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NIBBLE
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Determining Energy Requirements of Critically ill Patients: Complex Energy Predictive Equations vs. Weight Only?

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The clinical nutrition literature is rich with studies using indirect calorimetry to measure energy expenditure in critically ill patients in order to develop and validate predictive equations for use when indirect calorimetry is unavailable or not feasible. While most of these equations include height, weight and age as predictor variables, a few simply use body weight to predict energy needs. However, these equations have not yet been linked with clinically important outcomes as a test of the effectiveness of applying such formulas to the direction of actual energy intake in clinical practice settings.

Thus the purpose of a recent secondary data analysis of the International Nutrition Surveys (INS) 2007-2009 was to close these information gaps by evaluating the impact of delivery of energy intake based on predictive equations to important clinical outcomes[1]. Equations that used weight as the only variable were compared with those that used multiple variables on the outcomes of mortality and time to discharge alive from the hospital. Because energy intake goals in patients with obesity are often calculated differently from other patients, all evaluations were adjusted for body mass index (BMI) group (underweight, normal weight, overweight, obese). Further, because any impact of the equation used on these clinical outcomes may be affected as a result of actual energy intake delivered by the EN or PN, models were also adjusted for the actual energy delivery.

What are the main findings of our large observational study?

Complex equations were used for 40% of patients. The complex equations group comprised equations by Schofield in 851 patients, Harris-Benedict in 772, Ireton-Jones in 594 and Mifflin-St Jeor in 52. The weight-only group included 424 patients with < 20 kcal/kg, 713 with 25-29 kcal/kg, and 1932 with 30-35 kcal/kg. The number of patients who had indirect calorimetry (161) was too small for comparison.

In the 5,672 patients in the ICU four or more days, mortality was not different based on weight only versus complex equations. The cumulative hazard of discharge alive marginally favored the weight-only equations (Figure 1, P=0.04). Patients with obesity (OR 0.83, 95% CI 0.71-0.96), and those with greater energy intake (OR 0.65, 95% CI 0.56, 0.76) had lower odds of mortality than those with normal weight or those with lower energy intake.

We redid the analysis in a subgroup of 3,356 patients who stayed in the ICU at least 12 days to ask the questions in a sicker group of patients, all of whom have 12 full days exposure to feeding. Mortality was not impacted by type of predictive equation, but was lower in overweight and obese than normal weight patients and in those with greater energy intake (OR 0.79, 95% CI 0.64, 0.97). Time to discharge alive was not different by type of energy prediction equation, but those with greater energy intake and patients who were overweight or obese were more likely to be discharged alive sooner than those with lower energy intake and normal weight patients.

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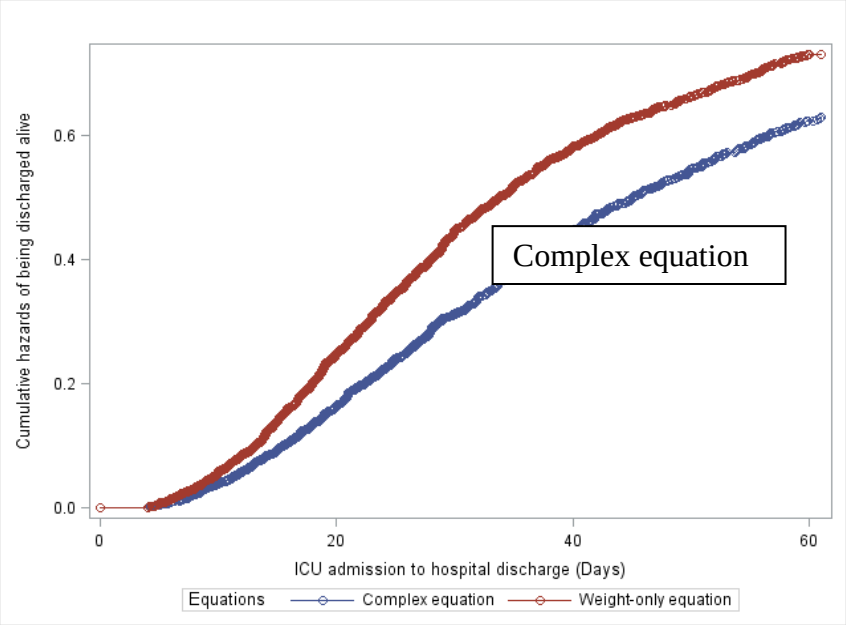

Figure 1: The cumulative hazard of discharge alive in weight only vs complex equations

Clinical Outcomes in Critically Ill Patients – Delivery of Greater Energy Intake is More Important than the Equation Used!

The delivery of closer to goal energy intake was more important in this study than the type of equation used. We had anticipated that the use of complex equations would provide lower mortality and shorter time to discharge alive because of the greater accuracy of these equations. It can be argued that the type of equation was not tested fairly because such a small percentage of the derived energy goal (60-70%) was actually delivered

Key Messages

- There was no difference in mortality and little difference in time to discharge alive based on the type of equation used.
- Greater energy intake was associated with lower mortality and shorter time to discharge alive, both in patients in ICU 4-11 days and in those sicker patients in ICU 12 or more days.
- Focus on delivery of goal energy intake appears from this analysis to be more important to key clinical outcomes than which equation is used to predict the energy goal. However, the findings were limited by actual delivery of only 60-70% of goal intake.

References

[1] Compher C, Nicolo M, Chittams J, et al. Clinical Outcomes in Critically Ill Patients Associated With the Use of Complex vs Weight-Only Predictive Energy Equations. JPEN J Parenter Enteral Nutr 2014.

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