3.1 Nutritional Prescription (dose) of Enteral Nutrition: Use of indirect calorimetry vs. predictive equations January 31st, 2009

Recommendation:
There are insufficient data to make a recommendation on the use of indirect calorimetry vs. predictive equations for determining energy needs for enteral nutrition in critically ill patients.

Discussion: The committee noted the paucity of data and given the lack of treatment effect and the high costs associated with the use of indirect calorimetry (metabolic carts), despite no safety concerns, no recommendation was put forward.

Values	Definition	Score : 0, 1, 2, 3
Effect size	Magnitude of the absolute risk reduction attributable to the intervention listed--a higher score indicates a larger effect size	0
Confidence interval	95% confidence interval around the point estimate of the absolute risk reduction, or the pooled estimate (if more than one trial)--a higher score indicates a smaller confidence interval	1
Validity	Refers to internal validity of the study (or studies) as measured by the presence of concealed randomization, blinded outcome adjudication, an intention to treat analysis, and an explicit definition of outcomes--a higher score indicates presence of more of these features in the trials appraised	2
Homogeneity or Reproducibility	Similar direction of findings among trials--a higher score indicates greater similarity of direction of findings among trials	0
Adequacy of control group	Extent to which the control group presented standard of care (large dissimilarities=1, minor dissimilarities=2, usual care=3)	3
Biological Plausibility	Consistent with understanding of mechanistic and previous clinical work (large inconsistencies=1, minimal consistencies=2, very consistent=3)	1
Generalizability	Likelihood of trial findings being replicated in other settings (low likelihood i.e. single centre=1, moderate likelihood i.e. multicentre with limited patient population or practice setting=2, high likelihood i.e. multicentre, heterogeneous patients, diverse practice settings=3)	1
Low cost	Estimated cost of implementing the intervention listed--a higher score indicates a lower cost to implement the intervention in an average ICU	2
Feasible	Ease of implementing the intervention listed--a higher score indicates greater ease of implementing the intervention in an average ICU	0
Safety	Estimated probability of avoiding any significant harm that may be associated with the intervention listed--a higher score indicates a lower probability of harm	3

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Question: Does the use of indirect calorimetry vs. a predictive equation for determining energy needs (enteral nutrition) result in better outcomes critically ill adult patients?

Summary of evidence: There was only one study that answered the above question. Saffle et al 1990 compared the effectiveness of indirect calorimetry (IC) guided enteral nutrition to that guided by Curreri formula in burn patients (level 2 study).

Mortality: No difference in mortality between the two groups

Infections: Not reported

LOS: No difference between the two groups.

Ventilator days: Not reported

Other complications: Diarrhea, hyperglycemia, electrolyte imbalance did not differ between the two groups. Actual protein intake was significantly higher in the group receiving enteral nutrition via indirect calorimetry ($p < 0.01$).

Conclusion: There is no difference in mortality or other outcomes between enteral nutrition provided by the Curreri formula and enteral nutrition provided by indirect calorimetry in the early postburn period.

Level 1 study: if all of the following are fulfilled: concealed randomization, blinded outcome adjudication and an intention to treat analysis.
Level 2 study: If any one of the above characteristics are unfulfilled.

Table 1. Randomized studies evaluating indirect calorimetry vs. predictive equation in critically ill patients

Study	Population	Methods (score)	Intervention	Mortality # (%)† IC	Mortality # (%)† Curreri	RR (CI)**	Infections # (%) IC	Infections # (%) Curreri	RR (CI)**
1. Saffle 1990	Burns 47 % TSBA	C.Random: not sure ITT: yes Blinding: no (7)	EN via Indirect calorimetry (IC) vs. Curreri formula	3/26 (12)	2/23 (9)	1.33 (0.24-7.26)	NR	NR	NR

Study	LOS days Indirect Calorimetry	LOS days Curreri	Ventilator days Indirect Calorimetry	Ventilator days Curreri	Cost Indirect Calorimetry	Cost Curreri	Other Indirect Calorimetry	Other Curreri
Saffle 1990	48.8 ± 22.9 (26)	48.5 ± 24.9 (23)	NR	NR	NR	NR	Diarrhea 34.6 %	34.8 %
							Hyperglycemia 38.5 %	43.5 %
							Nausea 26.9 %	34.8 %
							Electrolyte imbalance 30.8 %	39.1 %
							Actual calories intake (Kcals) 3530 ± 134	3490 ± 132
							Actual protein intake (gms) 153 ± 7.1	116 ± 6.7

C.Random: concealed randomization
** RR= relative risk, CI= Confidence intervals
ITT: intent to treat
NR: not reported
( ): mean ± standard deviation (number)
† presumed hospital mortality unless otherwise specified
IC: indirect calorimetry

TOPIC: 3.1 Indirect calorimetry vs. predictive equations (enteral nutrition)

Article inclusion log

Criteria for study selection

Type of study: RCT or Meta-analysis
Population: critically ill, ventilated patients (no elective surgical patients)
Intervention: EN
Outcomes: mortality, LOS, QOL, functional recovery, complications, cost. Exclude studies with only biochemical, metabolic or nutritional outcomes.

	Author	Journal	I	E	Why Rejected
1	Saffle	J Trauma 1990	√		
2	Brandi	Nutrition 1997		√	Review article
3	Nataloni	Clin Nutr 1999		√	No clinical outcomes
4	Mentec	Crit Care Med 2001		√	Not RCT
5	Cheng	Clin Nutr 2002		√	Not RCT
6	Lo	JPEN J ParentrEnteral Nutr 2005		√	Not mechanically ventilated before study

I = included, E = excluded

References

1. Saffle JR, Larson CM, Sullivan J. A randomized trial of indirect calorimetry-based feedings in thermal injury. J Trauma. 1990 Jul;30(7):776-82.

2. Brandi LS, Bertolini R, Calafa M. Indirect calorimetry in critically ill patients: Clinical applications and practical advice. Nutrition 1997;13(4):349-358.

3. Nataloni S, Gentili N, Marini B, Guidi A et al. Nutritional assessment in head injured patients through the study of rapid turnover visceral proteins. Clin Nutr 1999;18(4):247-51.

4. Mentec H, Dupont H, Bocchetti M et al. Upper digestive intolerance during enteral nutrition in critically ill patients : Frequency, risk factors, and complications. Crit Care Med 2001;29(10):1955-1961.

5. Cheng CH, Chen CH, Wong Y et al. Measured versus estimated energy expenditure in mechanically ventilated critically ill patients. Clin Nutr 2002;21(2):165-72.

6. Lo HC, Lin CH, Tsai LJ. Effects of hypercaloric feeding on nutrition status and carbon dioxide production in patients with long-term mechanical ventilation. JPEN J Parentr Enteral Nutr 2005;29(5):380-397.