

Early enteral nutrition in the major trauma patient requiring intensive care: An overview of the evidence.

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Summary of this talk

- Provide a context.
- Review the most recent clinical evidence.
- Generate concise clinical recommendations.
- Summarize.



Background: Review of the Guidelines

- The concept of 'early' enteral feeding was popularized in the mid '80s.

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J Trauma 1986;26:874–881



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Background: Review of the Guidelines

- The concept of ‘early’ enteral feeding was popularized in the mid ‘80s.
- Five major ICU CPGs recommend *early* EN.
 - *Canadian guideline,*
 - *ACCEPT guideline (also Canadian),*
 - *Australian and New Zealand guideline,*
 - *European (ESPEN) guideline and*
 - *American (ASPEN and SCCM) guideline*

Moore EE, Jones TN. Benefits of immediate jejunostomy feeding after major abdominal trauma—a prospective, randomized study. *J Trauma* 1986;26:874–881

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Kreymann KG, Berger MM, Deutz NE, *et al.* ESPEN Guidelines on Enteral Nutrition: Intensive care. *Clinical Nutrition* 2006;25: 210–223.

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Background: Review of the Guidelines

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- Five major ICU CPGs recommend *early* EN.
- One major trauma CPG recommends *early* EN.



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“enteral feeding can be instituted in most patients after resuscitation is complete and hemodynamic stability has been gained.”

The Eastern Association for the Surgery of Trauma. Nutritional Support: Timing (Early versus Delayed Enteral Feedings). *J Trauma*. 57(3):660-679.



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Early EN in trauma: Direct evidence



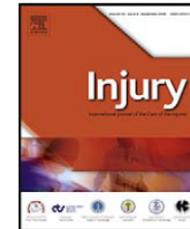
Early EN in trauma: Direct evidence



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Early enteral nutrition reduces mortality in trauma patients requiring intensive care: A meta-analysis of randomised controlled trials

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ABSTRACT

Introduction: To determine whether the provision of early standard enteral nutrition (EN) confers treatment benefits to adult trauma patients who require intensive care.

Materials and methods: MEDLINE and EMBASE were searched. Hand citation review of retrieved guidelines and systematic reviews was undertaken and academic and industry experts were contacted.

Methodologically sound randomised controlled trials (RCTs) conducted in adult trauma patients requiring intensive care that compared the delivery of standard EN, provided within 24 h of injury, to standard care were included.

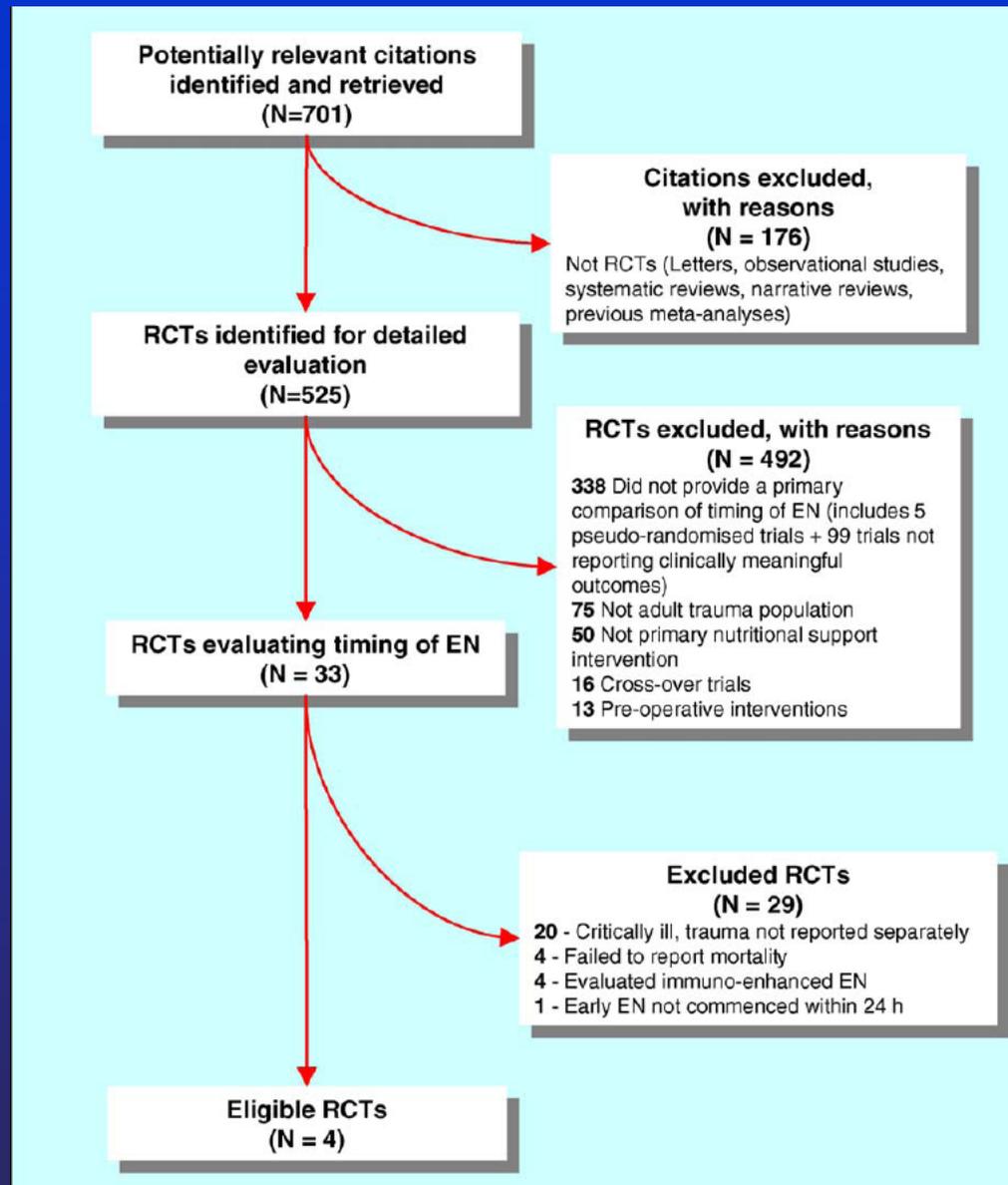
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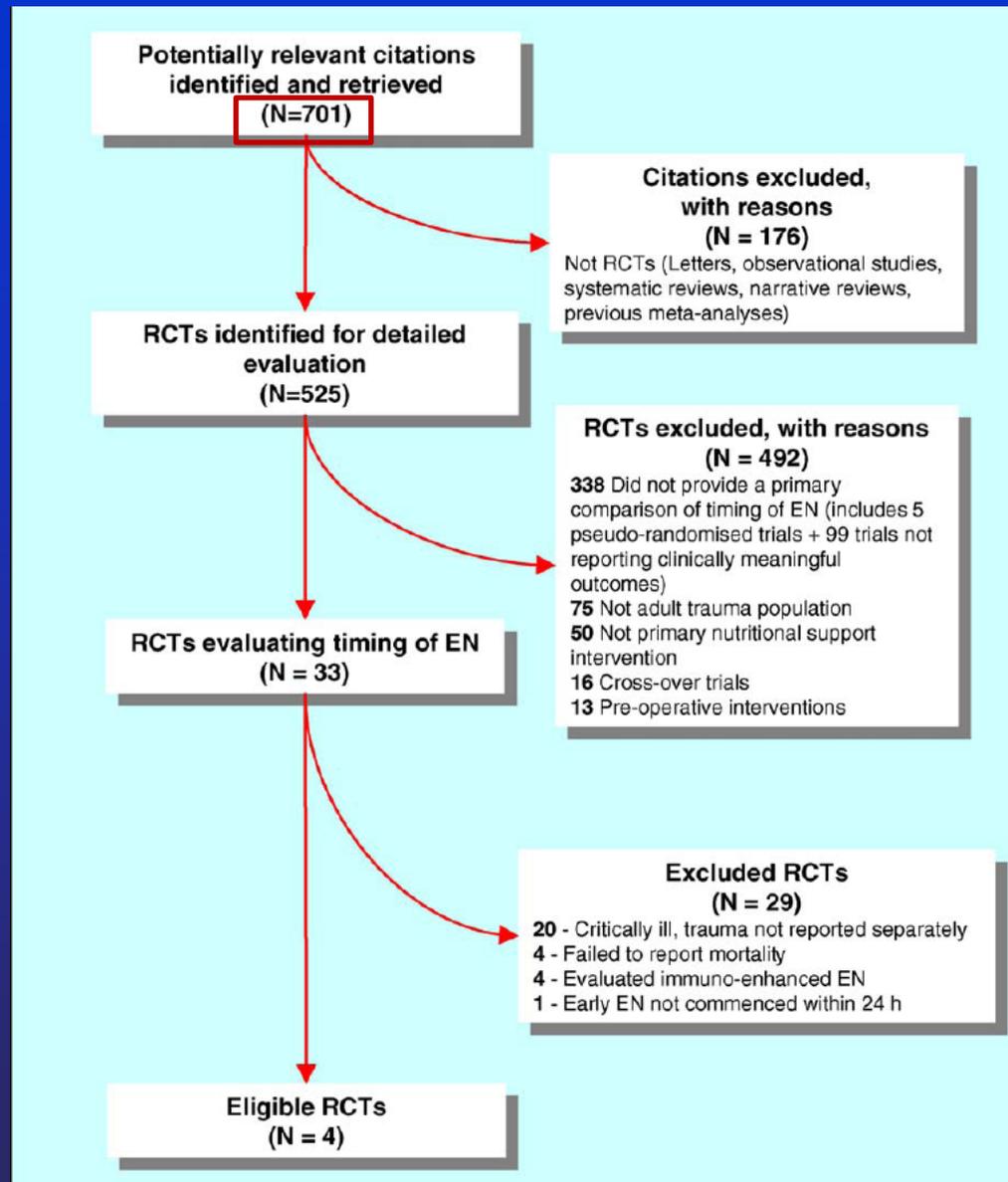
Early EN in trauma: Direct evidence

- RCT's conducted in:
 - adult trauma patients requiring intensive care and;
 - standard EN begun within 24hrs of injury compared to standard care (oral intake upon return of bowel sounds, TPN, or TPN + delayed EN);
 - conducted an extensive electronic literature search

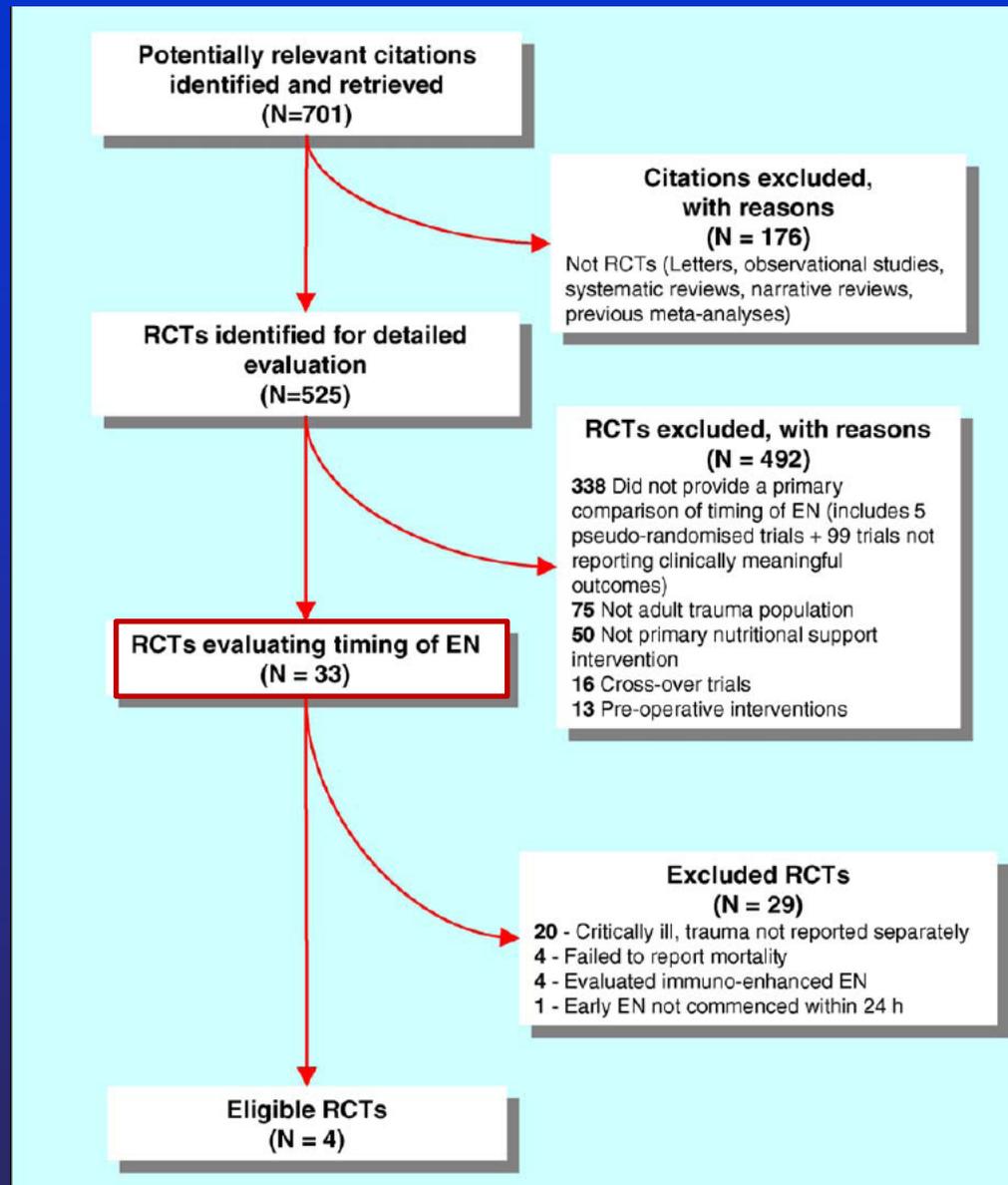
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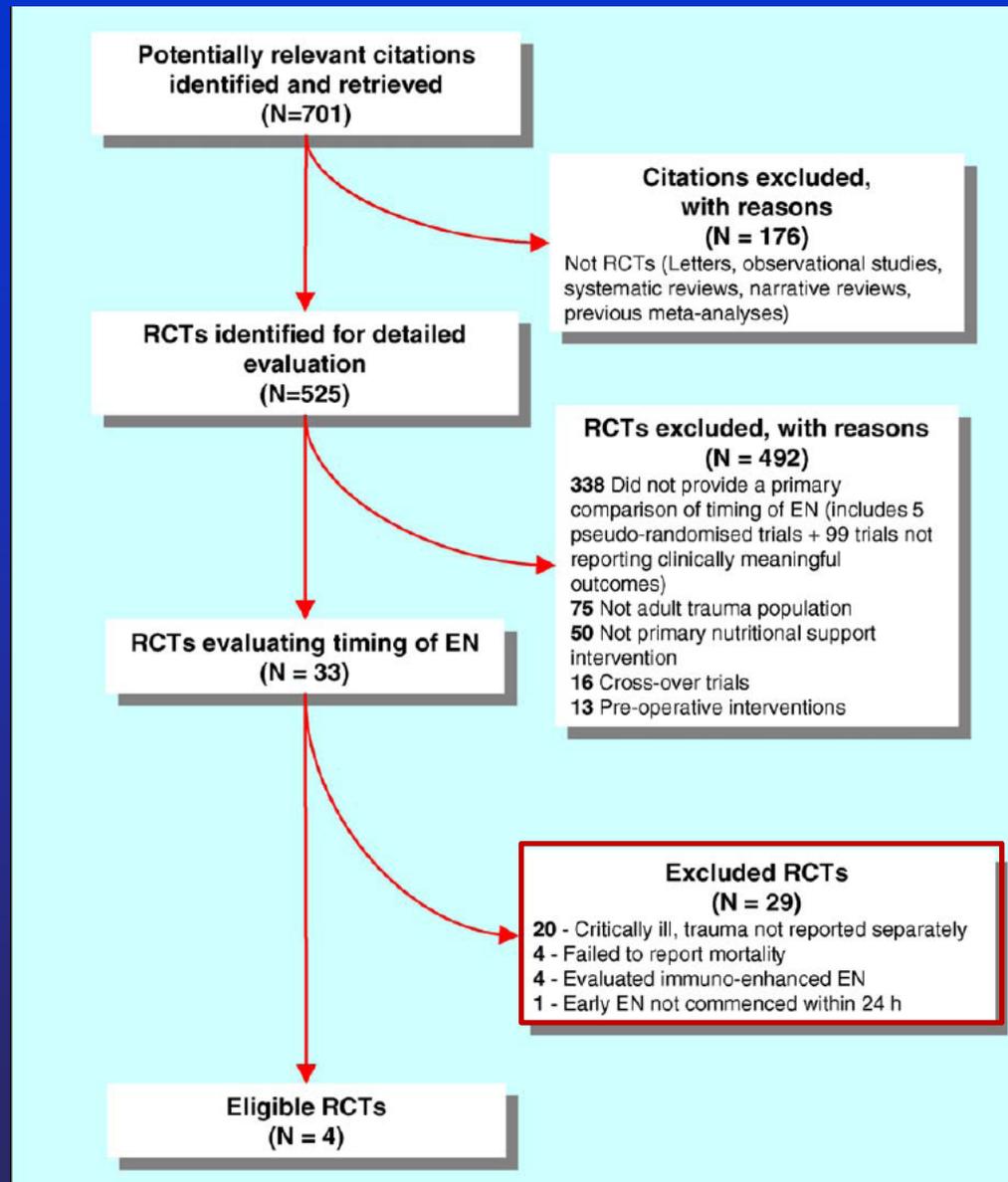
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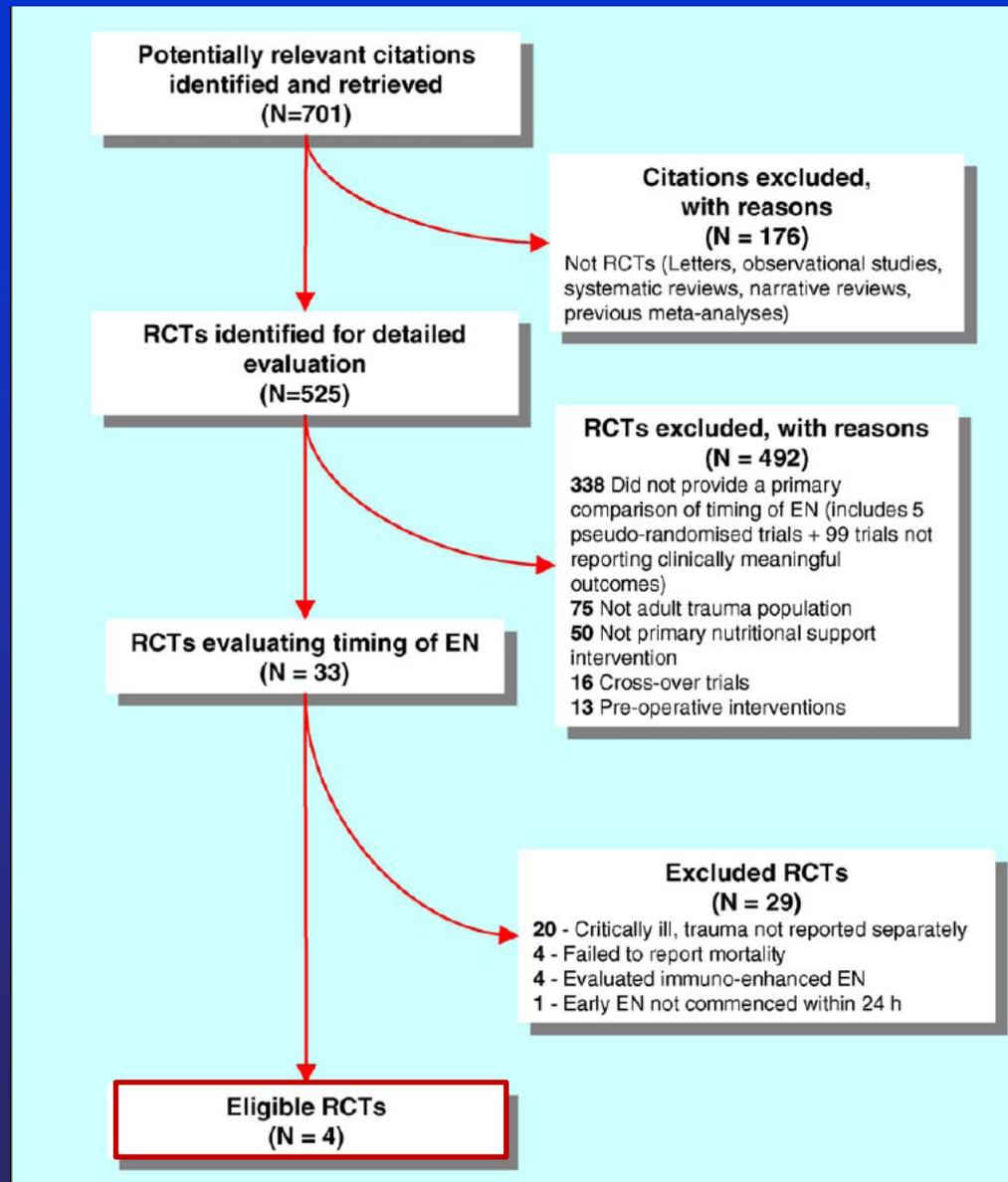
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Early EN in trauma: Direct evidence

Table 2
Characteristics of eligible studies.

Study	Patient population	Early EN intervention	Control intervention
Chuntrasakul 1996	Severe trauma (ISS >20 and <40) Mean ISS 29 ± 1.5	Immediately after resuscitation or surgery: 30 mls/h 3/4 strength EN (Traumacal™) via NGT, concentration increased over time. Goals estimated using modified Harris-Benedict equation. TPN was added if goals were not met	5% dextrose/NSS for maintenance. Oral intake commenced upon return of bowel sounds
Kompan 1999	Multiple trauma (ISS > 25) Mean ISS 33.6 ± 10 Mean APACHE II 11.5 ± 5.8	Immediately after resuscitation: EN (Jevity™) 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. <i>Note:</i> 50% of goal received via TPN for first 24 h before EN was begun
Kompan 2004	Multiple trauma (ISS > 20) Mean APACHE II 11.3 ± 4.8	Immediately after resuscitation: Same protocol as Kompan 1999 except goal set at an average of 25 nonprotein kcal/kg	Same protocol as Early EN except EN begun 38.5 ± 15.6 h after trauma. <i>Note:</i> 50% of goal received via TPN for first 24 h before EN was begun
Moore 1986	Major abdominal trauma (ATI > 15)	Within 12–18 h of surgery: EN (Vivonex HN at 1/4 strength) via NJT at 50 ml/h. Rate and concentration increased at 8 h intervals to target (full strength solution 125ml/h) at 72 h	5% dextrose (approx. 100 g/day) during first 5 days post-op and then TPN if not tolerating oral diet at that time

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Early EN in trauma: Direct evidence

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 - *We do not know which group these 12 patients were randomised to.*
 - *Excessive loss to follow-up is a major validity flaw.*

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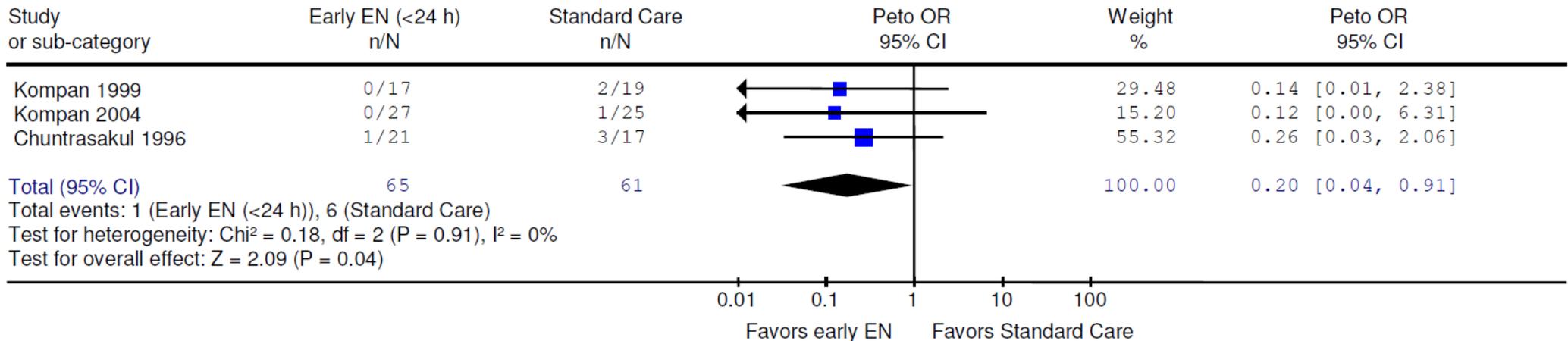
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Primary analysis: RCTs without major flaws

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



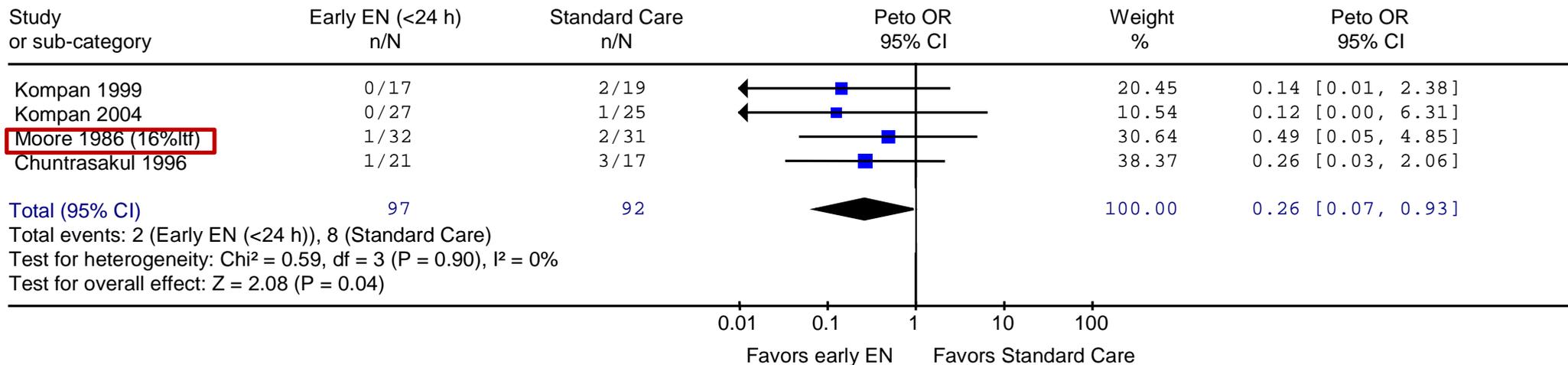
Mortality reduced by 8.3%, $p=0.04$

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Sensitivity analysis: Including Moore et al.

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 Outcome: 01 Mortality, Sensitivity Analysis



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Early EN in trauma: Direct evidence

- Early EN also resulted in:
 - Reduced incidence of pneumonia (33% eEN vs 64%, $p=0.050$)
 - 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.



Early EN in Upper GI Sx: Indirect evidence



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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

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 - Wound infections (7.1% eEN vs 9.3%, $p=0.26$)
 - 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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A special case: The Open Abdomen

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Feeding the Open Abdomen: Dogma?

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Feeding the Open Abdomen: Dogma?

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- Fear of increasing bowel distension, making it harder for the surgeon to obtain fascial closure.

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- Fear of inducing small bowel necrosis by stressing an underperfused bowel.
- Fear of increasing bowel distension, making it harder for the surgeon to obtain fascial closure.

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



Should we fear enteral nutrition?



Should we fear 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.



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
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49% (292/597) had full thickness bowel injuries, with direct repair, anastomosis or colostomy performed

39% (232/597) received EN *before first attempt at closure of the abdomen*



Should we fear enteral nutrition?

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

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Should we fear enteral nutrition?

- Intention to treat analysis *for all 597 patients.*
- Controlling for hospital, ISS, mechanism of injury, closure at second laparotomy, total 24-hr infused volume and presence of bowel injury, patients who received EN before first attempt at closure experienced:

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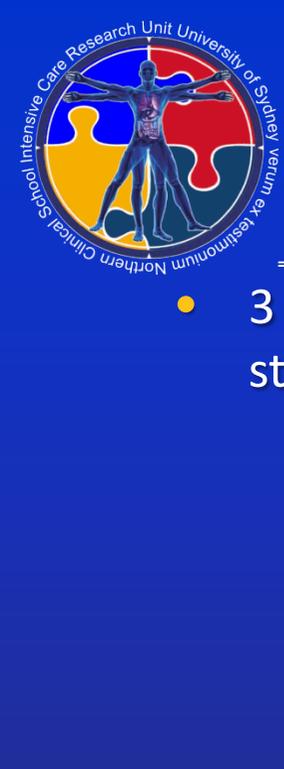
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 - Significantly higher ultimate fascial closure rates (OR 2.1, $p < 0.01$);
 - There was no difference in complication rates (OR 0.9, $p = 0.68$) and;
 - Significantly lower mortality (OR 0.4, $p = 0.01$).



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- Intention to treat analysis *for all 597 patients.*
- Controlling for hospital, ISS, mechanism of injury, closure at second laparotomy, total 24-hr infused volume and presence of bowel injury, patients who received EN before first attempt at closure experienced:
 - Significantly higher ultimate fascial closure rates (OR 2.1, $p < 0.01$);
 - There was no difference in complication rates (OR 0.9, $p = 0.68$) and;
 - Significantly lower mortality (OR 0.4, $p = 0.01$).

Receiving EN before first attempt at closure resulted in significant improvements in outcome.



Should we fear enteral nutrition?

- 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.

Collier B, Guillaumondegui O, Cotton B et al. Feeding the open abdomen. *JPEN* 2007;31(5):410-415.

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Should we fear enteral nutrition?

- 3 other smaller observational studies in open abdomen patients, comparing EN started prior to fascial closure with delayed nutrition
- Compared with delayed feeding, EN started prior to fascial closure was associated with:
 - Reduced rates of pneumonia
 - Higher rates of primary fascia closure
 - Lower rates of fistula
 - Lower total hospital charges

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Should we fear enteral nutrition?

- 3 other smaller observational studies in open abdomen patients, comparing EN started prior to fascial closure with delayed nutrition
- Compared with delayed feeding, EN started prior to fascial closure was associated with:
 - Reduced rates of pneumonia
 - Higher rates of primary fascia closure
 - Lower rates of fistula
 - Lower total hospital charges

There were no reported adverse events with the use of EN started prior to fascial closure

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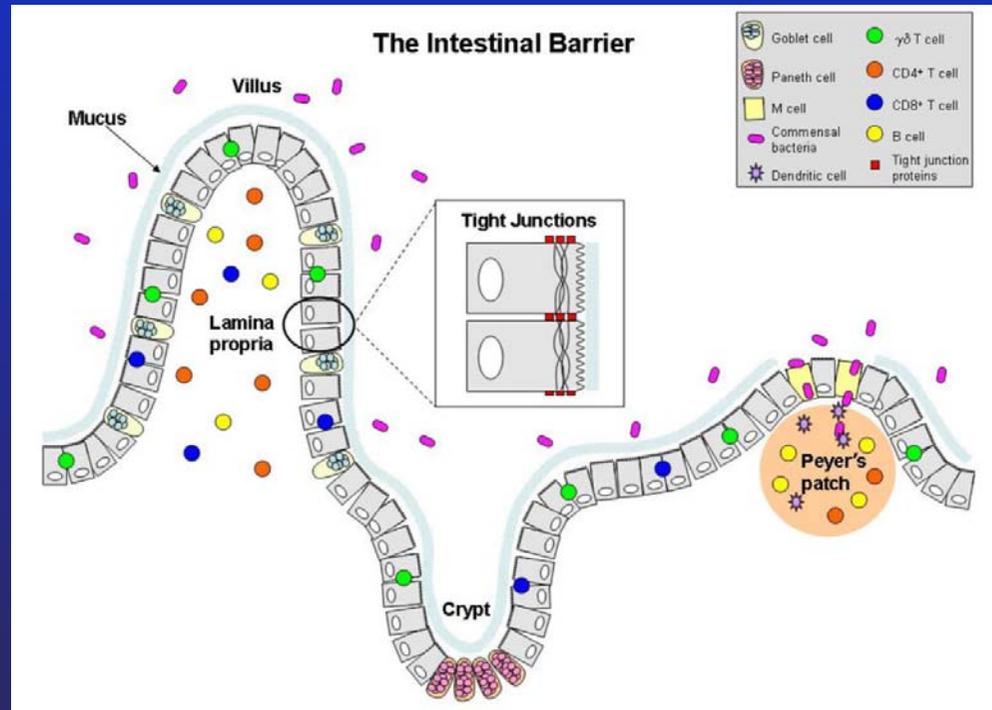
This process leads to increased nutrient needs, which begins early and may persist throughout recovery and rehabilitation.



The gut as the motor of MODs

With the onset of shock and critical illness:

- Loss of functional and structural integrity of the intestinal epithelium.



Clark JA and Coopersmith CM. Intestinal crosstalk – a new paradigm for understanding the gut as the “motor” of critical illness. *Shock* 2007;28(4):384-393.



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- Gut stasis, bacterial overgrowth *and* loss of structural integrity leads to bacterial translocation (*even more* bacterial cross intestinal barrier!!!).
- Gut neutrophils become 'primed' and release cytokines into lymphatic drainage and also may travel to distant sites
 - Increases overall oxidative stress, predisposing to infection and MODs

Summary





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- **Direct evidence** (RCTs in Trauma patients), **indirect evidence** (RCTs in upper GI Sx), **observational studies** and **physiology** supports *the benefits of early EN for trauma patients*



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Early EN in trauma: Direct evidence

Table 2
Characteristics of eligible studies.

Study	Patient population	Early EN intervention	Control intervention
Chuntrasakul 1996	Severe trauma (ISS >20 and <40) Mean ISS 29 ± 1.5	Immediately after resuscitation or surgery: 30 mls/h 3/4 strength EN (Traumacal™) via NGT, concentration increased over time. Goals estimated using modified Harris-Benedict equation. TPN was added if goals were not met	5% dextrose/NSS for maintenance. Oral intake commenced upon return of bowel sounds
Kompan 1999	Multiple trauma (ISS > 25) Mean ISS 33.6 ± 10 Mean APACHE II 11.5 ± 5.8	Immediately after resuscitation: EN (Jevity™) 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. <i>Note:</i> 50% of goal received via TPN for first 24 h before EN was begun
Kompan 2004	Multiple trauma (ISS > 20) Mean APACHE II 11.3 ± 4.8	Immediately after resuscitation: Same protocol as Kompan 1999 except goal set at an average of 25 nonprotein kcal/kg	Same protocol as Early EN except EN begun 38.5 ± 15.6 h after trauma. <i>Note:</i> 50% of goal received via TPN for first 24 h before EN was begun
Moore 1986	Major abdominal trauma (ATI > 15)	Within 12–18 h of surgery: EN (Vivonex HN at 1/4 strength) via NJT at 50 ml/h. Rate and concentration increased at 8 h intervals to target (full strength solution 125ml/h) at 72 h	5% dextrose (approx. 100 g/day) during first 5 days post-op and then TPN if not tolerating oral diet at that time

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- Role of Parenteral Nutrition
 - Patients with contraindications to early EN may benefit from early PN.
 - PN does *not* increase infectious complications.

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Key papers

MAJ (P) James D. Frizzi, MC, USA, MAJ Peter D. Ray, MC, USAR, and CAPT John B. Raff, MC, USNR. Enteral Nutrition by a Forward Surgical Team in Afghanistan. *Southern Medical Journal* 2005;98(3):273-278.

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Original Article

Enteral Nutrition by a Forward Surgical Team in Afghanistan

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Objectives: The modern practice of trauma surgery is a global physiologic approach to caring for the injured patient. Included in that approach is consideration of the traumatized patient's nutritional needs and implementing early enteral feeding. This is routine practice in the United States but logistically impractical when using commercial enteral feeding formulas in the austere environment of a Forward Operating Base in Afghanistan.

hospitals, now is pushed forward to the edge of the battlefield to augmented Forward Surgical Teams (FSTs). At the FST facility, the injured receive urgent surgical and/or orthopaedic care to preserve life, limb, or eyesight. Traditionally, the wounded soldier is treated by the FST only to control bleeding and contamination of his wounds, then is immediately evacuated to a higher-echelon facility en route to the conti-



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Key Points

- Feeding access can be safely placed in a Forward Surgical Team facility.
- Reasonable enteral nutrition formulas for US soldiers can be assembled from available foods on a Forward Operating Base.
- Properly selected local food can be formulated into an equivalent enteral feed for local nationals treated at US military facilities.

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