Energy expenditure in critically ill adult patients with acute brain injury: indirect calorimetry versus predictive equations

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Abstract:
Background: Predictive energy expenditure (PEE) equations are commonly used in lieu of indirect calorimetry (IC) due to cost and limited resources; however, these equations may not be as accurate as IC in estimating resting energy expenditure (REE) in critically ill patients, putting them at risk of malnutrition. The purpose of this study is to compare PEE and measured energy expenditure (MEE) in critically ill adults with acute brain injury.

Methods: This was a retrospective review of adult patients admitted to the Neurosciences ICU with acute brain injury between May 1st, 2014 and April 1st, 2016 who had IC performed. Three predictive equations (PE), Harris Benedict (HBE), Penn State University, and Mifflin St Jeor (MSJ), were used in comparison to IC results. Subgroup analyses included a modified ASPEN weight-based equation, stratifying patients based on BMI and type of acute brain injury.

Results: One hundred and forty-four patients met inclusion criteria. Comparing the PEE estimated by the three predictive equations to the MEE from IC found no significant difference ($p$-value = 0.1). High degrees of interpatient variability were discovered in each ANOVA analysis, with standard deviations ranging from 17 – 29% of each PE. Despite no difference found among PEE and MEE, Pearson’s correlations indicated weak associations when HBE, Penn State, and MSJ were individually compared to MEE ($r$-values = 0.372, 0.409, and 0.372, respectively). In patients with a BMI < 30 kg/m², a significant difference was found ($p$-value < 0.01) between PEE and MEE trending toward underestimation of REE with predictive equations. A significant difference between PEE and MEE was also found in aneurysmal subarachnoid hemorrhage patients ($p$-value < 0.01) underestimating REE with predictive equations.

Conclusion: The results of this study highlight the importance of using IC whenever possible due to the interpatient variability that exists among REE of critically ill patients with acute brain injury. Although predicative equations appear to have similar estimations as IC, interpatient variability warrants more accurate measurement with IC to avoid over or underfeeding critically ill patients with acute brain injury.