Nutrition support in abdominal catastrophe in the ICU

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Content

Very brief overview of critical care nutriton

- Metabolic & catabolic response
- Muscle wasting
- EN vs. PN

Nutrition in abdo catastophe

- Open abdo's
- Nutritional when its gone wrong
- ICU challenges
- Case studies

"Recently there have been increases in the number of methodologically sound studies in the field of nutrition therapy. They add to expanding body of knowledge but highlight more areas of uncertainties and controversies"

Preiser et al 2015.
Review - Metabolic & nutritional support of critical ill patients

Intensive Care Med (2017) 43:1239–1256
DOI 10.1007/s00134-017-4711-6

RESEARCH AGENDA

The intensive care medicine research agenda in nutrition and metabolism

Yaseen M. Arabi[1*], Michael P. Casaer[2], Marianne Chapman[3], Daren K. Heyland[4], Carole Ichai[5], Paul E. Marik[6], Robert G. Martindale[7], Stephen A. McClave[8], Jean-Charles Preiser[9], Jean Reignier[10,11], Todd W. Rice[12], Greet Van den Berghe[2], Arthur R. H. van Zanten[13] and Peter J. M. Weijs[14,15]

Table 2 Remaining areas of uncertainty in nutrition of critically ill patients

1. Evaluation of energy expenditure and monitoring of nutritional effects in different phases of critical illness and across patients with different nutritional risks

1.1 Does nutrition guided by measuring energy expenditure affect patient outcome as compared to estimated energy expenditure (EE) by predictive equations?
1.2 What is the approach for estimating EE that is associated with improved outcomes?
1.3 What is the most appropriate energy target expressed as a proportion of (time-dependent) EE and should energy intake match the EE?
1.4 How to assess the burden/beneficial effect of feeding on metabolism and cellular integrity in a clinically useful, continuous point of care measurement monitoring?
1.5 Is there a role for biomarkers in monitoring feeding?
1.6 How to identify patients at highest nutritional risk in its acute and chronic components?
1.7 Does nutrition risk assessment alter the timing of initiation, rate of increase, or ultimate goals of nutrition therapy?
1.8 What is the role of existing nutritional risk scores including nutritional and non-nutritional variables (e.g., NRS-2002 or combination of NUTRIC + PANDORA?) [21]
1.9 How to define and monitor for refeeding syndrome and what is the optimal caloric and protein intake in these patients?

2. Method of administration of enteral and parenteral nutrition

2.1 What is the optimal timing for initiation of artificial feeding?
2.2 What is the optimal strategy for management for enteral feeding?
2.3 How should feeding strategy vary at different stages of critical illness and recovery?
2.4 What is the effect of continuous feeding vs intermittent feeding on protein synthesis and on patient-centered outcomes?
2.5 What is the role of alternative lipid emulsions in PN?

3. Substrate requirements: proteins, carbohydrates, and micronutrients

3.1 What is optimal protein dose to facilitate recovery of critically ill patients in general and nutritionally high-risk patients in particular (mortality and physical function) and does it need to be combined with some sort of muscle use/exercise?
3.2 Is there any interrelationship between calorie and protein "dose"?
3.3 What is the amount of substrate that is actually absorbed in critically ill patients given gut dysfunction and malabsorption?
3.4 What is the role of whey-based protein (high in leucine) in muscle synthesis and facilitating recovery from critical illness?
3.5 What combinations of amino acids are optimal: should they mimic "normal" intake or be aimed at inducing metabolism or supporting host defense?
3.6 What is the role of small peptide vs polymeric formulae in patients at high risk of intolerance?
3.7 What is the appropriate amount of micronutrients to be provided in ICU patients?

4. Nutrition and functional recovery

4.1 What is the best way to measure the effect of nutrition on physical recovery outcomes of survivors of ICU?
4.2 Is there a role for bedside measures to monitor the impact of feeding practices on muscle (such as blood, urine, or muscle imaging) and how to correlate these measures with long-term functional and vital outcomes?
4.3 What is the effect of combination of ranges of proteins + physical activity + monitoring of muscle mass/function?

5. Management of intestinal and gastric feeding intolerance

5.1 What is the role of novel pro-motility agents?
5.2 Does the acceleration of gastric emptying to increase nutrient delivery to the small intestine during gastric feeding result in improved clinical outcomes?
5.3 What is the association between small bowel feeding and non-occlusive bowel disease/necrosis?

6. Immune-modulating nutrition

6.1 What is the role of glutamine in glutamine-deficient patients and conditions (like burn-injured patients)?
6.2 What is the role of moderate-dose glutamine in patients receiving exclusive PN after the first week in ICU and in absence of renal or hepatic failure?
6.3 What is the role of high-dose IV selenium in cardiac surgery patients?
6.4 What is the role of high-dose IV fish oils in inflammatory conditions, like sepsis and cardiac surgery?
6.5 What is the role of high-dose zinc supplementation in critically ill adults?
6.6 What is the role of vitamin D supplementation in critically ill patients?
6.7 Is there a role of pharmacological agents in promoting retention of muscle mass and improved physical outcomes (e.g., growth hormone, ghrelin agonists, anabolic steroids, and others)?
6.8 Is there a role for arginine/fish oil formula in severe acute pancreatitis?
6.9 Should pharmaconutrition be used alone or in combination with other EN or PN?
6.10 What is the effect of timing of immune-modulating nutrition: pre ICU, early, late etc.?
6.11 How does the effect of immune-modulating nutrition relate to the actual immune status?

7. Glucose control

7.1 Should glucose targets differ by diabetic status? Should glucose targets differ according to previous glycemic control in patients with pre-existing diabetes?
7.2 What are the prospects for precision glycemic control?
7.3 Should glucose control differ by feeding strategy and by glucose measurement strategy?
7.4 What is the role of insulin glargine in glucose control in critically ill patients?
7.5 What is role for GLP-1 and its agonists in blood glucose control during critical illness?
7.6 What is the optimal strategy to control blood glucose with avoidance of hypoglycemia and glycemic fluctuations?

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Time course of the disease and type of critical illness

It may be important to distinguish between acute critical illness, subacute critical illness, chronic critical illness, and the relatively stable postoperative ICU patient (Fig. 2). These different phases of critical illness, or specifically the points of "anabolic switch", are as yet undefined. It is possible that, when relevant, nutritional support should be individualized on the basis of the patient evolution: as the patient improves clinically and can start rehabilitation, nutrition support should be adapted to the new health state.

Metabolic response

- ✓ Contemporary critical care management may blunt the metabolic response
- ✓ MEE is significantly decreased with deep sedation & paralysis
- ✓ MEE ~20-50% above baseline
- ✓ Degree of hypermetabolism is variable. Depends on injury, degree of inflammation, body composition, age, treatment

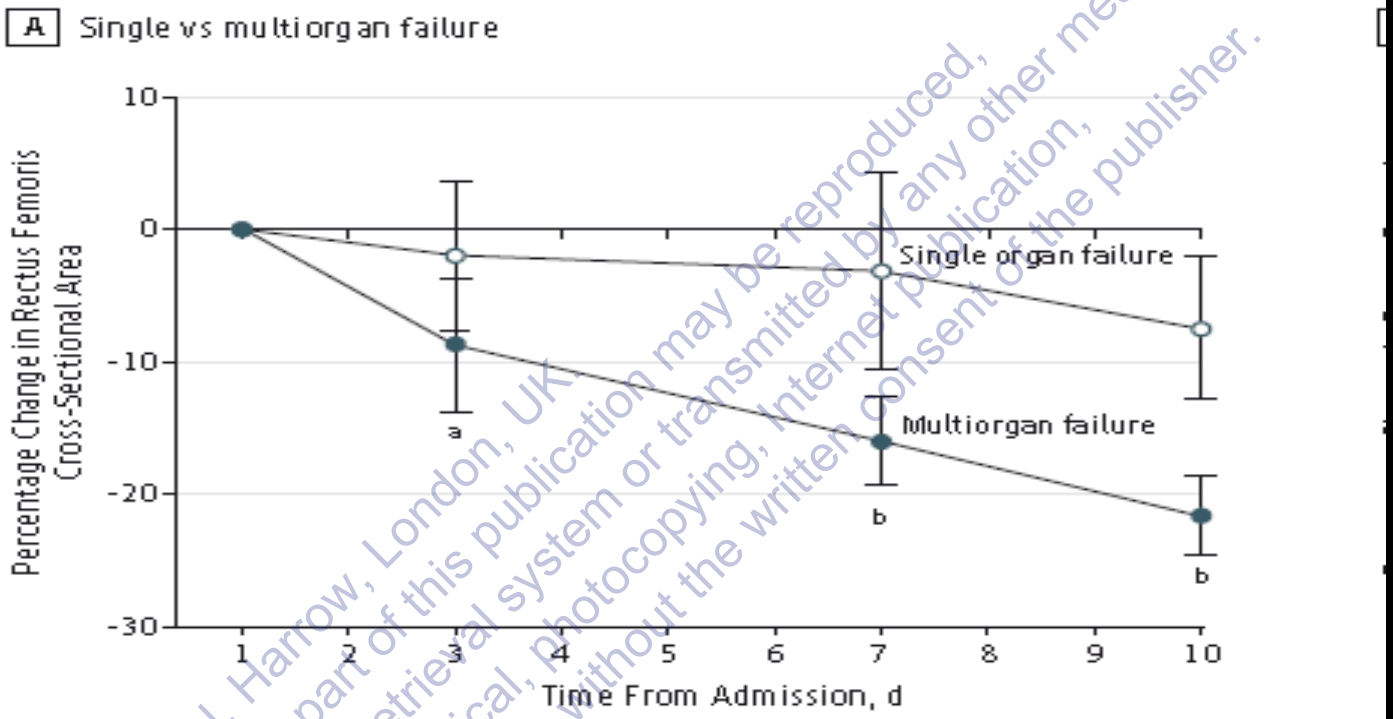
Anbar 2013;Frankenfield 2006; Brain trauma.org 2016

Catabolic response

- ✓ Breakdown exceed synthesis
- ✓ Suggested protein targets 1.2-2g/Kg
- ✓ Lack of large prospective RCT's (EFFORT 2018)
- ✓ Conflicting opinions
- ✓ Observational data high protein associated with better outcomes
- ✓ AA's during catabolism could fuel breakdown
- ✓ Recovery- synthesis could be boosted with combination of protein & activity

McClave 2016; Thiessen 2017

Figure 5. Measurements of Muscle Wasting During Critical Illness by Organ Failure



No. of patients				
Single organ failure	15	14	15	15
Multiorgan failure	47	43	45	47

Data are expressed as means and 95% confidence intervals.

[a] $P=.03$ for change from day 1 to day 3 in multiorgan failure vs single organ failure.

[b] $P<.001$ for change from day 1 to day 7 and day 1 to day 10 in multiorgan failure vs single organ failure.

Puthucheary JAMA 2013

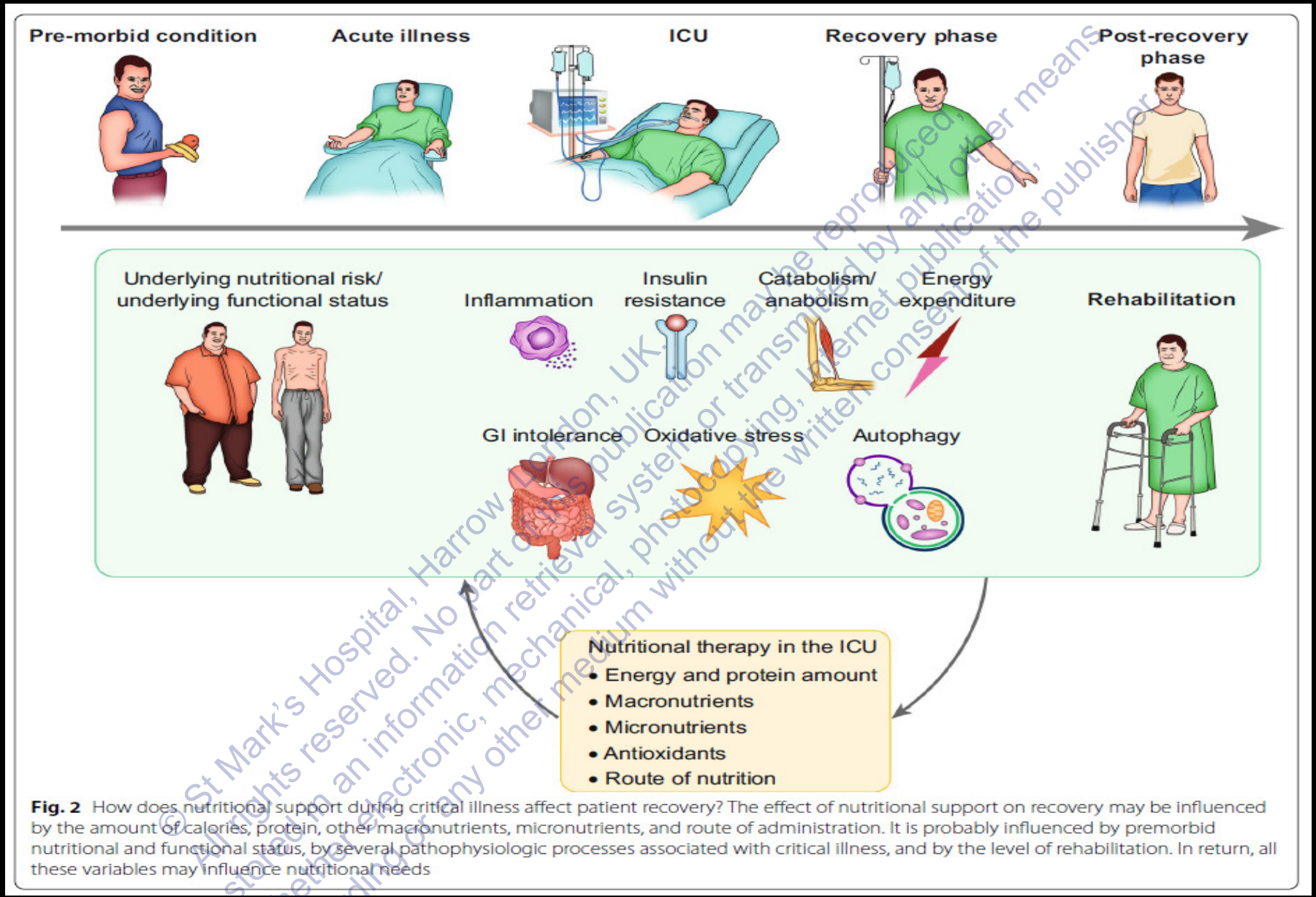
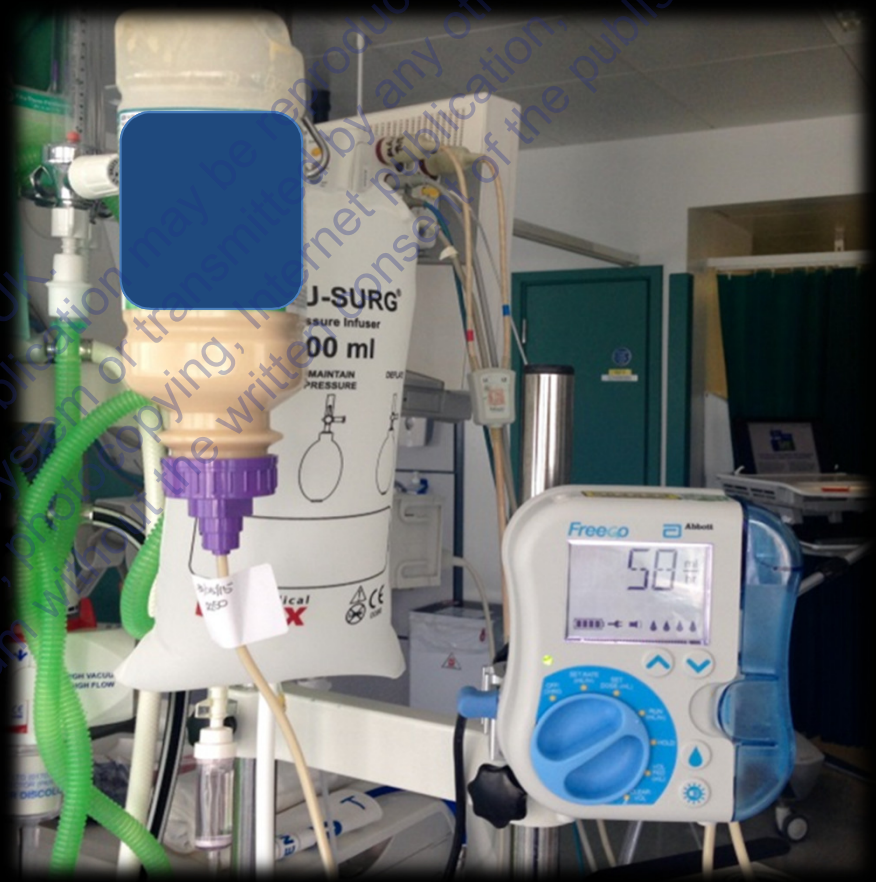


Fig. 2 How does nutritional support during critical illness affect patient recovery? The effect of nutritional support on recovery may be influenced by the amount of calories, protein, other macronutrients, micronutrients, and route of administration. It is probably influenced by premorbid nutritional and functional status, by several pathophysiologic processes associated with critical illness, and by the level of rehabilitation. In return, all these variables may influence nutritional needs

Arabi et al. The intensive care medicine research agenda in nutrition & metabolism. 2017

Which route – EN vs. PN



Intensive Care Med (2003) 29:867–869
DOI 10.1007/s00134-003-1744-9

EDITORIAL

Paul E. Marik
Michael Pinsky

Death by parenteral nutrition

According to the *Merriam-Webster Dictionary* a poison or toxin is "a substance that through its chemical action usually kills, injures or impairs an organism" [1]. Based on this definition, in the critically ill, total parenteral nutrition (TPN) meets all the criteria of a poison/toxin.

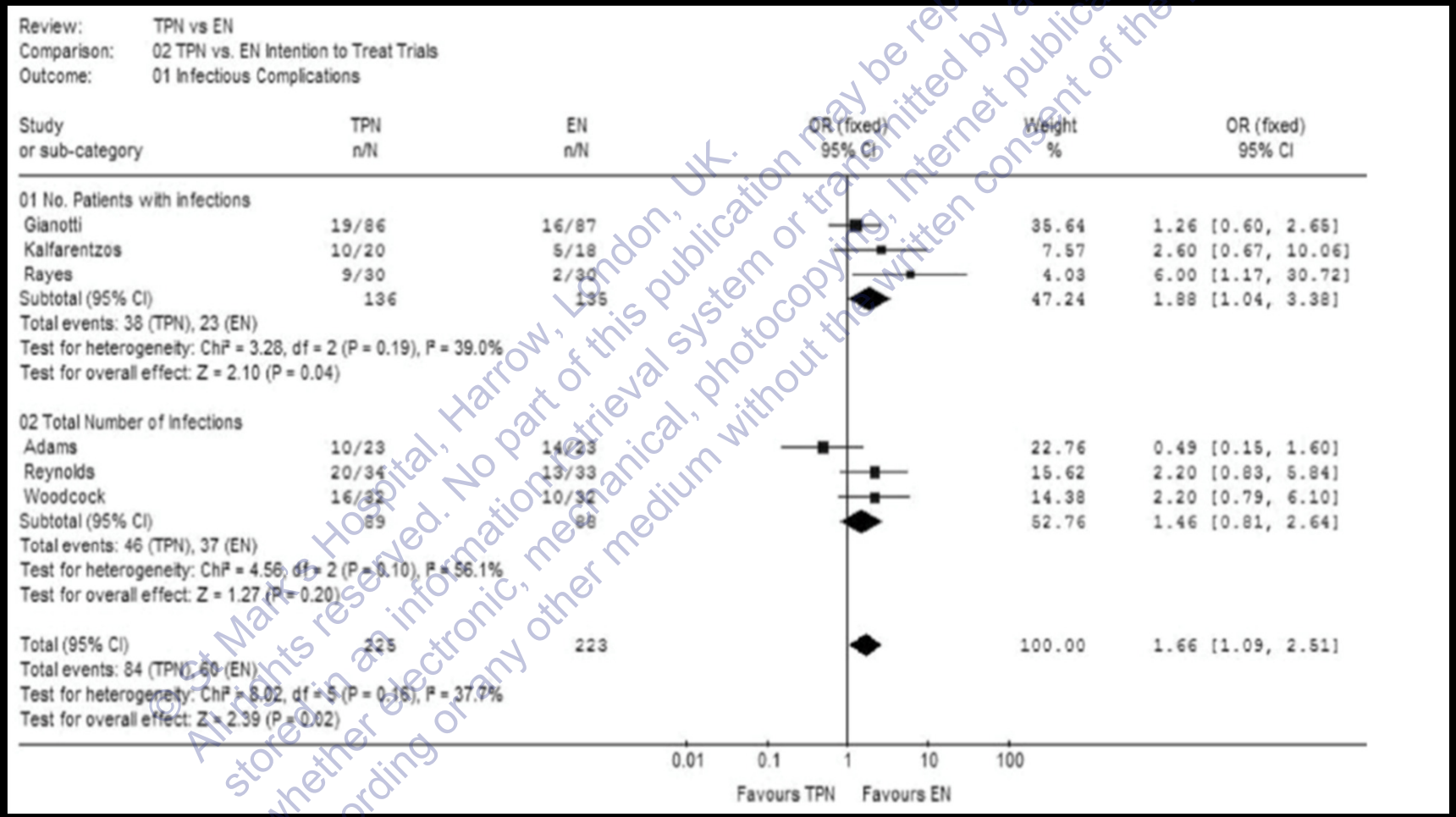
In conclusion, for the intensivist the acronym "TPN" may represent "total poisonous nutrition."

Intensive Care Med (2005) 31:12–23
DOI 10.1007/s00134-004-2511-2

SYSTEMATIC REVIEW

Fiona Simpson
Gordon Stuart Doig

Parenteral vs. enteral nutrition in the critically ill patient: a meta-analysis of trials using the intention to treat principle



Considerations

- ✓ Age of the studies
- ✓ Line care
- ✓ Calorie intake up to 70kcal/kg
- ✓ Mean 35kcal/kg
- ✓ TPN formulation

calories

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Trial of the Route of Early Nutritional Support in Critically Ill Adults

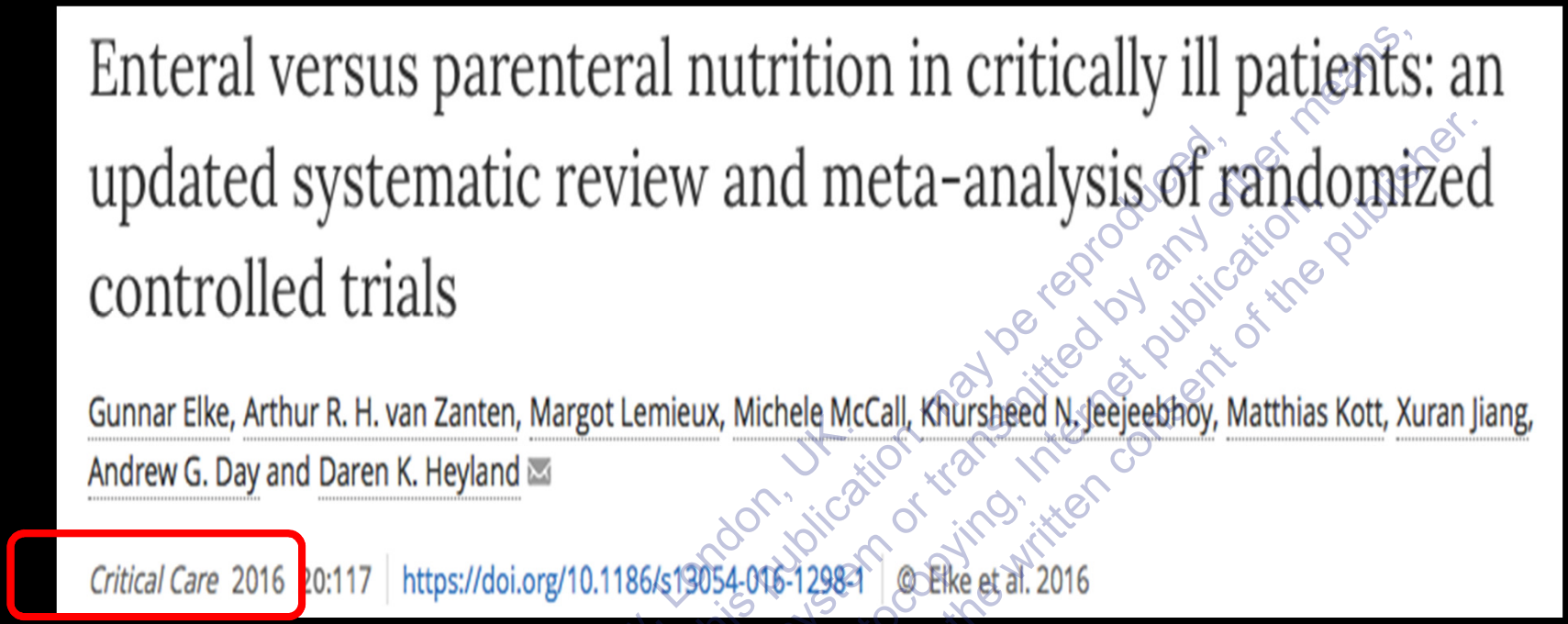
Sheila E. Harvey, Ph.D., Francesca Parrott, M.Sci., David A. Harrison, Ph.D., Danielle E. Bear, M.Res., Ella Segaran, M.Sc., Richard Beale, M.B., B.S., Geoff Bellingan, M.D., Richard Leonard, M.B., B.Chir., Michael G. Mythen, M.D., and Kathryn M. Rowan, Ph.D., for the CALORIES Trial Investigators*

CALORIES trial

Landmark UK nutrition study	• 33 ICU's in England, 2388 adult patients
Trial of route EN vs PN	• Randomized to PN or EN within 36hrs and continued exclusively for 5 days
Primary outcome	• All-cause mortality at 30 days
Secondary outcomes	• Infections, duration of organ support , ICU & hospital LOS
Targets	• 25kcal/kg • Local practice for obese • Pragmatic design

CALORIES results

- ✓ No difference seen in 30 day mortality
- ✓ No difference seen in
  - ✓ Duration of organ support
  - ✓ Number of infectious complications
  - ✓ LOS in ICU or hospital
  - ✓ Duration of survival up to 90 days
- ✓ More vomiting & hypo's in EN
- ✓ Neither group achieved targets
  - ✓ 18.5kcal/kg (EN) vs 21kcal/kg (PN)
- ✓ CONCLUSIONS:- PN is not harmful…



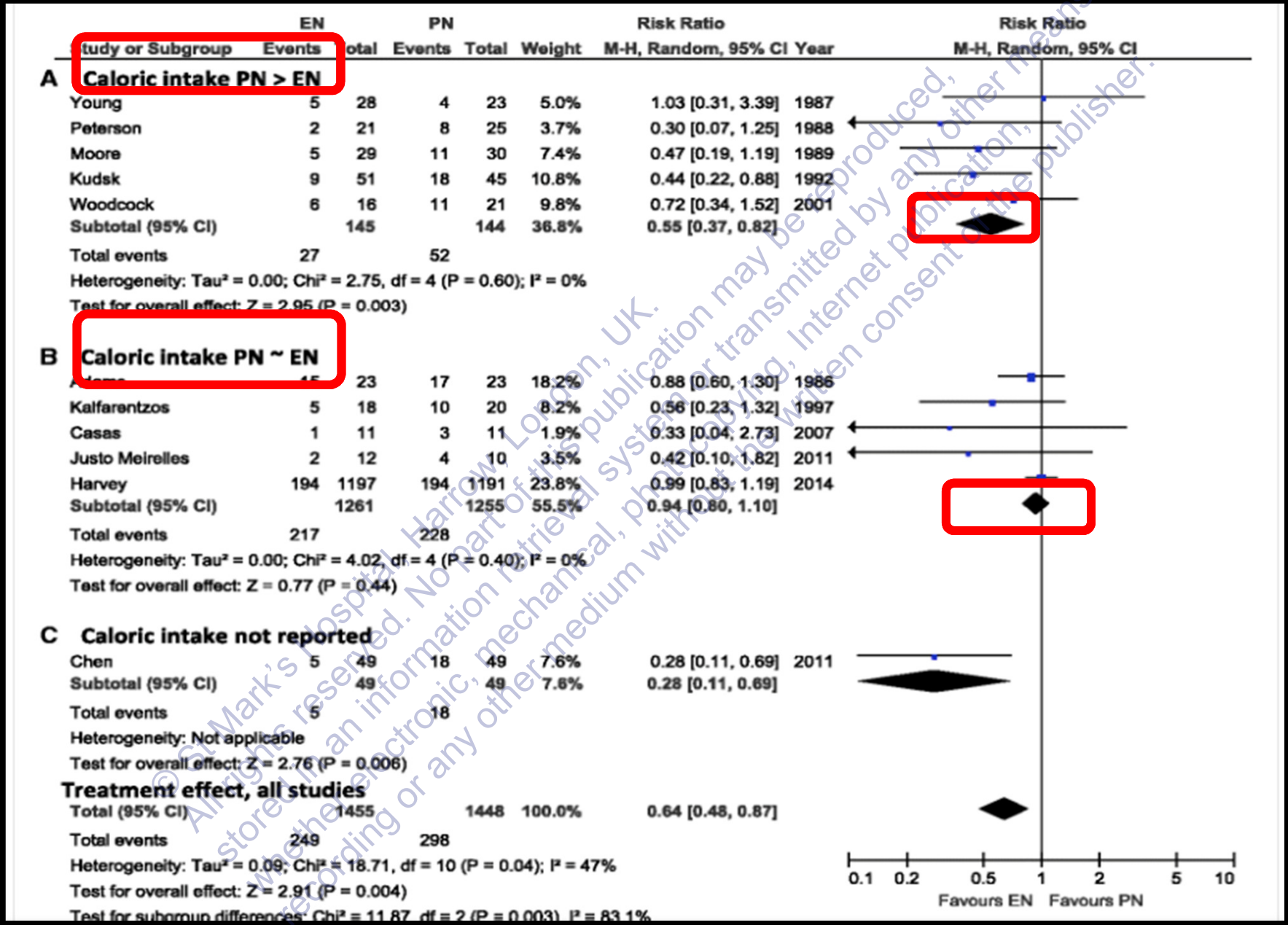
Enteral versus parenteral nutrition in critically ill patients: an updated systematic review and meta-analysis of randomized controlled trials

Gunnar Elke, Arthur R. H. van Zanten, Margot Lemieux, Michele McCall, Khursheed N. Jeejeebhoy, Matthias Kott, Xuran Jiang, Andrew G. Day and Daren K. Heyland

Critical Care 2016 20:117 | https://doi.org/10.1186/s13054-016-1298-1

RESULTS:- No difference in mortality and a reduction in infectious complications with EN, but …….

Infections



EN vs. PN conclusions

- ✓ EN offers multiple benefits inc non nutritional
  - ✓ Maintaining gut integrity, supporting microbiome, immune responses
- ✓ So EN should be first line for all patients
- ✓ But …. If EN not possible, safe to use PN
- ✓ Calorie load rather than route that is harmful
- ✓ Controversy exists over dose & timing

Nutrition in abdominal catastrophes

Nutrition support in abdominal catastrophe

If in ICU, then the surgery has gone really wrong

Will have severe sepsis & MOF with high mortality

Treat as a critically ill patient

Often no gut continuity

PN is appropriate

Forget EN for now

- Leave for recovery phase or out of ICU

Polk & Schwab – World J Surg 2012

ICU Challenges

- ✓ How to get wt's & Ht's ?
- ✓ How do we identify which phase the patient is in and when they move from one to the other?
- ✓ What are the right calorie / protein targets?
- ✓ How do you measure outcomes?
- ✓ What are realistic outcomes?
- ✓ What recovery is expected & can nutrition influence it?

Open abdomens

Open abdomens

- **Without bowel injury** early EN is safe and feasible and associated with
  - ✓ Early closure
  - ✓ Fewer complications/ fistula formulation
  - ✓ Lower incidence of VAP
  - ✓ Reduce mortality
- **With bowel injury** – EN may not influence
  - ✓ closure, compilations, mortality
  - ✓PN maybe indicated initially
- Additional 15-30g protein / 1L of exudate

Burlew et al. J Trauma Acute Care Surg 2012;73(6):
Collier et al. JPEN 2007;31(5):
Dissanake et al . J Am Coll Surg 2008;207(5)

OPEN ABDO – Case study 1

- 70 year old man
- Lapartomy, anterior resection and loop ileostomy. Home after 11 days
- Re-admitted 4 days later mechanical SBO
- Emergency laparotomy + SB resection. Heavy contamination, 'hostile surgical environment'. No gut continuity - Open abdo
- 2 days later -re-look. Unable to identify GI anatomy, at risk of causing iatrogenic perforation. Decision not to continue
- 4 days later- re look . Friable and extremely matted small bowel loops. Impossible to perform any form of adhesiolysis or exploration due to the fragility of the tissues. Abdo left open.
- > 1L/day out of abdo drains

Anthropometrics

1st op	• 98kg , BMI 33
Re-adm to hospt / ICU	• 96.2kg BMI 32
ICU D7 & 14	•MUAC 34cm suggestive of BMI 29.6 (? 89kg) •MUAC 33.5cm (? element of oedema)
ICU D 21 & 60	• MUAC 33cm (suggestive of BMI 28.6 / 84kg) ? he has lost 12kg over ICU stay • MUAC = 33cm

Questions

BMI > 30- what energy and protein targets to use?

Would you treat for refeeding syndrome? If so, how low would you go?

Would you account for abdominal loses

PN- off shelf vs. scratch bag?

What clinical factors would make you change?

Do you monitor for weight loss & what is acceptable?

Nutritional interventions

- ✓ Obese
  - ✓ – IBW 75kg
  - ✓ 25kcal/ IBW = 1875kcals
  - ✓ 14kcal/ ABW = 1344kcals
- ✓ 2g/ 75kg - 150g P/ 24g N^2
  - ✓ + 15-30g protein/ 2-5gN^2 from abdo losses
- ✓ Treated as re-feeding risk
- ✓ Start with 15kcal/ IBW for 2 days
- ✓ Day 3- Progress to 25kcal/ IBW ~ 1800kcals

PN- off shelf vs. scratch bag?

- ✓ 1st 5 days used off shelf bags
  - ✓ But underfed by at least 12gN^2/d
- ✓ Surgeons think he'll need long term PN
- ✓ Changed over to scratch bags, to meet N^2 targets
- ✓ Scratch bag =1940kcals (~25kcal/IBW) & 25.7g N^2

PN- scratch bags

- ✓ D 21 visually losing wt & decreased MUAC
- ✓ Doing physio, expending more energy so increased calories by ~400kcals/day
- ✓ Change scratch bag to 2340kcals & 25.7g N^2
- ✓ What weight should we aim for & if can't weigh, what else can we use as an outcome?
- ✓ Building muscle vs laying down fat

Progress

- 2 month ICU stay
- Left profoundly weak, delerious and deconditioned
- Left ICU with open abdo & fistula
- No gut continuity
- Spent 6/12 on ward waiting for IF unit bed

Case study 2

- ✓ 30 year old male
- ✓ Bariatric surgery- sleeve gastrectomy > leak, multiple stents, home Jej feeding (10month)
- ✓ Aorto-oesophageal fistula caused by stent – vascular repair – sent home jej fed
- ✓ Adm to ICU following elective gastrectomy, oesophagectomy, colonic interposition & aortic repair. New jejunostomy inserted
- ✓ Very sick, MOF, ARDS
- ✓ Chlye leak
- ✓ On ICU for 3 months

Anthropometrics

Wt at sleeve	• 175kg/ BMI 53
Wt with aortic fistula	• 107kg / BMI 32(loss of 68kg)
Wt at gastrectomy (ICU)	• 99kg / BMI 29
Wt 2 months on ICU	• 83kg / BMI 25
Wt 3 months on ICU	• 80kg / BMI 24

Questions

What weight to use (actual / IBW)

What are your nutritional aims?

Do the aims change over duration of ICU stay?

Which route : EN vs. PN?

How to manage a chyle leak?

Nutritional aims

- ✓ Initially used IBW (BMI 29)
- ✓ Started at 20kcal/IBW , as so sick
- ✓ Aim to avoid overfeeding
- ✓ Alter calorie targets over the different phases
- ✓ At 14 days – 25kcal/IBW
- ✓ At 2 months – increasing calories to maintain wt
- ✓ At 3 months – increased again – On ICU d/c 3000kcals/day (38kcal/ABW)
- ✓ Patient unhappy with low weight

Route: EN vs. PN

- ✓ First 10 days surgeons apprehensive of viability of gut / anastomosis – PN
- ✓ Started Jej feeding at D10 > chyle leak
- ✓ Patient strict Muslim, so family declined use of Semi-elemental feed (pork enzymes used)
- ✓ Back to PN
- ✓ Day 30 returned to EN via Jej
- ✓ Left ICU starting to eating & jej feeding
- ✓ Left hopsital eating & jej feeding

ICU Take home messages

- High input patients, frequent reviews
- Need to alter nutritional plan over course of ICU stay to match phase of critical illness
- Talk to ICU team
- PN is not harmful & often indicated
- Individualised PN bags often needed
- Will end up nutritionally and physically wasted.
- “Create survivors not victims”
- Ward nutritional rehabilitation & optimisation