were initially recruited. Twenty-eight patients were precluded at the enrolment stage, whereas 12 patients were eliminated during the follow-up phase due to re-exploration or institution of extracorporeal support or death. Further, LUS, chest radiograph, and TFC were analysed on 106 patients on 1st and 100 infants on 2nd postoperative days. Therefore, total 100 infants were included in the final analysis [Figure 1].

In this study, 64 patients underwent successful early weaning (Group SW, $n = 64$) within 12 hours following surgery, while 36 infants (Group DW, $n = 36$) required prolonged mechanical ventilation.

Infants were comparable between SW versus DW groups with regards to the age, gender, and weight [Table 1]. However, higher RACHS score, prolonged bypass, and cross clamp time were noted in Group DW. The ventilatory duration, the ICU, and hospital length of stay were longer in Group DW.

The characteristics of different techniques for predicting ventilatory weaning are represented in Table 2. TFC ($\text{k}\Omega^{-1}$) was considerably more in Group DW (55 ± 11.45 vs. 29.02 ± 3.33 , $P = 0.0001$)

than in Group SW (52.39 ± 8.62 vs. 28.52 ± 3.86 , $P = 0.0001$) on the 1st and 2nd postoperative days, respectively. The LUS score and the chest radiograph score were also remarkably higher in the Group DW in comparison with Group SW [Figure 2]. The $\text{PaO}_2/\text{FiO}_2$ ratio was also significantly lower and lactate levels were higher in patients with delayed weaning [Table 2, Figure 2].

TFC $> 45 \text{ k}\Omega^{-1}$ can predict delayed weaning from ventilatory support [area under the curve (AUC) = 0.94, P value < 0.001] with 91% sensitivity and 97% specificity. In regression analysis, TFC correlated with age ($r^2 = 0.107$, adjusted $r^2 = 0.983$; $P = 0.001$), gender ($r^2 = 0.005$, adjusted $r^2 = -0.005$; $P = 0.047$), CPB time ($r^2 = 0.565$, adjusted $r^2 = 0.561$; $P = 0.001$), aortic cross clamp time ($r^2 = 0.546$, adjusted $r^2 = 0.541$; $P = 0.001$), central venous pressure ($r^2 = 0.414$, adjusted $r^2 = 0.408$; $P = 0.001$), and blood lactate level ($r^2 = 0.469$, adjusted $r^2 = 0.463$; $P = 0.026$). Also, the LUS score > 14.5 (AUC = 0.83 with 81% sensitivity and 84% specificity, P value < 0.001) and chest radiograph score > 2.5 (AUC = 0.81 with 71% sensitivity and 62% specificity, P value < 0.001) can predict delayed weaning from ventilatory support [Figure 3a].

Even TFC $> 37 \text{ k}\Omega^{-1}$ can forecast pulmonary complications following surgery (AUC = 0.86, P value < 0.001) with 84% sensitivity and 88% specificity. LUS

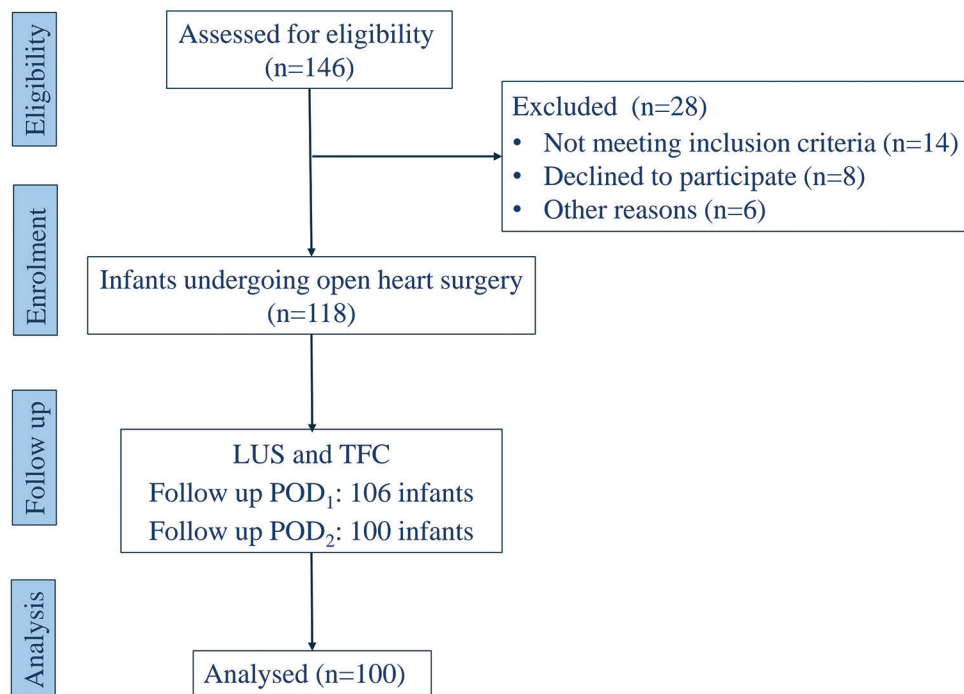


Figure 1: Strengthening the reporting of observational studies in epidemiology (STROBE) flow chart. LUS: Lung ultrasound; TFC: Thoracic fluid content; POD: Postoperative day

Table 1: Demographic profile and surgical details of patients

Parameters	Total patients (n=100)	Group SW (<12 h) (n=64)	Group DW (>12 h) (n=36)	P
Age (months)	5.56±2.79	6.02±2.04	5.72±3.61	0.596
Gender (Male/Female)	46/54	27/37	19/17	0.428
Weight (kg)	7.48±2.03	7.93±2.48	6.91±3.11	0.075
RACHS score	2 (2-2)*	2 (2-2)*	2 (2-4)*	<0.0001
CPB time (min)	99.53±49.1	75.16±28.04	142.86±48.87	<0.0001
AoXCI time (min)	79.13±43.52	57.56 ±24.33	117.47±43.92	<0.0001
Duration of MV (h)	12.57±9.56	6.33±1.41	23.67±7.5	<0.0001
ICU stay (days)	3.66±1.75	2.73±1.09	5.31±1.47	<0.0001
Hospital length stay (days)	9.92±6.48	6.47±1.02	16.06±7.51	<0.0001
Diagnosis	Total patients (n=100)	Group SW (<12 hr) (n=64)	Group DW (>12 hr) (n=36)	P
AP window repair (n)	2	0	2	<0.0001
ASO (n)	12	0	12	
ASO±VSD closure (n)	5	0	5	
BD Glenn (n)	7	5	2	
ICR (n)	18	10	8	
TAPVC repair (n)	4	0	4	
VSD closure (n)	46	45	1	
VSD closure±PDA ligation (n)	6	4	2	

Data represented in (Mean±standard deviation), median (interquartile range)*, or number (n). AP: Aortopulmonary; AoXCI: Aortic cross clamp; ASO: Arterial switch operation; BD: Bidirectional; CPB: Cardiopulmonary bypass; DW: Delayed weaning; ICR: Intracardiac repair; ICU: Intensive care unit; IQR: Interquartile range; MV: Mechanical ventilation; PDA: Patent ductus arteriosus; RACHS: Risk Adjustment for Congenital Heart Surgery; SW: Successful weaning; TAPVC: Total anomalous pulmonary venous connection; VSD: Ventricular septal defect

Table 2: Postoperative outcome parameters to predict successful weaning

Parameters	POD1			POD2		
	Group SW (<12 h) (n=64)	Group DW (>12 h) (n=36)	P	Group SW (<12 h) (n=64)	Group DW (>12 h) (n=36)	P
TFC	29.02±3.33 [28.69,31.04]	55±11.45 [52.39,60.48]	0.0001	28.52±3.86 [28.00,31.17]	52.39±8.62 [50.37,55.81]	0.0001
LUS score	12 (10,14)* [11.22,13.25]	18 (15.75,22)* [17.59,20.47]	0.0001	8 (7,12)* [8.48,10.54]	18 (11.75,22)* [15.21,19.91]	0.0001
Chest X-ray	2 (2,3)* [2.31,2.69]	4 (3,5)* [3.88,4.49]	0.0001	2 (1.25,3)* [1.94,2.38]	4 (3,5)* [3.78,4.40]	0.0001
P/F ratio	295.19±43.55	225.44±37.04	0.0001	298.16±45.99	239±29.77	0.0001
Lactate	2.46±0.42	3.73±1.08	0.0001	2.03±0.53	2.65±0.68	0.0001

Data represented in (Mean±standard deviation), or median (interquartile range)*, and [95% confidence interval]. DW: Delayed Weaning; IQR: Interquartile range; LUS: Lung ultrasound; TFC: Thoracic fluid content; P/F: Partial pressure of arterial oxygen/Fraction of inspired oxygen (PaO₂/FiO₂); POD: Postoperative day; SD: Standard deviation; SW: Successful weaning; X-ray: Radiograph

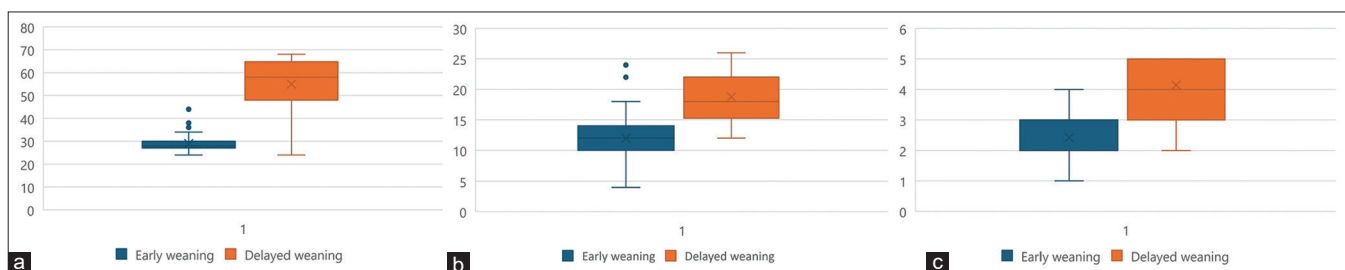


Figure 2: Box and Whisker plot demonstrating thoracic fluid content (TFC) measured by electrical cardiometry (a), lung ultrasound (LUS) score (b), and chest radiograph score (c) in patients with successful weaning and delayed weaning

score of >16.5 can predict postoperative pulmonary complications (AUC = 0.90, *P* value <0.001) with 87% sensitivity and 93% specificity. Similarly, chest radiograph score (>3.5) can predict postoperative pulmonary complications (AUC = 0.95, *P* value <0.001) with 94% sensitivity and 96% specificity [Figure 3b].

DISCUSSION

TFC, LUS score, and chest radiograph score predict delayed weaning from mechanical ventilators in infants undergoing OHS. Further, delayed ventilatory weaning is usually due to congested lungs, especially

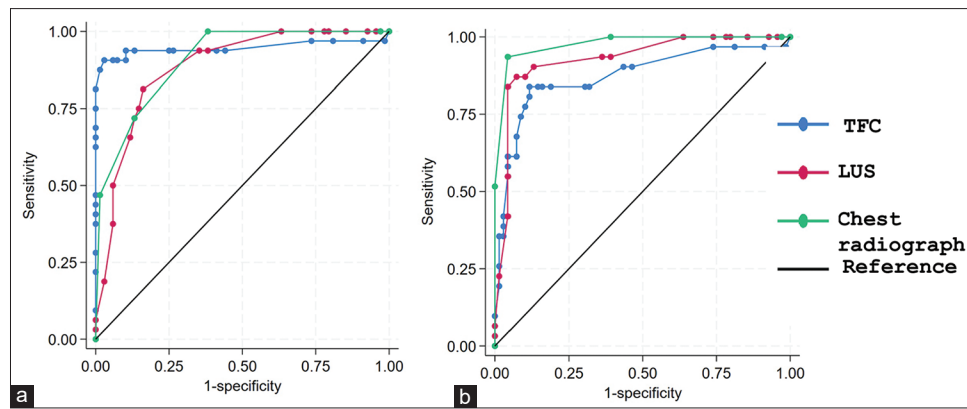


Figure 3: Receiver operating characteristic curve of thoracic fluid content (TFC) measured by electrical cardiometry, lung ultrasound (LUS) score, and chest radiograph score showing predictability of delayed weaning from mechanical ventilation (a) and postoperative pulmonary complications (b)

in infants with cardiovascular dysfunction. Therefore, accurate estimation of pulmonary fluid content is decisive in ventilated infants following cardiac surgery to guide fluid therapy and optimise ventilatory settings and successful weaning from MV. While LUS and chest radiograph have been the traditional techniques for evaluating pulmonary fluid content, TFC by electrical bioimpedance offers a potential alternative with promising advantages like continuous trend monitoring, easy to use, and accurate results as demonstrated in this study. Further, predictability of delayed weaning from ventilatory support by TFC has higher AUC than chest radiograph and LUS.

To the authors' knowledge, this is the only study that has demonstrated the predictability of TFC for postoperative pulmonary complications in terms of delayed weaning in infants following cardiac surgery. Conventional methods like LUS score and chest radiograph-guided estimation of fluid status are usually imprecise and erroneous owing to surgical dressing in small paediatric chest, and subjective nature with interobserver variability.^[13] Moreover, a significant interobserver difference may arise for detecting pulmonary congestion by LUS and chest radiograph.^[14] Therefore, there is an emerging interest for a non-invasive, convenient, objective tool like electrical cardiometry for more precise estimation of fluid content. Also, appropriate fluid resuscitation and early diuretic therapy guided by fluid loading condition may result in early weaning, thereby minimising ICU and hospital duration, especially in most vulnerable infants following OHS. Cardiovascular dysfunction, resulting in hypervolaemia and pulmonary congestion, may therefore contribute significantly to delayed ventilator weaning. Before weaning from MV, various

modalities are evolved to assess fluid status and identify the need for diuretic therapy.^[8,15]

Infants have unique cardiopulmonary physiology characterised by higher metabolic demands, increased oxygen consumption, and an immature respiratory system.^[2] Their lungs have fewer and smaller alveoli and reduced functional residual capacity, which make them more prone to airway collapse and ventilation-perfusion mismatch.^[3] The cardiovascular system has limited myocardial reserve and a greater dependence on heart rate to maintain cardiac output.^[8] These physiological features predispose infants to postoperative pulmonary complications including atelectasis, pulmonary oedema, and impaired gas exchange.^[3] TFC reflects the amount of fluid within the thoracic cavity and pulmonary vasculature, and an increase in TFC may indicate pulmonary congestion or interstitial oedema, which can contribute to respiratory compromise and difficulty in weaning from MV.^[5] Therefore, monitoring TFC alongside clinical and haemodynamic parameters may help in early detection of postoperative pulmonary complications and guide fluid management in infants undergoing cardiac procedures.

Impedance variation offered by thoracic tissue to electrical current results in estimation of TFC. TFC is an objective numerical parameter and potential alternative to subjective LUS. Assessment of TFC has been found to directly correlate to fluid overload in chest radiographs, clinical features of heart failure, and total fluid balance.^[5,16] A study comparing LUS with transpulmonary thermodilution in paediatric cardiac surgical patients found that LUS B-line scoring has limited utility for semiquantitative assessment of extravascular lung water (EVLW) index (EVLWI) at

lower levels. However, at higher EVLWI thresholds, LUS demonstrated better discriminatory ability along with acceptable sensitivity and specificity.^[17] Recently, EVLW score measured by LUS demonstrated a positive relationship with the duration of MV across all time points, with correlation coefficients of $r = 0.70$, $r = 0.40$, and $r = 0.52$ immediately, at 6–8 hours, and at 18–24 hours following surgery, respectively.^[18]

The current study compared TFC, LUS, and chest radiograph as predictors of ventilatory weaning in infants following OHS. Several other studies were aligned with the study results. Gadallah *et al.*^[19] found remarkably higher TFC in adults with failed weaning ($61.47 \pm 5.16 \text{ k}\Omega^{-1}$) than those who achieved successful weaning ($42.50 \pm 10.47 \text{ k}\Omega^{-1}$). The current study was also in concordance with Fathy *et al.*,^[20] where the unsuccessful weaning group in critically ill postoperative cases had a greater TFC ($61 \pm 26 \text{ k}\Omega^{-1}$) than the successful group ($45 \pm 14 \text{ k}\Omega^{-1}$). Similarly, Avci *et al.*^[21] discovered considerably higher TFC in failed weaning acute decompensated heart failure patients than those with successful weaning. Aligned with the present study, Elbagoury *et al.*^[6] found significantly higher TFC in patients with failed weaning and also demonstrated that a TFC threshold of $<45 \text{ k}\Omega^{-1}$ predicted successful weaning with 91% sensitivity and 97% specificity.

TFC is a non-invasive surrogate of pulmonary capillary wedge pressure (PCWP) as it can determine EVLW. Further, PCWP is obtained through right heart catheterisation, and evidence in critically ill patients or in cardiac surgery is limited.^[22,23] One study found that $\text{TFC} \geq 35 \text{ k}\Omega^{-1}$ had 97% specificity and 86% sensitivity for the detection of $\text{PCWP} \geq 15 \text{ mm Hg}$.^[24] Furthermore, electrical cardiometry-derived TFC exhibited a great capability of detecting pulmonary oedema (AUC 0.941, cut-off value $>40 \text{ k}\Omega^{-1}$) with a good correlation between TFC and LUS score.^[25] Moreover, $\text{TFC} > 40 \text{ k}\Omega^{-1}$ was correlated with high levels of serum brain natriuretic peptide in patients with diastolic heart failure.^[26] Therefore, TFC by electric cardiometry can estimate the cardiopulmonary interplay better, especially in infants undergoing OHS. $\text{TFC} > 45 \text{ k}\Omega^{-1}$ is a potential prognosticator of delayed ventilatory weaning in infants following cardiac surgeries, but it is not superior in comparison to either LUS or chest radiographic detection of postoperative pulmonary complications.

The present study poses several limitations. First, it was a single-centred trial. In addition, the study is an observational study including a small number of

patients. Further multicentric trials involving a large number of infants are needed to establish its clinical utility. Pulmonary arterial and venous pressures were not measured intraoperatively, assuming comparable cardiac surgical procedures in both the successful and delayed weaning groups. Thoracic bioimpedance is not reliable in an open thorax condition; therefore, infants transferred to the ICU with an open chest following cardiac surgery could not be assessed in this study. Lastly, the reliability, accuracy, and clinical utility of TFC in neonates undergoing cardiac surgeries cannot be concluded as only a few neonates were included in the study.

CONCLUSION

$\text{TFC} > 45 \text{ k}\Omega^{-1}$ is associated with delayed weaning from mechanical ventilators in infants following complex congenital cardiac surgeries. In addition, electrical cardiometry can be used as an objective bedside trend monitor for assessing infants for postoperative pulmonary complications.

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None.

Author contributions

DD: Design, definition of intellectual content, data acquisition, manuscript preparation, data analysis. MC: Concept, editing, guarantor. NM: Manuscript review, supervision. SC: Manuscript review, supervision. DV: Data collection, manuscript review. PR: Data collection, manuscript review.

Presentation at conferences/CMEs and abstract publication

This study was presented as a paper in ISACON 2025 in Raipur and won KOP's award in cardiac anaesthesia category.

Data availability statement

De-identified data may be requested with reasonable justification from the authors (email to the corresponding author) and shall be shared after approval as per the authors' institution policy.

Disclosure of use of artificial intelligence (AI)-assistive or generative tools

Artificial intelligence (AI)-assistive or generative tools were not used for generation and interpretation of data.

Declaration of use of permitted tools

No permitted tools were used.

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Conflicts of interest

There are no conflicts of interest.

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