LETTER TO THE EDITOR

Simplified 8-site lung ultrasound examination to assess fluid overload in children on haemodialysis

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A recent article found the simplified 8-site assessment to correlate well with a classical full 28-site examination in the evaluation of volume overload, supporting its use in adult haemodialysis patients [1].

Assessment of fluid status is clinically important yet challenging in children on dialysis, and we previously reported the utility of lung ultrasound for this purpose [2]. Lung ultrasound is a non-invasive, bedside and emerging technique for the diagnosis of hypervolemia and quantifying the number of B-lines. Various scoring systems have been proposed to quantify the extent of extravascular lung water in children, but there is no standardized system. Studies in paediatric haemodialysis patients use a 28-site examination [2, 3], or a 14-site scanning method for patients with weight <20 kg [2]. Four-zone [4] and 6-zone scores [5] have been also proposed in children not on dialysis. Using linear or convex probes to measure B-lines at 28 sites in neonates or young children can result in overlap between the different scanning sites. These technical challenges, and difficulties for some children cooperating with a 28-site examination, have hampered clinical uptake of lung ultrasound in paediatric dialysis.

Table 1. Patient characteristics: clinical and epidemiological data

| All patients on chronic haemodialysis (n = 15)                     |
|---------------------------------------------------------------|
| Age at onset of study, years                                  | 13.6 (4.1–16.4) |
| Gender distribution (M:F)                                     | 9:5             |
| Duration of renal replacement therapy, months                 | 8.5 (4.0–37.0)  |
| Diagnosis of nephropathy                                      | ANCA vasculitis (2), congenital FSGS, genetic FSGS, nephropathiesis (2), atypical haemolytic uraemic syndrome (2), SLE (2), immunoglobulin A nephropathy, bilateral hypoplasia (3) and bilateral Wilms tumour |
| Percentage increase of interdialytic weight gain/dry weight   | 3.3 (0–8.6)     |
| Oligoanuria, n (%)                                            | 3/15            |
| Left ventricular hypertrophy, n (%)                           | 9/15            |
| NT-proBNP, mean                                               | 2906 (159–55 520) |
| Physical signs or symptoms of overt fluid overload, n (%)     | 12/42 (29) assessments |
|                                                              | 6/15 (40) patients |

Data are presented as median and range.

ANCA, anti-neutrophil cytoplasmic autoantibody; FSGS, focal segmental glomerulosclerosis; F, female; M, male; NT-proBNP, N-terminal pro-brain natriuretic peptide; SLE, systemic lupus erythematosus.
Recently, Loutradis et al. suggested that a simplified 8-site B-lines score technique should be adopted in the evaluation of volume overload in paediatric haemodialysis patients [6].

We therefore compared 28-site lung ultrasound assessments versus a simplified 8-site assessment in 15 children with a median (range) age of 13.6 (4.1–16.4) years and a median (range) duration on haemodialysis of 8.5 (4.0–37.0) months [Table 1]. Children had examinations as part of clinical care, and parental consent for use of anonymized data was obtained. Each child had ultrasound examinations before dialysis, recording B-lines in 28 positions. An 8-position score was calculated by using the following eight sites only: four on the right and four on the left hemithorax (second and fourth rib spaces in the parasternal and anterior axillary positions). In order to facilitate comparison with 28-site scores, 8-site B-line scores were normalized by multiplying by 28/8. Correlation was assessed by Spearman’s rho, and analyses were performed using R [RStudio Team (2020) RStudio: Integrated Development for R. RStudio, PBC, Boston, MA, USA; http://www.rstudio.com/].

We found a strong correlation between 28-site and 8-site B-line scores in children (Spearman’s $\rho = 0.91$, $P < 0.001$; Figure 1). In 1 of 42 (2%) assessments, hypervolemia measured as six B-lines in the 28-site assessment was missed in the 8-site assessment (0 B-lines). In all other examinations, no clinically significant differences were observed.

Our data in children corroborate findings in adult haemodialysis patients, that 8-site B-line score is tightly related to the classical 28-site score, and this score holds an almost identical predictive power to the reference score. We therefore propose use of 8-site lung ultrasound assessments for children on dialysis with a view to broadening clinical uptake of the technique to optimize volume assessment in children. Further research in children should focus on optimizing both 28-site and 8-site B-lines scores to assess fluid overload, taking patients’ age and body surface area into consideration.

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**CONFLICT OF INTEREST STATEMENT**

None declared.

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