

4.4 Composition of Enteral Nutrition: pH

January 31st, 2009

Recommendation:

There are insufficient data to make a recommendation regarding the use of low pH feeds in critically ill patients.

Discussion: The committee noted the paucity of data on efficacy i.e. the lack of a demonstrable treatment effect from the 3 studies despite high internal validity. The committee was also concerned about the potential for harm and feasibility concerns with acidified feeds.

Values	Definition	Score 0, 1, 2 or 3
Effect size	Magnitude of the absolute risk reduction attributable to the intervention listed--a higher score indicates a larger effect size	0
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	0
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	3
Homogeneity or Reproducibility	Similar direction of findings among trials--a higher score indicates greater similarity of direction of findings among trials	1
Adequacy of control group	Extent to which the control group represented standard of care (large dissimilarities = 1, minor dissimilarities=2, usual care=3)	3
Biological plausibility	Consistent with understanding of mechanistic and previous clinical work (large inconsistencies =1, minimal inconsistencies =2, very consistent =3)	2
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, heterogeneous patients, diverse practice settings =3.	2
Cost	Estimated cost of implementing the intervention listed--a higher score indicates a lower cost to implement the intervention in an average ICU	2
Feasible	Ease of implementing the intervention listed--a higher score indicates greater ease of implementing the intervention in an average ICU	1
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	1

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Question: Do acidified feeds (low pH) compared to standard feeds result in better outcomes in the critically ill adult patient?

Summary of evidence: There were 3 level 2 studies that were reviewed. In one recent study (Kruger 2006), there were two acidified feeds groups i.e. pH 3.5 and 4.8 that were compared to the standard formula (pH 6.8).

Mortality: One study (Heyland 1999) found that acidified feeds were associated with a trend towards an increase in mortality ($p = 0.10$), whereas there were no differences in mortality between the groups in the other two studies (Tulamiat 2005 and Kruger 2006).

Infections: There were no difference in infections between the groups in one study (Tulamiat 2005 $p = 0.7$) and a trend towards a reduction in infections was seen in the patients receiving the acidified feeds (Heyland RR 0.40, $p = 0.19$).

LOS and Ventilator days: There were no differences between the groups in the two studies that reported on these outcomes (Heyland, Kruger 2006)

Other complications: There was no difference in the incidence of GI bleeds between groups in any of the three studies.

Conclusions:

- 1) Low pH feeds, when compared to standard formula, have no effect on clinical outcomes in the critically ill adult.

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 acidified feeds in critically ill patients

Study	Population	Methods (score)	Intervention	Mortality # (%)†		Infections # (%)‡		LOS days		Ventilator days		Other	
				Acid feeds	Standard	Acid feeds	Standard	Acid feeds	Standard	Acid feed	Standard	Acid feeds	Standard
1) Heyland 1999	Critically ill ventilated patients from 8 ICUs N = 120	C.Random: yes ITT: no Blinding: double (12)	Acidified feeds, vital HN + HCL pH 3.5 vs standard feeds, Vital HN (pH 6.5)	15/49 (31)	7/26 (15)	3/49 (6)	7/46 (15)	3.0	12.0	7.8	8.5	GI bleeds 2/49 (4) 0/46 (0)	
2) Tulamait 2005	Patients recovering from prolonged ventilation N = 30	C.Random: yes ITT: no Blinding: double (10)	Acidified feeds, pH 4.5 (added potassium sorbate) vs standard feeds	1/16 (6)	2/13 (15)	3/16 (19)	1/13 (8)	NR	NR	NR	NR	GI bleeds 0/16 (0) 1/14 (7)	
3) Kruger unpublished 2006*	Patients from 4 mixed ICUs N = 67	C.Random: not sure ITT: yes Blinding: double (10)	Acidified feeds pH 3.5 vs. 4.5 vs. 6.8 (standard) Isocaloric, isonitrogenous	ICU pH 3.5 group 2/23 (9) pH 4.5 group 1/23 (4) pH 6.8 group 1/21 (4)		NR		ICU pH 3.5 group 7.5 ± 5.4 pH 4.5 group 8.2 ± 4.5 pH 6.8 group 9.3 ± 3.9		NR		GI bleeds pH 3.5 group 0/23 pH 4.5 group 0/23 pH 6.8 group 0/21 Gastric colonization and contamination of feeding delivery system was significantly lower in the acidified group	

C.Random: concealed randomization

ITT: Intent to treat

NR: Not reported

** RR= relative risk, CI= Confidence intervals

† presumed ICU mortality unless otherwise specified

‡ refers to the # of patients with infections unless specified

* data obtained from author

TOPIC: 4.3 Composition of EN: pH

Article inclusion log

Criteria for study selection

Type of study: RCT or Meta-analysis
Population: critically ill, ventilated patients (no elective surgery patients)
Intervention: EN
Outcomes: mortality, LOS, QOL, functional recovery, complications, cost. Exclude studies with only biochemical, metabolic or nutritional outcomes.

	Author	Journal	I	E	Why Rejected
1	Spilker	Chest 1996		√	Not RCT
2	Heyland	Crit Care Med 1999	√		
3	Kruger	ESPEN Congress 2006	√		
4	Tulamait	J Crit Care 2005	√		

I = included, E = excluded

Reference List

1. Spilker CA, Hinthorn DR, Pingleton SK. Intermittent enteral feeding in mechanically ventilated patients. The effect on gastric pH and gastric cultures. *Chest* 1996;110(1):243-8.
2. Heyland DK, Cook DJ, Schoenfeld PS, Frietag A, Varon J, Wood G. The effect of acidified enteral feeds on gastric colonization in critically ill patients: results of a multicenter randomized trial. Canadian Critical Care Trials Group. *Crit Care Med.* 1999 Nov;27(11):2399-406.
3. Kruger J-M, Demetre L, Cate F, Barclay D. The effect of acidified enteral formulae on microbial gastric and tracheal colonization and contamination of the enteral feeding delivery system in the intensive care unit. Poster presentation at ESPEN Congress 2006, Turkey.
4. Tulaimat A, Laghi F, Mikrut K, Carey RB, Budinger GR. Potassium sorbate reduces gastric colonization in patients receiving mechanical ventilation. *J Crit Care.* 2005 Sep;20(3):281-7.