5.1 Strategies to Optimize Delivery and Minimize Risks of EN: Feeding Protocols March 2013

There were no new randomized controlled trials since the 2009 update and hence there are no changes to the following Summary of Evidence.

Recommendation: *Based on 1 level 2 study and 2 cluster randomized controlled trials, an evidence based feeding protocol that incorporates prokinetics at initiation and a higher gastric residual volume (250 mls) and the use of post pyloric feeding tubes, should be considered as a strategy to optimize delivery of enteral nutrition in critically ill adult patients.*

Discussion: There were 3 trials that demonstrated an improvement in nutritional outcomes (i.e. residual volumes, time to reach goal rate of EN, etc) with the use of a feeding protocol. It is uncertain whether this translates into an improvement in clinical outcomes since in one cluster trial, a moderately large reduction in mortality was observed, whereas a lack of treatment effect was observed in the other. Given the signals from several observational studies of protocols [1, 2, 3] of improving the delivery of enteral nutrition and the favourable safety, feasibility considerations and low cost, the committee decided that the use of a feeding protocol that incorporates prokinetics, higher gastric residual volumes and small bowel feeding, be considered as a strategy to optimize nutritional intake.

(1) Mackenzie SL et al. Implementation of a nutrition support protocol increases the proportion of mechanically ventilated patients reaching enteral nutrition targets in the adult intensive care unit. JPEN 2005 29(2):74-80.
(2) Barr J, Hecht M, Flavin KE et al. Outcomes in critically ill patients before and after the implementation of an evidence-based nutritional management protocol. Chest. 2004 Apr;125(4):1446-57.
(3) Kozar RA, McQuiggan MM, Moore EE, Kudsk KA, Jurkovich GJ, Moore FA. Postinjury enteral tolerance is reliably achieved by a standardized protocol. J Surg Res. 2002 May 1;104(1):70-5.

Semi Quantitative Scoring

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	2
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 represented standard of care (large dissimilarities = 1, minor dissimilarities=2, usual care=3)	1
Biological plausibility	Consistent with understanding of mechanistic and previous clinical work (large inconsistencies =1, minimal inconsistencies =2, very consistent =3)	3
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, heterogenous patients, diverse practice settings =3.	2
Low cost	Estimated cost of implementing the intervention listed--a higher score indicates a lower cost to implement the intervention in an average ICU	3
Feasible	Ease of implementing the intervention listed--a higher score indicates greater ease of implementing the intervention in an average ICU	3
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	2

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Question: Does the use of a feeding protocol result in better outcomes in the critically ill adult patient?

Summary of evidence: There was one level two study that compared outcomes of a feeding protocol with a higher gastric residual volume threshold (250 mls) plus mandatory prokinetics to a feeding protocol with a lower gastric residual volume threshold (150 mls) (Pinilla 2001). In addition, two cluster randomized controlled trials evaluated the effect of a enhanced feeding protocol as one of several interventions geared towards optimizing nutrition (Martin 2004, Doig 2008). In both the cluster randomized controlled trials, the effect of evidence based nutrition algorithms (plus an educational intervention) geared at improving nutrition on patient outcomes was tested. These algorithms assessed gastrointestinal tolerance and promoted the use of prokinetics, post pyloric feeding tubes and supplemental parenteral nutrition to meet at least 80% caloric goal.

Mortality: Only one study reported on mortality (Martin 2004) and there was a trend towards a reduction in hospital mortality in the ICUs that received the evidence based algorithms/education (p=0.058), whereas no such difference was observed in the Doig 2008 cluster trial. Given the disparate nature of the studies, a meta-analysis was not done.

Infections: The incidence of infections did not differ between groups in the study that reported on this outcome (Pinilla 2001).

LOS and Ventilator days: In both the cluster randomized controlled trials, no differences in ICU length of stay was observed, however, the hospital length of stay was significantly lower in the ICUs that received the evidence based algorithms/education in one trial (p=0.003, Martin 2004).

Other outcomes: In the study by Pinilla et al, there was a lower number of elevated gastric residual aspirations in the group that received the protocol with higher residual volume threshold + prokinetics ($p<0.005$). There was a trend towards less time taken to reach goal rate of feeding in the group that received the protocol with a higher gastric residual volume threshold + prokinetics ($p <0.09$). The time from ICU admission to start of enteral nutrition was lower in the ICUs that were randomized to the algorithm group (p=0.17) in the cluster randomized trial. The # days 100% goal calories were met was higher in the ICUs that were randomized to the practice change group in the Doig study (p=0.03). The time from ICU admission to start of enteral nutrition was lower in the ICUs that were randomized to the algorithm group/practice change group in both cluster trials (Martin 2004 p=0.17, Doig 2008 $p<0.001$).

Conclusions:

1) Feeding protocols/algorithms with prokinetics, post-pyloric tubes may be associated with a trend towards a reduction in hospital mortality and a significant reduction in hospital length of stay.

2) Feeding protocols with prokinetics and a higher gastric residual volume threshold (250 mls) are associated with a trend towards a reduction in gastric residual aspirations and less time taken to reach goal feeding rate in the critically ill.

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 feeding protocols in critically ill patients

Study	Population	Methods (score)	Intervention	Mortality # (%)		Infections # (%)‡	
				High RV	Low RV	High RV	Low Rv
1) Pinilla 2001	Mixed ICU's N = 96	C.Random: not sure ITT: yes Blinding:no (9)	Feeding protocol with a higher gastric RV threshold (250 mls) + prokinetics vs feeding protocol with lower RV (150 mls)	NR	NR	1/44 (2)	0/36 (0)
2) Martin 2004	Cluster RCT of 14 mixed ICU's N = 492	C.Random: no ITT: no Blinding:no (5)	Nutrition algorithms with prokinetics+post pyloric feeding+ supplemental parenteral nutrition to meet at least 80% caloric goal vs. none	Algorithms 72/269 (27)	No Algorithms 82/223 (37)	NR	NR
3) Doig 2008	Cluster RCT of 27 ICUs. Patients expected to remain in ICU >2 days N = 1118	C.Random: yes ITT: yes Blinding: no (8)	Development of evidence-based guideline + implementation of a practice-change strategy composed of 18 specific interventions vs. Site monitoring + data collection only	Hospital 172/561 (28.9) ICU 137/561 (24.5)	Hospital 153/557 (27.4) ICU 121/561 (21.5)	NR	NR

Table 1. Randomized studies evaluating feeding protocols in critically ill patients (continued)

Study	LOS (days)		Nutritional and other Outcomes	
	High RV	Low RV	High RV	Low RV
1) Pinilla 2001	ICU 9.5 ± 6.4 (44)	ICU 13.2 ± 18.3 (36)	Hours to reach goal rate 15 ± 10 % nutritional needs met 76 ± 18 intolerances 20/44 (45) High GRV aspirations 10/44 (23)	22 ± 22 70 ± 25 21/36 (58) 19/36 (53)

2) Martin 2004	Algorithms Hospital 25 ICU 10.9	No algorithms Hospital 35 ICU 11.8	Algorithms No algorithms Days from ICU admit to start of EN 1.61 2.16 Days to 80% goal rate of EN 4.80 5.10 Calorie intake per patient day (cals) 1269 1002
3) Doig 2008	ICU 9.1 (8.2 - 10.1) Hospital 24.2 (22.2 - 26.8)	ICU 9.9 (8.9 - 11.1) Hospital 24.3 (22.3 - 26.4)	Time (days) from ICU admission to EN or PN (mean) 0.75 (0.64 - 0.87) 1.37 (1.17 - 1.60) Energy (kcal) intake (mean) 1241 (1121 - 1374) 1065 (961 - 1179) Protein (g) intake (mean) 50.1 (45.4 - 55.3) 44.2 (40.0 - 48.9) 100% Goal of kcal intake (days) 6.1 (5.6 - 6.65) 5.02 (4.61 - 5.48)

C.Random: concealed randomization
ITT: intent to treat
RV: residual volume
GRV: gastric residual volume
Ventilator days: not reported

± ( ) : mean ± Standard deviation (number)
‡ refers to the # of patients with infections unless specified
NA: not available
** RR= relative risk, CI= Confidence intervals