Resting Energy Expenditure assessment in mechanically ventilated critically ill children: the importance of Indirect Calorimetry

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Introduction. Malnutrition is common in critically ill children, and is considered a negative prognostic factor for their clinical outcomes[1,2]. Traditionally, Resting Energy Expenditure (REE) is calculated using predictive equations. These equations might be inaccurate in the critical scenario. Indirect Calorimetry (IC) is the gold standard to measure REE and allows tailored nutrition support[3].

Aim of the study was to evaluate the accuracy of commonly employed equations as compared to IC-derived values in critically ill children.

Methods. Children admitted to our unit between January 2017 and March 2019, aged <18 years and mechanically ventilated were enrolled. Endotracheal tube leak >10% and/or a fraction of inspired oxygen ≥0.6 constituted exclusion criteria. Harris-Benedict, Schofield and WHO formulae were applied to estimate REE. We performed IC for 30 minutes and REE was measured. The agreement between IC- and equation-based values of REE was assessed via paired t-test and Bland-Altman analysis. Data are expressed as mean and standard deviation. Statistical significance was defined as $p<0.05$.

Results. Forty-four critically ill children (4.3±4.2 years, 18.1±16.4 kg) admitted for acute respiratory failure (n=24), neurological (n=13) or other diseases (n=7) were studied. Measured REE ranged between 16 and 89 kcal/kg/die (mean 43±15). Typically, all formulae significantly over-estimated the REE, as compared to IC (**Table 1**). Furthermore, the Bland-Altman analysis revealed wide limits of agreement, suggesting low accuracy of the prediction equations.

Conclusions. In critically ill, mechanically ventilated patients REE is on average significantly lower than predicted by currently applied equations. This finding might be explained by a reduced work of breathing and/or the use of sedatives and paralyzing agents. Measurement of REE through IC is essential to avoid over/underfeeding in this population.

References

1. Agostoni C et al. JPGN **2016**

2. Taku Oshima et al. Clinical Nutr **2017**

3. Smallwood CD et al. J Pediatr. **2017**

Table 1. Agreement between Indirect Calorimetry - and equation-based values of REE

		Paired t test	*Bland-Altman analysis*		
	REE (kcal/kg/die)	***p* value**	**BIAS**	**Upper LOA**	**Lower LOA**
Harris-Benedict formula	64 ± 28	< 0.001	-21	21	-63
Schofield formula	48 ± 16	0.032	-5	24	-33
WHO formula	52± 12	0.0002	-8	18	-35

REE data are presented as mean ± standard deviation