What's New in ICU Nutrition Research?

Danielle Bear

Principal Critical Care Dietitian

St Thomas' Hospital, London

Outline

- Individualised nutrition support
  - Defining energy targets
  - Feeding route
- Current research
  - Energy expenditure
  - Feeding route
  - Nutrient losses on CRRT

Energy Targets

Energy Balance

- Larger energy deficit associated with worse outcomes
  - Increased ICU LOS
  - Increased days on MV
  - Increased complications
  - Increased mortality

Rubinson et al, 2004; Villet et al, 2005, Dvir et al, 2006; Petros et al, 2006

Energy Balance

Permissive underfeeding and intensive insulin therapy in critically ill patients: a randomized controlled trial[1–3]

Yaseen M Arabi, Hani M Tamim, Gousia S Dhar, Abdulaziz Al-Dawood, Muhammad Al-Sultan, Maram H Sakkijha, Salim H Kahoul, and Riette Brits

ONLINE FIRST

Initial Trophic vs Full Enteral Feeding in Patients With Acute Lung Injury

The EDEN Randomized Trial

Energy Balance

Study	Outcome	
Permissive Underfeeding (Arabi et al, 2011)	Decreased hospital mortality Decreased 180 day mortality	Underfeeding Group
The EDEN Study (Rice et al, 2012)	No difference Increased trend toward d/c home over rehabilitation facility	Full feeding Group

Conflicting Evidence

ESPEN GUIDELINES

ESPEN Guidelines on Enteral Nutrition: Intensive care$

K.G. Kreymann[a,*], M.M. Berger[b], N.E.P. Deutz[c], M. Hiesmayr[d], P. Jolliet[e], G. Kazandjiev[f], G. Nitenberg[g], G. van den Berghe[h], J. Wernerman[i],
DGEM:[$ $] C. Ebner, W. Hartl, C. Heymann, C. Spies

The tight calorie control study (TICACOS): a prospective, randomized, controlled pilot study of nutritional support in critically ill patients

Pierre Singer
Ronit Anbar
Jonathan Cohen
Haim Shapiro
Michal Shalita-Chesner
Shaul Lev
Elad Grozovski
Miryam Theilla
Sigal Frishman
Zecharia Madar

Guidelines for the provision and assessment of nutrition support therapy in the adult critically ill patient: Society of Critical Care Medicine and American Society for Parenteral and Enteral Nutrition: Executive Summary*

Robert G. Martindale, MD, PhD; Stephen A. McClave, MD; Vincent W. Vanek, MD; Mary McCarthy, RN, PhD; Pamela Roberts, MD; Beth Taylor, RD; Juan B. Ochoa, MD; Lena Napolitano, MD; Gail Cresci, RD; American College of Critical Care Medicine; and the A.S.P.E.N. Board of Directors

Optimisation of energy provision with supplemental parenteral nutrition in critically ill patients: a randomised controlled clinical trial

Claudia Paula Heidegger, Mette M Berger, Séverine Graf, Walter Zingg, Patrice Darmon, Michael Costanza, Ronan Thibault, Claude Pichard

Permissive underfeeding and intensive insulin therapy in critically ill patients: a randomized controlled trial[1–3]

Yaseen M Arabi, Hani M Tamim, Gousia S Dhar, Abdulaziz Al-Dawood, Muhammad Al-Sultan, Maram H Sakkijha, Salim H Kahoul, and Riette Brits

Early versus Late Parenteral Nutrition in Critically Ill Adults

Michael P. Casaer, M.D., Dieter Mesotten, M.D., Ph.D., Greet Hermans, M.D., Ph.D., Pieter J. Wouters, R.N., M.Sc., Miet Schetz, M.D., Ph.D., Geert Meyfroidt, M.D., Ph.D., Sophie Van Cromphaut, M.D., Ph.D., Catherine Ingels, M.D., Philippe Meersseman, M.D., Jan Muller, M.D., Dirk Vlasselaers, M.D., Ph.D., Yves Debaveye, M.D., Ph.D., Lars Desmet, M.D., Jasperina Dubois, M.D., Aime Van Assche, M.D., Simon Vanderheyden, B.Sc., Alexander Wilmer, M.D., Ph.D., and Greet Van den Berghe, M.D., Ph.D.

Canadian Clinical Practice Guidelines for Nutrition Support in Mechanically Ventilated, Critically Ill Adult Patients*

Daren K. Heyland, MD, FRCPC, MSc*; Rupinder Dhaliwal, RD*; John W. Drover, MD, FRCSC, FACS†; Leah Gramlich, MD, FRCPC‡; Peter Dodek, MD, MHSc§; and the Canadian Critical Care Clinical Practice Guidelines Committee

Energy Targets

Pierre Singer
Ronit Anbar
Jonathan Cohen
Haim Shapiro
Michal Shalita-Chesner
Shaul Lev
Elad Grozovski
Miryam Theilla
Sigal Frishman
Zecharia Madar

The tight calorie control study (TICACOS): a prospective, randomized, controlled pilot study of nutritional support in critically ill patients

Early versus Late Parenteral Nutrition in Critically Ill Adults

Michael P. Casaer, M.D., Dieter Mesotten, M.D., Ph.D., Greet Hermans, M.D., Ph.D., Pieter J. Wouters, R.N., M.Sc., Miet Schetz, M.D., Ph.D., Geert Meyfroidt, M.D., Ph.D., Sophie Van Cromphaut, M.D., Ph.D., Catherine Ingels, M.D., Philippe Meersseman, M.D., Jan Muller, M.D., Dirk Vlasselaers, M.D., Ph.D., Yves Debaveye, M.D., Ph.D., Lars Desmet, M.D., Jasperina Dubois, M.D., Aime Van Assche, M.D., Simon Vanderheyden, B.Sc., Alexander Wilmer, M.D., Ph.D., and Greet Van den Berghe, M.D., Ph.D.

Optimisation of energy provision with supplemental parenteral nutrition in critically ill patients: a randomised controlled clinical trial

Claudia Paula Heidegger, Mette M Berger, Séverine Graf, Walter Zingg, Patrice Darmon, Michael C Costanza, Ronan Thibault, Claude Pichard

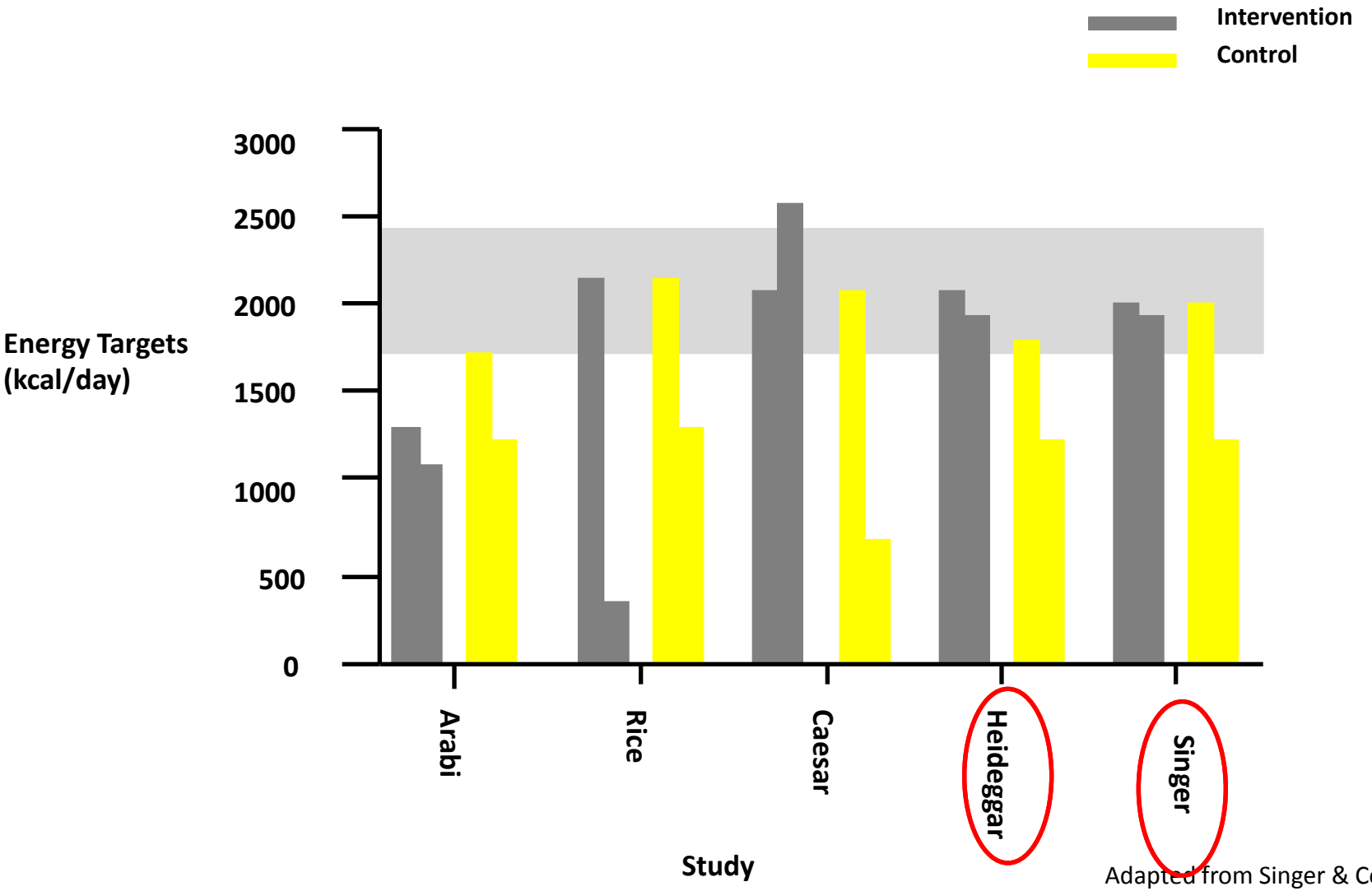
Energy Targets

Study	Outcome	
TICACOS (Singer et al, 2011)	Lower hospital mortality Positive energy and protein balance Longer ICU LOS More days on mechanical ventilation Increased infection rates	Intervention
EPaNIC (Caesar et al, 2012)	Fewer infections Shorter duration on mechanical ventilation Shorter ICU and Hospital LOS	Late Group
SPN (Heideggar et al, 2012)	Reduced number of infections Reduced number of antibiotic days Shorter duration on mechanical ventilation	SPN Group

Energy Targets

- Aims
- Patients groups, nutritional status
- LOS
- Sample sizes
- Outcomes
- Methodology
  - Indirect calorimetry (once vs repeated)
  - Predictive equations
- Protein targets rarely met

Energy Targets



Adapted from Singer & Cohen, 2012

Energy Targets

- More individualised approach
  - Indirect Calorimetry
  - SPN adjustments
- Repeated calculations/measurements of energy needs
- Calculate balances
- ?meet protein intakes

Current Research

A study comparing two methods of measuring energy expenditure in critically ill patients: Indirect Calorimetry (Deltatrac II) versus Sensewear Armband.

Current Research…

Aim: To determine level of agreement (bias and reliability in energy expenditure measurements between indirect calorimetry (deltatrac II) and the sensewear armband in mechanically ventilated, critically ill patients.

Current Research…

Inclusion Criteria	Exclusion Criteria
Adult (≥ 18 years) Anticipated MV and artificial nutrition support >72hours	$FiO_2 \geq 60\%$ PEEP > 8mmHg Ventilated with nitric oxide ECMO HFOV CRRT Air leak in ventilation circuit Ventilated with AVEA ventilator Bolus feeding Nickel allergy Therapeutic cooling Study burden Liverpool Care pathway

Current Research…

Current Research…

Exclusion	Percentage Excluded (%)
Air leak in the ventilation circuit	**39**
Continuous renal replacement therapy	**22**
Expected mechanical ventilation <72 hours	9
PEEP > 8mmHg	9
Chest drains insitu	6
Decision made to limit/withdraw care	6
ECMO	4
Ventilated with AVEA ventilator	4
FiO_2 > 60%	3
Trial burden	2
Non-English speaking	1
Therapeutic cooling	1

Current Research…

Interim Results

	Sex	Diagnosis	Age	BMI (kg/m^2)	SOFA	FiO_2 (%)
1	Male	OOHCA	60	30	1	21
2	Female	Severe Respiratory Failure	30	16.7	4	35
3	Male	OOHCA	50	27.8	3	30
4	Male	Cardiogenic shock	44	24	6	30
Median	-	-	**47**	**25.9**	**3.5**	**30**
IQR	-	-	**33.5-57.5**	**18.5-29.4**	**1.5-5.5**	**23.3-33.8**

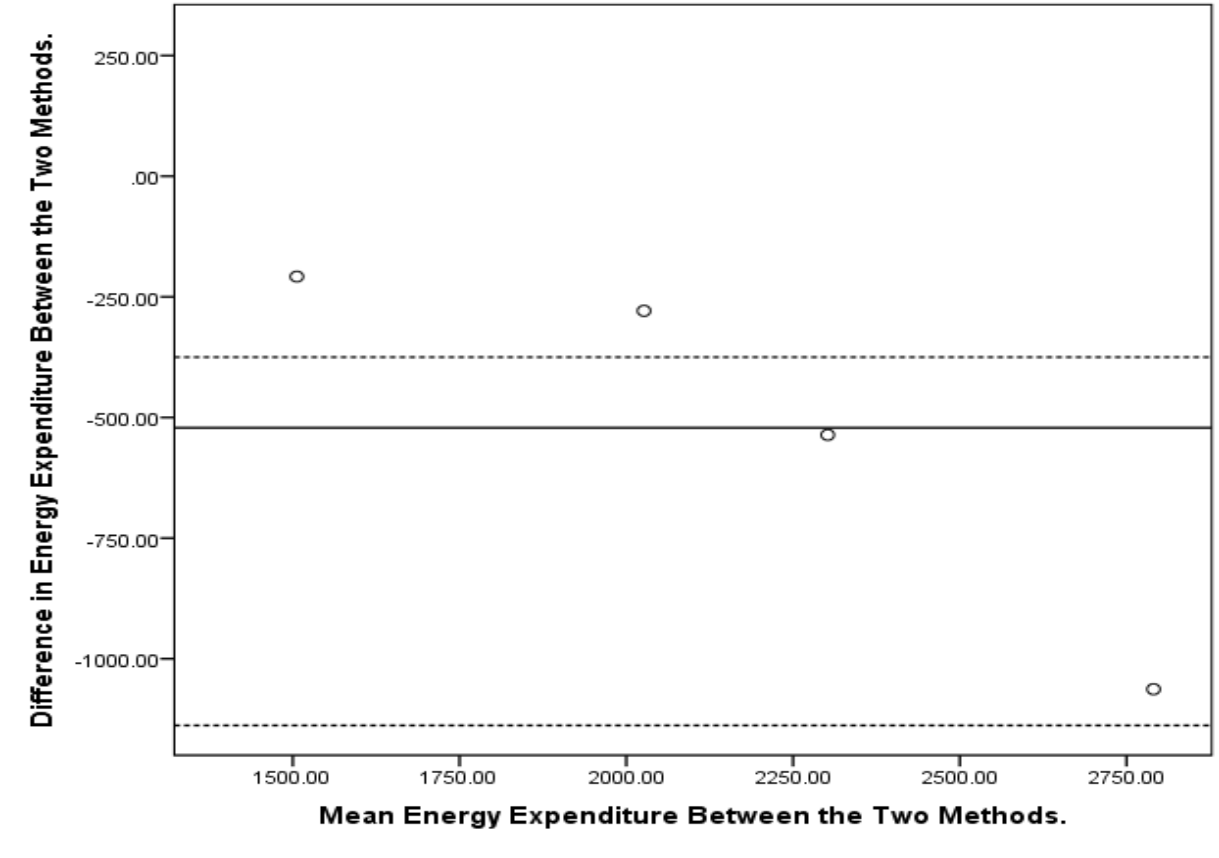
Current Research…

Interim Results

	Deltatrac II (kcal)	Sensewear Armband (kcal)	Percent difference (%)	P value
1	2570	2034	21	
2	1610	1402	13	
3	3322	2259	32	
4	2166	1887	13	
Mean (SD)	**2417 (720.3)**	**1895 (181.4)**	**19.8 (8.9)**	**0.07**

Current Research…

Interim Results – Bland Altman Plot



Current Research…

Conclusion

- Bland Altman analysis shows wide limits of agreement.
- Sensewear Armband appears more practical and user friendly than indirect calorimetry.
- Completion of the study with adequate recruitment required.

Current Research…

Feeding Route – Post-Pyloric Feeding

- Limited studies showing benefit
  - May reduce incidence of pneumonia
- May improve nutrient provision in certain groups of patients
  - High risk for GI intolerance
- Access may be an issue
  - Cortrak
  - Tiger 2

Davies et al, 2012; Acosta-Escribano et al, 2010; White et al, 2009; Hsu et al, 2009.

Current Research…

- ECMO
  - Gastric feeding leads to inadequate energy intake (mean 55% on ECMO)
  - High percentage with large GRVs
    - More than 70% requiring prokinetics within 24 hours
    - 95% by 48 hours
  - Feed interruptions

Makikado et al, 2012; Lukas et al, 2010; Scott et al, 2004.

Current Research…

Results

Nutrient delivery and adequacy of feeding			
	Gastric	Jejunal	p value
Energy Intake (as % of target)	79.2 (62.8-89.5)	92.3 (76.0-99.8)	<0.016
No. days energy intake adequate* (%)	135 (60.5)	133 (82.1)	<0.001 §
Protein Intake (as % of target)	71.1 (55.0-91.2)	91.9 (71.8-102.8)	<0.027
No. days protein intake adequate* (%)	131 (58.7)	127 (78.4)	<0.001 §

Current Research…

Conclusions

- Jejunal feeding was associated with greater proportion of adequate feeding days.
- Daily estimated nutritional requirements were met using jejunal feeding though not with gastric feeding.

Current Research…

Observational study measuring essential nutrients in critically ill patients with severe acute kidney injury treated with and without continuous haemofiltration.

Current Research…

Aim: To serially measure plasma levels of vitamins, trace elements and amino acids in critically ill patients with severe AKI and to evaluate whether there are any additional losses into the filtrate during continuous veno-venous haemofiltration (CVVH).

Current Research…

Primary Outcome

Difference in plasma concentrations of essential micronutrients between patients with and without CVVH.

Secondary Outcomes

a) Concentrations of trace elements, vitamins and amino acids in filtrate in patients on CVVH

b) Differences in filtrate losses between patients on CVVH ≥30ml/kg/hr vs >30ml/kg/hr

c) Differences in serum levels of micronutrients and amino acids between patients on CVVH ≤ 30ml/kg/hr vs > 30ml/kg/hr.

Current Research…

Inclusion Criteria	Exclusion Criteria
Patients in the Critical Care Unit with severe AKI (Stage II or II) ≥ 18 years	Pre-existing dialysis dependent renal failure Life expectancy <48 hours Need for TPN Need for IV multivitamin or trace elements Jehovah's Witness Hb <7g/dl (unless being transfused for clinical reasons)

Current Research…

KDIGO Guidelines

Stage	Serum Creatinine	Urine Output
1	≥1.5-1.9 times baseline or 0.3mg/dl (.26.4umol/L) increase in 48 hours	<0.5ml/kg.hr for ≥ 6-12 hours
2	≥2.0-2.9 times baseline	<0.5ml/kg.hr for ≥12 hours
3	≥3.0 times baseline OR increase in creatinine ≥4mg/dl (352umol/L) OR treatment with RRT	<0.3ml/kg.hr ≥24 hours OR anuria ≥12 hours

Current Research…

A phase III, open, multi-centre, randomised controlled trial comparing the clinical and cost-effectiveness of early nutritional support in critically ill patients via the parenteral versus the enteral route

Current Research…

Primary objectives

- To estimate the effect of early nutritional support via the parenteral route (PN) compared with the enteral route (EN) on mortality at 30 days
- To estimate the incremental cost-effectiveness of early PN compared with early EN at one year.

Current Research…

Secondary objectives

To compare PN with EN for:

- Duration of specific and overall organ support
- Infectious and non-infectious complications
- Duration of critical care unit and acute hospital length of stay
- Mortality at: discharge from the critical care unit and from hospital, 90 days and at one year
- Nutritional and health-related quality of life at 90 days and at one year
- Resource use and costs at 90 days and at one year
- Estimated lifetime incremental cost-effectiveness

Current Research…

Inclusion Criteria	Exclusion Criteria
Adult (defined as age 18 years or over) An **unplanned** admission (including planned admissions becoming unplanned e.g. unexpected post-operative complications) Expected to receive nutritional support for two or more days in your unit Not planned to be discharged within three days (defined by clinical judgment) from your unit.	Who have been in a critical care unit for more than 36 hours (i.e. from the date/time of original admission to a critical care unit) Previously randomised into CALORIES **Pre-existing contraindications to PN or EN** **Received PN or EN within the last seven days** **Admitted with a percutaneous endoscopic gastrostomy, percutaneous endoscopic jejunostomy, needle/surgical jejunostomy or nasojejunal tube in situ** Admitted to the critical care unit for treatment of thermal injury (burns) Palliative care Patients whose expected stay in the UK is less than six months Pregnant

Current Research…

Where are we now?

- 25 active sites
  - More joining
- > 1800 patients recruited so far
  - Aiming 2400
- Plan to finish recruitment November 2013

Questions