Indirect calorimetry performed during non-invasive ventilation. Preliminary results of the "CALO-NIV" trial.

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INTRODUCTION

Resting energy expenditure (REE) represents the starting point for the correct assessment of energy requirements, which are needed for personalized nutrition. This is especially important in critically ill children[1,2]. Indirect calorimetry provides the most accurate measurement of REE by assessing patients' respiratory gas exchange ($\dot{V}O_2$ and $\dot{V}CO_2$)[3]. Additionally, IC provides an insight on carbohydrates/lipids utilization by defining the respiratory quotient (RQ). However, IC is only validated in spontaneously breathing and mechanically ventilated patients, but not in patients undergoing non-invasive ventilation (NIV)[4]. Our preliminary results show that IC is possible during NIV-CPAP (continuous positive airway pressure)[5].

The **aim** of the research is to further investigate the application of IC during NIV-CPAP and the possible use of IC during NIV-PS (pressure support).

METHODS

We enrolled children aged<6 years admitted to our pediatric intensive care unit and weaning from NIV. Three IC measurements (Canopy mode, see **Figure 1**) were performed for 20 minutes in randomized order in the following conditions: 1) Spontaneous breathing, 2) NIV-CPAP, 3) NIV-PS (NIV performed by single-limb circuit and vented mask). Average values for $\dot{V}CO_2$, $\dot{V}O_2$, RQ and REE were obtained in the three conditions. Comparison between groups was performed via Wilcoxon matched pairs test. Agreement was assessed via Bland-Altman analysis. Statistical significance was defined as $p<0.05$.

Figure 1. Indirect Calorimetry performed in Canopy mode during NIV

RESULTS

Eleven patients (median age 5.3 months, median weight 7.3 kg) were enrolled. $\dot{V}CO_2$, $\dot{V}O_2$, RQ and REE did not differ significantly between groups.

Limits of agreement (LOA) and BIAS indicate a good agreement between the three measures (**Table 1**).

Table 1. Agreement between IC data obtained during spontaneous breathing (SB) and NIV-CPAP or NIV-PS

SB vs. CPAP				
	p-value SB vs. CPAP	BIAS SB vs. CPAP	Lower LOA SB vs. CPAP	Upper LOA SB vs. CPAP
REE (kcal/kg/die)	0.28	5.42	-18.53	29.36
RQ	0.62	0.01	-0.25	0.28
$\dot{V}CO_2$ (ml/min/kg)	0.08	0.84	-2.17	3.84
$\dot{V}O_2$ (ml/min/kg)	0.46	0.66	-2.92	4.25
SB vs. PS				
	p-value SB vs. PS	BIAS SB vs. PS	Lower LOA SB vs. PS	Upper LOA SB vs. PS
REE (kcal/kg/die)	0.34	1.32	-21.20	23.84
RQ	0.34	0.04	-0.25	0.33
$\dot{V}CO_2$ (ml/min/kg)	0.20	0.62	-2.59	3.83
$\dot{V}O_2$ (ml/min/kg)	0.78	-0.05	-3.76	3.67

P-value refers to Wilcoxon matched pairs test. BIAS, lower and upper LOA refer to Bland-Altman analysis

CONCLUSIONS

So far, our data confirm the accuracy of IC performed in children undergoing NIV using a single limb circuit with intentional leaks. These results need to be confirmed on a broader cohort of critically ill children.

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