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Nutrition support in the major trauma patient: Open abdomen??

Easy peasy lemon squeezy!!!

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Faculty Disclosures

Gordon S. Doig & Fiona Simpson

Relevant financial relationships with a commercial interest:

- Fresenius Kabi, Academic Research Grants (Past), Consultant and Speaker's Honoraria (Current)
- Baxter Healthcare, Academic Research Grant (Current), Consultant and Speaker's Honoraria (Current)
- Nestle Healthcare, Academic Research Grant (Current), Consultant and Speaker's Honoraria (Current)

Outline

Within the context of a clinical case:

- Consider how the results of recent clinical research might apply to the patient discussed.
- Review benefits of earlier nutrition (*nutrition = calories + protein + lipids*) in trauma.
- Summary.

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  - blunt abdominal trauma, splenic rupture
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  - Chest-X-ray:
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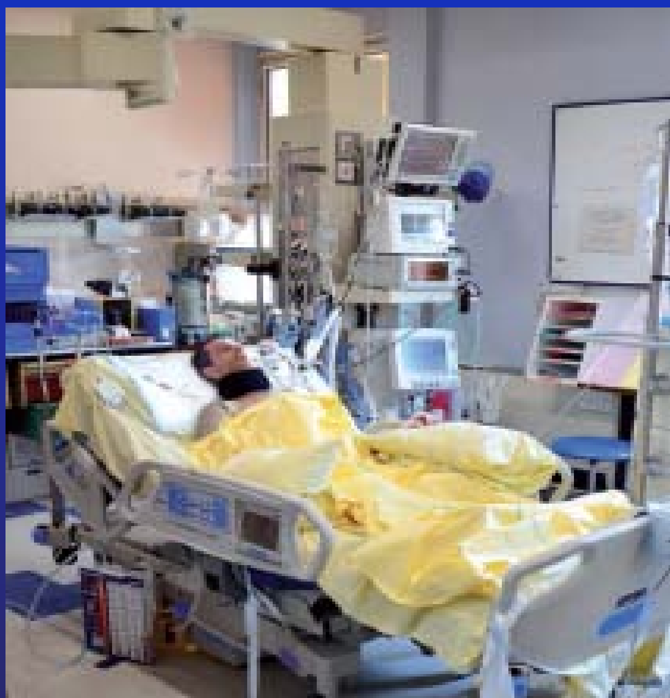

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5. Parenteral nutrition begun after initial surgery.

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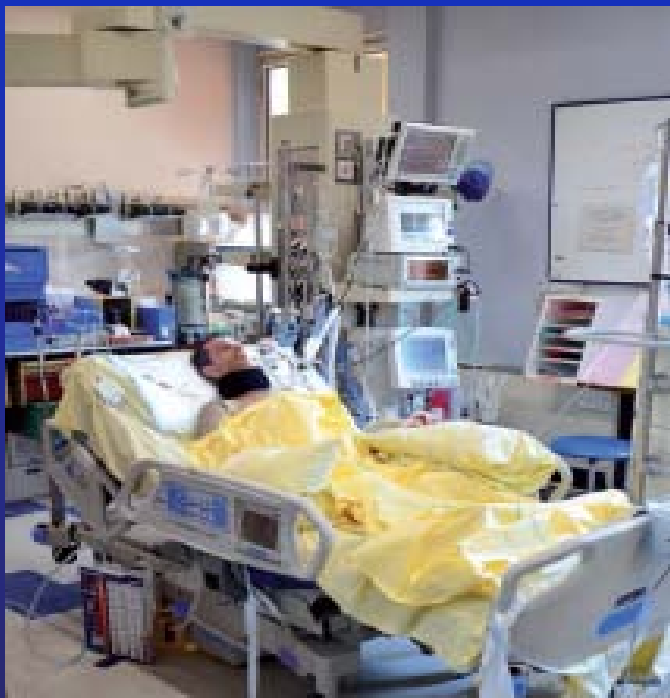

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4. If I chose PN, I would be concerned about increasing infectious complications.

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The Open Abdomen

"deliberately leaving a laparotomy wound open is now the standard of care in clinical situations that require either planned reoperations or decompression of intra-abdominal hypertension"

Scott BG, Feanny MA, Hirshberg A. Early definitive closure of the open abdomen: A quiet revolution. *Scandinavian J Surg* 2005;94:9-14.

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Therefore many open abdomen patients receive no nutrition until fascial closure.

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Should we fear enteral nutrition?

Observational study reviewing 597 trauma patients from 11 US trauma centres who were managed with *open abdomen*.

- average age 38, 77% male
- 72% blunt trauma, ISS 31
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39% (232/597) received EN *before first attempt at closure of the abdomen*

- Average time to EN start, 3.6 days after injury

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- Intention to treat analysis *for all 597 patients.*

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Considering all patients, receiving EN before first attempt at closure resulted in significant improvements in outcome.

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  - Mortality and EN (OR 0.79, p=0.69).

For patients with a bowel injury, mortality effect (OR=0.79) was half the effect for no bowel injury (OR=0.3, previous slide). Perhaps an issue of sample size, however the authors conclude "EN seems to be neither advantageous nor detrimental for these patients"

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- 3 other smaller observational studies in open abdomen patients, comparing EN started prior to fascial closure with delayed nutrition

Dissanaike S, Pham T, Shalhub S et al. Effect of immediate enteral feeding on trauma patients with an open abdomen: Protection from nosocomial infections. *J Am Coll Surg* 2008;207:690-697.

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- Compared with delayed feeding, EN started prior to fascial closure was associated with:

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- Compared with delayed feeding, EN started prior to fascial closure was associated with:
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Should we fear early enteral nutrition?

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- Meta-analysis of all methodologically sound RCT’s conducted in:
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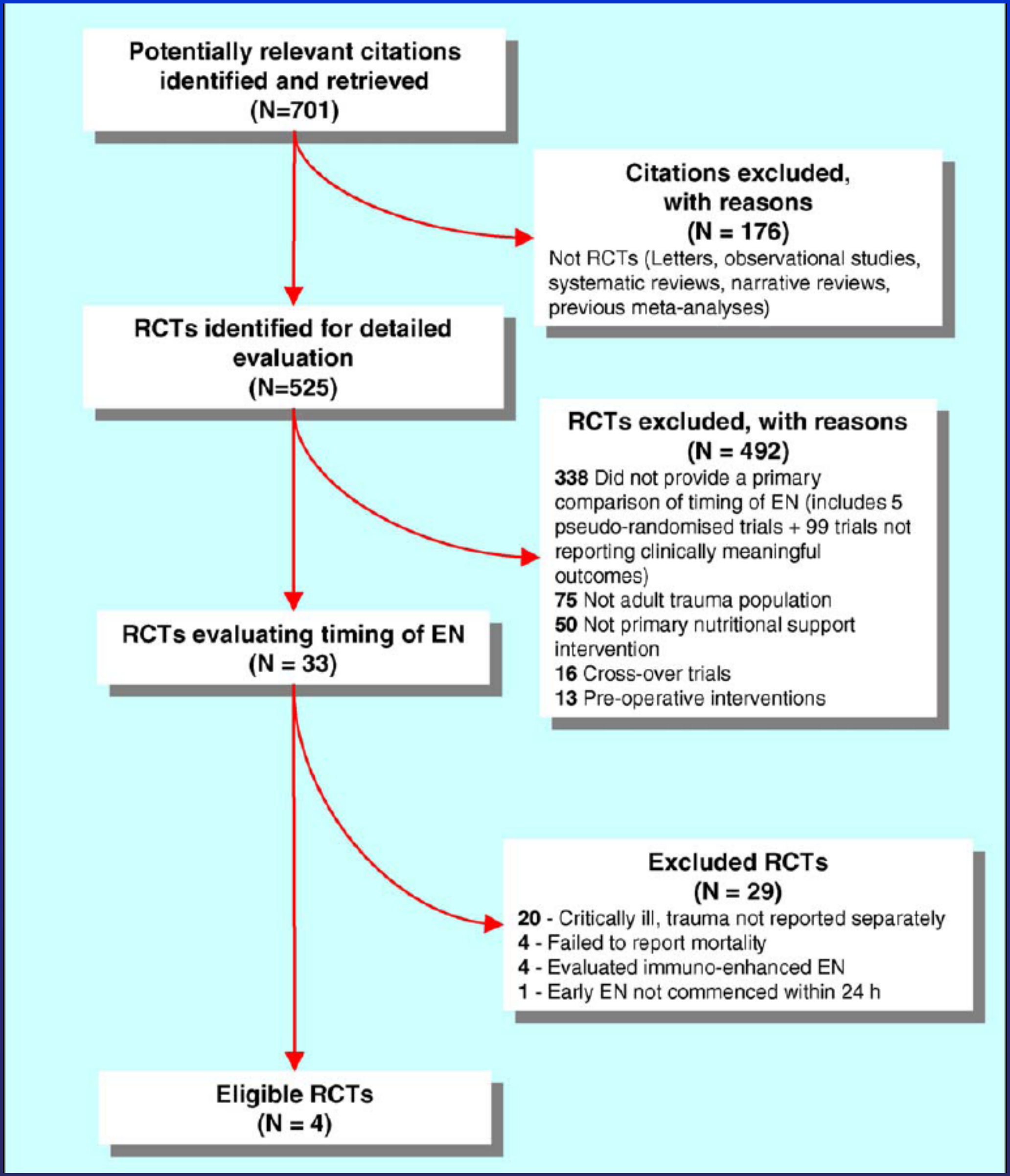

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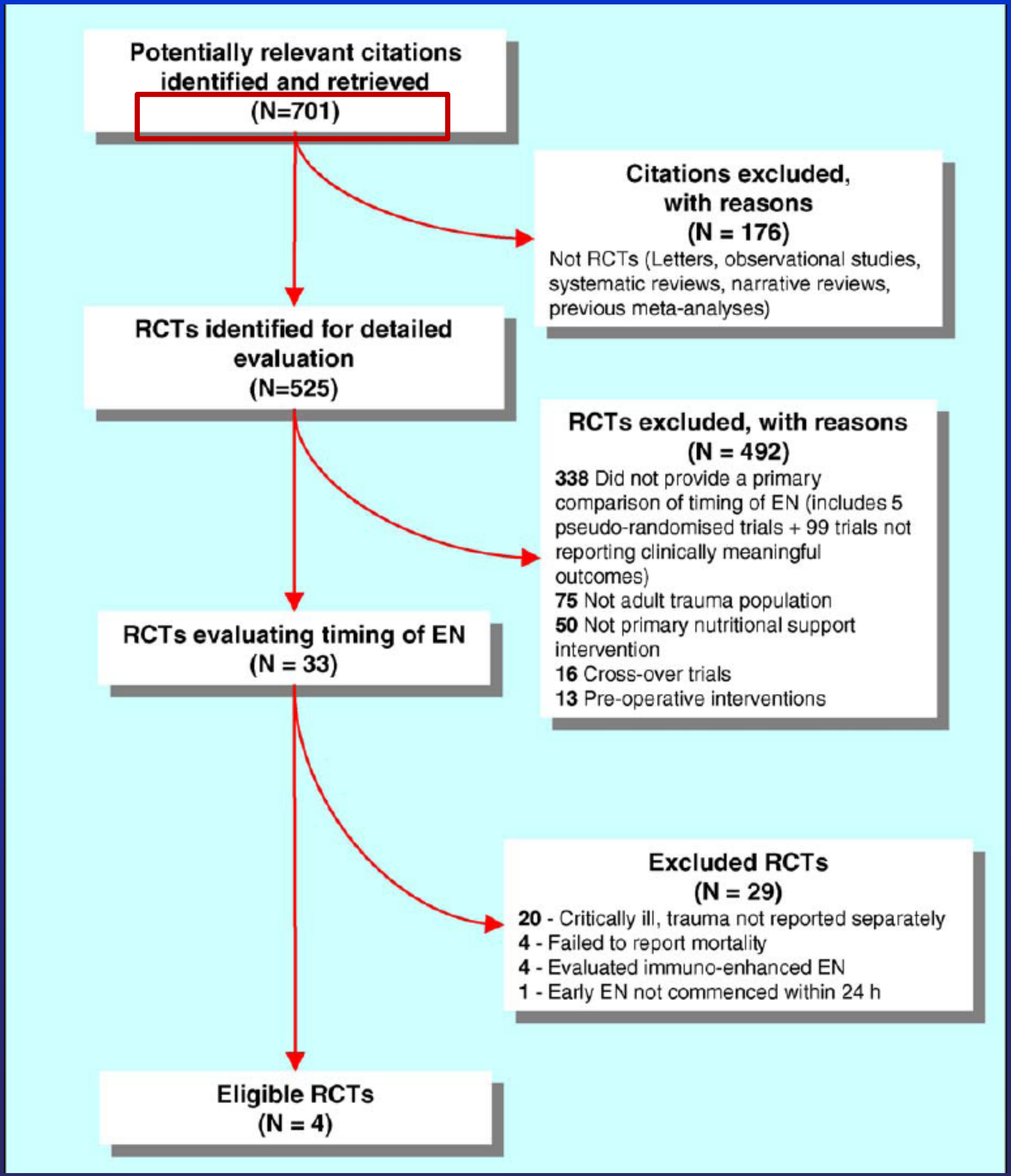

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Study	Patient population	Early EN intervention	Control intervention
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Kompan 1999	Multiple trauma (ISS > 25) Mean ISS 33.6 ± 10 Mean APACHE II 11.5 ± 5.8	Immediately after resuscitation: EN (Jevity^{TM}) started at 20 ml/h via NGT. Increased to 50% of estimated goal on Day 1, 75% of estimated goal on Day 2 and 100% of goal on Day 3. Estimated goal was set at 25–35 nonprotein kcal/kg per day and 0.2–0.3 g nitrogen/kg per day at 72 h post-ICU admission. TPN was added to meet estimated requirements	Same protocol as Early EN except EN begun a median 41.4 (33.9–53.6 range) hours after trauma. *Note*: 50% of goal received via TPN for first 24 h before EN was begun
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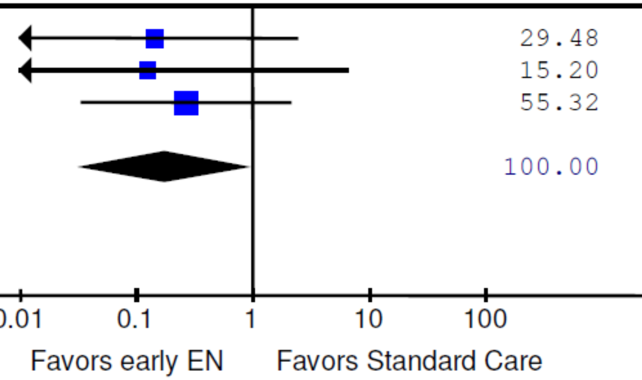
Should we fear ***early*** *enteral nutrition?*

Review: Early EN (<24h) vs Standard Care (TRAUMA - Primary)
Comparison: 01 Early (<24 h) EN vs Standard Care
Outcome: 01 Mortality, Intention to treat analysis

Study or sub-category	Early EN (<24 h) n/N	Standard Care n/N	Peto OR 95% CI	Weight %	Peto OR 95% CI
Kompan 1999	0/17	2/19		29.48	0.14 [0.01, 2.38]
Kompan 2004	0/27	1/25		15.20	0.12 [0.00, 6.31]
Chuntrasakul 1996	1/21	3/17		55.32	0.26 [0.03, 2.06]
Total (95% CI)	65	61		100.00	0.20 [0.04, 0.91]



Total events: 1 (Early EN (<24 h)), 6 (Standard Care)
Test for heterogeneity: Chi² = 0.18, df = 2 (P = 0.91), I² = 0%
Test for overall effect: Z = 2.09 (P = 0.04)

Mortality reduced by 8.3%, p=0.04

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- Early EN also resulted in:
  - Reduced incidence of pneumonia (33% eEN vs 64%, p=0.050)
  - No significant difference in the *incidence* of MODs, (70% eEN vs 68%, p=0.82) but a trend towards a reduction in the *severity* of MODS (2.5 vs 3.1 organ failures per patient, p=0.057)

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There were no signs of any harms.

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F

Should we fear feeding across an anastomosis?

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- A Meta-analysis comparing RCT's of early feeding (within 24h) versus no feeding in patients undergoing gastrointestinal surgery.
- 13 studies, 1,173 patients

Lewis SJ, Andersen HK, Thomas S. Early enteral nutrition within 24 h of Intestinal Surgery versus later commencement of feeding: A systematic review and Meta-analysis. *J Gastrointest Surg* 2009;13:569-575.

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  - Anastomotic dehiscence (2.8% eEN vs 4.3%, p=0.27)
  - Pneumonia (2.3% eEN vs 3.3%, p=0.46)

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"There is no obvious benefit for keeping patients "nil by mouth" after gastrointestinal surgery"

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In the trauma patient with an open abdomen, starting EN prior to abdominal closure may:

- Significantly reduce time to closure
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- NOT result in any increase in complications

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Should we fear parenteral nutrition?

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Should we fear parenteral nutrition?

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CARING FOR THE CRITICALLY ILL PATIENT

ONLINE FIRST

Early Parenteral Nutrition in Critically Ill Patients With Short-term Relative Contraindications to Early Enteral Nutrition

A Randomized Controlled Trial

Gordon S. Doig, PhD
Fiona Simpson, MND
Elizabeth A. Sweetman, MHM
Simon R. Finfer, FCICM
D. Jamie Cooper, FCICM
Philippa T. Heighes, MN
Andrew R. Davies, FCICM
Michael O'Leary, FCICM
Tom Solano, FCICM
Sandra Peake, FCICM
for the Early PN Investigators of the ANZICS Clinical Trials Group

Importance Systematic reviews suggest adult patients in intensive care units (ICUs) with relative contraindications to early enteral nutrition (EN) may benefit from parenteral nutrition (PN) provided within 24 hours of ICU admission.

Objective To determine whether providing early PN to critically ill adults with relative contraindications to early EN alters outcomes.

Design, Setting, and Participants Multicenter, randomized, single-blind clinical trial conducted between October 2006 and June 2011 in ICUs of 31 community and tertiary hospitals in Australia and New Zealand. Participants were critically ill adults with relative contraindications to early EN who were expected to remain in the ICU longer than 2 days.

Interventions Random allocation to pragmatic standard care or early PN.

Main Outcomes and Measures Day-60 mortality; quality of life, infections, and body composition.

Results A total of 1372 patients were randomized (686 to standard care, 686 to early PN). Of 682 patients receiving standard care, 199 patients (29.2%) initially commenced EN, 186 patients (27.3%) initially commenced PN, and 278 patients (40.8%) remained unfed. Time to EN or PN in patients receiving standard care was 2.8 days (95% CI, 2.3 to 3.4). Patients receiving early PN commenced PN a mean of 44 minutes after enrollment (95% CI, 36 to 55). Day-60 mortality did not differ significantly (22.8% for standard care vs 21.5% for early PN; risk difference, −1.26%; 95% CI, −6.6 to 4.1; P=.60). Early PN patients rated day-60 quality of life (RAND-36 General Health Status) statistically, but not clinically meaningfully, higher (45.5 for standard care vs 49.8 for early PN; mean difference, 4.3; 95% CI, 0.95 to 7.58; P=.01). Early PN patients required fewer days of invasive ventilation (7.73 vs 7.26 days per 10 patient × ICU days, risk difference, −0.47; 95% CI, −0.82 to −0.11; P=.01) and, based on Subjective Global Assessment, experienced less muscle wasting (0.43 vs 0.27 score increase per week; mean difference, −0.16; 95% CI, −0.28 to −0.038; P=.01) and fat loss (0.44 vs 0.31 score increase per week; mean difference, −0.13; 95% CI, −0.25 to −0.01; P=.04).

Conclusions and Relevance The provision of early PN to critically ill adults with relative contraindications to early EN, compared with standard care, did not result in a difference in day-60 mortality. The early PN strategy resulted in significantly fewer days of invasive ventilation but not significantly shorter ICU or hospital stays.

Trial Registration anzctr.org.au Identifier: ACTRN012605000704695

JAMA. 2013;309(20):doi:10.1001/jama.2013.5124 www.jama.com

Parenteral nutrition has been in common use since the 1960s[1] and is accepted as the standard of care for patients with chronic nonfunctioning gastrointestinal tracts.[2] In critical illness, controversy surrounds the appropriate use of parenteral nutrition,[3] but large-scale trials have begun to answer important questions.

Published in 2011, EPaNIC (Early Parenteral Nutrition Completing Enteral Nutrition in Adult Critically Ill Patients)[4] enrolled 4640 critically ill patients to investigate the effects of using parenteral nutrition when enteral nutrition failed to reach a caloric target. EPaNIC did not find any benefits from using additional parenteral nutrition in patients who could receive enteral nutrition[5]; however, many other important questions regarding parenteral nutrition remain.

See related article.

Author Affiliations: Northern Clinical School Intensive Care Research Unit (Dr Doig and Mss Simpson, Sweetman, and Heighes), The George Institute for Global Health (Dr Finfer), University of Sydney, Sydney, Australia; Alfred Hospital, Melbourne, Australia (Drs Cooper and Davies); Royal Prince Alfred Hospital, Sydney (Dr O'Leary); Westmead Hospital, Sydney (Dr Solano); and Queen Elizabeth Hospital, Adelaide, Australia (Dr Peake).

The Early PN Trial Contributing Sites and Site Investigators are listed at the end of this article.

Corresponding Author: Gordon S. Doig, PhD, Royal North Shore Hospital, Intensive Care Unit, Pacific Hwy, St Leonards, NSW 2065, Australia (gdoig@med.usyd.edu.au).

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Table 4. New Infections During Study

Patients With New Infections[a]	No. (%) Standard Care (n = 682)	Early PN (n = 681)	Risk Difference (Exact 95% CI)	Exact *P* Value[b]

[a] new infections based on cultures obtained in the study ICU.

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Table 4. New Infections During Study

Patients With New Infections[a]	No. (%) Standard Care (n = 682)	Early PN (n = 681)	Risk Difference (Exact 95% CI)	Exact *P* Value[b]
Catheter[c]	32 (4.69)	31 (4.55)	−0.14 (−5.45 to 5.12)	>.99
Catheter tip[c]	28 (4.11)	26 (3.82)	−0.29 (−5.60 to 5.01)	.89

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Clinically significant UTI	1 (0.15)	2 (0.29)	0.15 (−5.16 to 5.45)	.62

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CPIS-probable pneumonia[e]	96 (14.08)	81 (11.89)	−2.18 (−7.50 to 3.11)	.26
CPIS-confirmed pneumonia[f]	45 (6.60)	43 (6.31)	−0.28 (−5.60 to 5.01)	.91

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Any major infection[g]	78 (11.4)	74 (10.9)	−0.57 (−5.89 to 4.72)	.80

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[g] Attributable excess case mortality greater than 15%.

Eligibility Criteria

Main inclusion criteria:

- Adult patients admitted to ICU for less than 24 h.
- Not expected to receive enteral, parenteral or oral intake ‘today’ or ‘tomorrow’.

F

Who got into the trial:

Main types of patients enrolled:

- 234 (17%) GI perforation (surgical),

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- 62 (5%) GI bleeding (med/surg).

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- 62 (5%) GI bleeding (med/surg).

Major trauma patient with open abdomen who is NOT going to receive EN today or tomorrow would have been eligible for this trial.

G

Table 1. Patient Characteristics and Baseline Balance

Baseline Characteristics	Standard Care (n = 682)	Early PN (n = 681)
Age, mean (SD), y	68.6 (14.3)	68.4 (15.1)
Female gender, No. (%)	262 (38.4)	281 (41.3)
BMI, mean (SD)[a,b]	28.5 (6.9)	27.9 (6.8)
APACHE II score, mean (SD)[c,e]	21.5 (7.8)	20.5 (7.4)
Mechanically ventilated, No. (%)	549 (80.6)	572 (83.9)

F

Nutrition therapy process measures

Early parenteral nutrition (681 patients):

- 679/681 patients (99.7%) commenced PN 44 minutes after enrolment

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Pragmatic standard care (682 patients):

- 279/682 (40%) standard care patients commenced EN 3.7 days after enrolment

G

Table 2. Mortality

	Standard Care (n = 680)[a]	Early PN (n = 678)[a]	Risk Difference, % (95% CI)	*P* Value
Deaths before study day 60, No. (%)	155 (22.8)	146 (21.5)	−1.26 (−6.6 to 4.1)	.60
Covariate-adjusted deaths before study day 60[b]			0.04 (−4.2 to 4.3)	>.99

[a] 5 patients (2 Standard Care, 3 Early PN) could not be contacted on study Day 60 to determine vital status. Considered 'missing at random' for ITT Primary and Adjusted primary outcome analysis.

[b] Multivariate model controlled for confounding due to baseline imbalance and strong predictors: **Age, gender, BMI, APACHE 2 score, Chronic Liver, Chronic Respiratory and Source of Admission**.

#Bender R, Vervolgyi V. Estimating adjusted NNTs in randomised controlled trials with binary outcomes: A simulation study. *Contemporary Clinical Trials* 2010;31:498-505.

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	Standard Care (n = 680)[a]	Early PN (n = 678)[a]	*P* Value
Quality of life and physical function, mean (SD)[c]	(n = 525)	(n = 532)	
RAND-36 general health status[d]	45.5 (26.8) (n = 516)	49.8 (27.6) (n = 525)	.01

Ware JE, Jr., Sherbourne CD. The MOS 36-item short-form health survey (SF-36). I. Conceptual framework and item selection. *Med Care* 1992;30:473-483.

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Minimally Important Difference = ½ SD = 13.5

Juniper EF, Guyatt GH, Willan A, Griffith LE. Determining a minimal important change in a disease-specific Quality of Life Questionnaire. *J Clin Epidemiol* 1994;47:81-87.
Norman GR, Sloan JA, Wyrwich KW. Interpretation of changes in health-related quality of life: The remarkable universality of a half a standard deviation. *Medical Care* 2004;41:582-592.
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Table 3. Concomitant Interventions, Adjusted for Time at Risk (ICU Stay)[a]

	Mean (95% CI), Days per 10 Patient × ICU Days		
	Standard Care (n = 682)	Early PN (n = 681)	*P* Value[b]
Invasive mechanical ventilation	7.73 (7.55 to 7.92)	7.26 (7.09 to 7.44)	.01

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Invasive mechanical ventilation	7.73 (7.55 to 7.92)	7.26 (7.09 to 7.44)	.01
Pressure ulcer treatment	0.87 (0.74 to 1.02)	0.78 (0.67 to 0.92)	.54
Low serum albumin (<2.5 g/dL)	5.47 (5.28 to 5.67)	5.76 (5.56 to 5.97)	.15
Systemic antibiotic use	7.95 (7.78 to 8.12)	8.05 (7.88 to 8.22)	.55
Witnessed aspiration	1.59 (0.98 to 2.54)	1.96 (1.21 to 3.13)	.66
With new pulmonary infiltrates	0.48 (0.20 to 1.15)	0.71 (0.30 to 1.72)	.65
Renal replacement therapy	0.99 (0.82 to 1.81)	0.80 (0.67 to 0.96)	.25

G

Length of Stay	(n = 682)	(n = 681)	*P* Value
ICU stay, mean (95% CI), d	9.3 (8.9 to 9.7)	8.6 (8.2 to 9.0)	.06
Hospital stay, mean (95% CI), d	24.7 (23.7 to 25.8)	25.4 (24.4 to 26.6)	.50

F

Daniel C., 42 years, Motor accident

- 186 cm, 72 kg
- Dx:
  - cerebral hematoma
  - multiple rip fractures, rupture of pulmonary artery
  - blunt abdominal trauma, splenic rupture
  - pelvic fracture, massive blood loss
- Op:
  - drainage of hematoma, repair of pulmonary artery
  - spleen resection, abdominal revision
  - pelvic osteosynthesis
- 5 hours postoperative
  - open abdomen, scheduled for review next day
  - no post pyloric feeding tube
  - mechanically ventilated, FIO_2 0.6
  - Temp. 39.2 °C
  - Chest-X-ray:
    - bilateral infiltrates

G

Could we consider enteral nutrition?

Burlew CC, Moore EE, Cuschieri J et al. Who should we feed? A Western Trauma Association multi-institutional study of enteral nutrition in the open abdomen after injury. *J Trauma Acute Care Surg* 2012;73(6):1380-1388.

Could we consider enteral nutrition?

- 597 patient observational study,
  - Significantly higher fascial closure rates;
  - No difference in complication rates and;
  - Significantly lower mortality.
- 39% received EN before closure of the abdomen, started 3.6 days after injury

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Could we consider *enteral nutrition?*

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Could we consider early enteral nutrition?

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Could we consider *early* enteral nutrition?

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- Significantly lower mortality
- Reduced pneumonia and severity of MODS
- No signs of harm

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What is the role of Early PN*?*

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- Significant reduction in duration of mechanical ventilation (1.1 days, $p = 0.009$)
- Strong trend towards reduction in ICU stay (0.75 days, $p=0.06$).
- Does not delay eventual EN start time

Burlew CC, Moore EE, Cuschieri J et al. Who should we feed? A Western Trauma Association multi-institutional study of enteral nutrition in the open abdomen after injury. *J Trauma Acute Care Surg* 2012;73(6):1380-1388.

Doig GS, Heighes PT, Simpson F and Sweetman EA. Early enteral nutrition reduces mortality in trauma patients requiring intensive care: A meta-analysis of randomised controlled trials. *Injury* 2011;42(1):50-56

Doig GS, Simpson F, Sweetman EA et al. Early parenteral nutrition in critically ill patients with short-term relative contraindications to early enteral nutrition: a randomized controlled trial. ***JAMA***. 2013 May 22;309(20):2130-8

What is the role of Early PN?

He could be fed enterally

He could be fed *early* (< 24 h from injury) enterally

If he is *not going to be fed early enterally*, he could be fed *early* parenterally!

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Nutrition with an open abdomen

He could be fed enterally

He could be fed *early* (< 24 h from injury) enterally

If he is *not going to be fed early* enterally, he could be fed *early* parenterally!

We are unaware of any published evidence that demonstrates short term fasting (or starvation) is beneficial to any group of critically ill patients.

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