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A Single-Center Prospective Observational Study Comparing Resting Energy Expenditure in Different Phases of Critical Illness: Indirect Calorimetry Versus Predictive Equations

(Article in press)

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Abstract

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Objectives: Several predictive equations have been developed for estimation of resting energy expenditure, but no study has been done to compare predictive equations against indirect calorimetry among critically ill patients at different phases of critical illness. This study aimed to determine the degree of agreement and accuracy of predictive equations among ICU patients during acute phase (≤ 5 d), late phase (6-10 d), and chronic phase (≥ 11 d). Design: This was a single-center prospective observational study that compared resting energy expenditure estimated by 15 commonly used predictive equations against resting energy expenditure measured by indirect calorimetry at different phases. Degree of agreement between resting energy expenditure calculated by predictive equations and resting energy expenditure measured by indirect calorimetry was analyzed using intraclass correlation coefficient and Bland-Altman analyses. Resting energy expenditure values calculated from predictive equations differing by ± 10% from resting energy expenditure measured by indirect calorimetry was used to assess accuracy. A score ranking method was developed to determine the best predictive equations. Setting: General Intensive Care Unit, University of Malaya Medical Centre. Patients: Mechanically ventilated critically ill patients. Interventions: None. Measurements and Main Results: Indirect calorimetry was measured thrice during acute, late, and chronic phases among 305, 180, and 91 ICU patients, respectively. There were significant differences (F= 3.447; p = 0.034) in mean resting energy expenditure measured by indirect calorimetry among the three phases. Pairwise comparison showed mean resting energy expenditure measured by indirect calorimetry in late phase (1,878 ± 517 kcal) was significantly higher than during acute phase (1,765 ± 456 kcal) (p = 0.037). The predictive equations with the best agreement and accuracy for acute phase was Swinamer (1990), for late phase was Brandi (1999) and Swinamer (1990), and for chronic phase was Swinamer (1990). None of the resting energy expenditure calculated from predictive equations showed very good agreement or accuracy. Conclusions: Predictive equations tend to either over- or underestimate resting energy expenditure at different phases. Predictive equations with "dynamic" variables and respiratory data had better agreement with resting energy expenditure measured by indirect calorimetry compared with predictive equations developed for healthy adults or predictive equations based on "static" variables. Although none of the resting energy expenditure calculated from predictive equations had very good agreement, Swinamer (1990) appears to provide relatively good agreement across three phases and could be used to predict resting energy expenditure when indirect calorimetry is not available.

Author keywords

basal metabolism | calorimetry | critical care | critical illness | nutritional requirements | predictive equations

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