

5.3 Strategies to optimize delivery and minimize risks of EN: Small bowel feeding vs. Gastric

June 28th, 2005

Recommendation:

Based on 11 level 2 studies, small bowel feeding compared to gastric feeding maybe associated with a reduction in pneumonia in critically ill patients. In units where small bowel access is feasible, we recommend the routine use of small bowel feedings. In units where obtaining access involves more logistical difficulties, small bowel feedings should be considered for patients at high risk for intolerance to EN (on inotropes, continuous infusion of sedatives, or paralytic agents, or patients with high nasogastric drainage) or at high risk for regurgitation and aspiration (nursed in supine position). Finally, where obtaining small bowel access is not feasible (no access to fluroscopy or endoscopy and blind techniques not reliable), small bowel feedings should be considered for those select patients that repeatedly demonstrate high gastric residuals and are not tolerating adequate amounts of EN intragastrically.

Discussion: The committee noted an overall modest effect size with respect to pneumonia with wide confidence intervals amongst studies that were heterogenous. There were also concerns expressed around implementation of small bowel feeding and the associated costs, which are institution dependent . In other words, the cost-benefit ratio would vary from institution to institution and the recommendation needed to reflect this fact. The committee also noted that the data on improved nutritional endpoints was favourable and it was decided that a recommendation be made that incorporated these improvements in nutritional intake.

Value	definition	Score: 0, +, ++, +++
Effect size	magnitude of the absolute risk reduction attributable to the intervention listed--a higher score indicates a larger effect size	2+ (pneumonia)
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	2+ with Taylor 1+ without Taylor
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 VAP--a higher score indicates presence of more of these features in the trials appraised	2+
Homogeneity	similar direction of findings among trials--a higher score indicates greater similarity of direction of findings among trials	1+
Low 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+ depending upon technique
Safe	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+

5.3 Topic: Strategies to optimize benefits and minimize risks of EN: Small Bowel feeding vs. Gastric

June 28th, 2005

Question: Does enteral feeding via the small bowel compared to gastric feeding result in better outcomes in the critically ill adult patient?

Summary of evidence: There were eleven randomized trials that were reviewed, all of which were level 2 studies. In the Taylor et al study, only 34 % of the patients achieved small bowel access in this study (large number of protocol violations) and hence the meta-analysis was done with and without this study. Minard et al compared outcomes in patients receiving early immune enhanced enteral nutrition via the small bowel to those receiving delayed immune enhanced enteral nutrition via the gastric route. A meta-analysis on the time dependent variables (LOS) was done with and without the Minard study.

Mortality: Based on the 9 studies that reported on mortality, no significant differences between the groups were found (RR 0.93, 0.72-1.20, $p = 0.6$) (see page 5-18). When the Taylor et al study was excluded, the relative risk did not change.

Infections: Based on the 9 studies that reported on infections, the meta-analysis showed that small bowel feeding was associated with a significant reduction in infections (RR 0.77, 0.60-1.00, $p = 0.05$) when compared to gastric feeding. The study by Taylor et al contributes greatly to the results of this meta-analysis and when the meta-analysis was done without the Taylor study, the statistical significance of reduction in infections outcomes with small bowel feeding disappeared (RR 0.83, $p = 0.3$). Refer to figures on page 5-17.

LOS: Based on the 5 studies that reported the LOS, a trend towards a reduction in ICU LOS with gastric feeding (standardized mean difference 0.68, -0.26-1.61, $p = 0.16$) was seen (see page 5-19). The presence of significant statistical heterogeneity weakens this estimate. When the Minard study was excluded from the analysis, this weak trend disappeared (RR 0.62, -0.50, 1.73, $p = 0.3$).

Ventilator days: Only reported in 1 study and no difference in ventilator days between groups receiving small bowel feeding vs gastric was noted (Montecalvo).

Other complications: Only a few studies reported on other issues, such as vomiting, diarrhea and abdominal bloating. There was no difference between interventions. The studies that reported nutritional delivery generally showed better success at meeting goal targets and reaching them sooner. However, this was confounded because of different gastric feeding strategies. The group that had a more aggressive feeding regimen and small bowel feeding (Taylor) had fewer major complications and a better neurological outcome at 3 months than the group receiving gastric feeds.

Conclusions:

- 1) Small bowel feeding, compared to gastric feeding maybe associated with a reduction in pneumonia in critically ill patients.
- 2) No difference in mortality or ventilator days in critically ill patients receiving small bowel vs.gastric feedings.
- 3) Small bowel feeding improves calorie and protein intake and is associated with less time taken to reach target rate of enteral nutrition when compared to gastric feeding.

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 small bowel feeding vs. gastric in critically ill patients

Study	Population	Methods (score)	Intervention	Mortality # (%)†		Pneumonia # (%)‡	
				Small bowel	gastric	Small bowel	gastric
1) ID # 49 Kortbeek 1999	Trauma ISS>16 Vent >48h N = 80	<i>C.Random: yes</i> ITT: yes Blinding: no (11)	Small bowel feeding vs gastric	4/37 (11)	3/43 (7)	10/37 (27)	18/43 (42)
2) ID # 50 Montecalvo 1992	Med/Surg ICU Anticipated feed >3days N =38	C.Random: not sure ITT: no Blinding: no (8)	Small bowel feeding vs gastric	5/19 (26)	5/19 (26)	4/19 (21)	6/19 (32)
3) ID # 51 Davies 2002	Med/surg/trauma Feed > 3days MV=90%; APACHE-21 N = 73	C.Random: not sure ITT: no Blinding: no (8)	Small bowel feeding vs gastric	4/34 (12)	5/39 (13)	2/31 (6)	1/35 (3)
4) ID # 52 Esparaza 2001	MICU MV = 98% APACHE -25 N = 54	C.Random: not sure ITT: yes Blinding: no (8)	Small bowel feeding vs gastric	10/27 (37)	11/27 (41)	NA	NA
5) ID # 53 Neumann 2002	MICU N = 60	C.Random: not sure ITT: yes Blinding: no (6)	Small bowel feeding vs gastric	NA	NA	1/30 (3) aspiration	0/30 (0) aspiration
6) ID # 55 Kearns 2000	MICU Feed >3days APACHE -21 N = 44	C.Random: not sure ITT: yes Blinding: no (9)	Small bowel feeding vs gastric	5/21 (24)	6/23 (26)	4/21 (19)	3/23 (13)

Table 2. Randomized studies evaluating small bowel feeding vs. gastric in critically ill patients

Study	LOS days		Ventilator days		Nutritional Outcomes		Other	
	Small bowel	gastric	Small bowel	gastric	Small bowel	gastric	Small bowel	gastric
1) ID # 49 Kortbeek 1999	10 (3-24) ICU 30 (16-47) hospital	7 (3-32) ICU 25 (9-88) hospital	9 (2-13)	5 (3-15)	Time to tolerate full feeds 34 ± 7.1 hrs 43.8 ± 22.6 hrs		NA	NA
2) ID # 50 Montecalvo 1992	11.7 ± 8.2 (19) ICU	12.3 ± 10.8 (19) ICU	10.2 ± 7.1 (19)	11.4 ± 10.8 (19)	Daily caloric intake (%) 61 ± 17 46.9 ± 25.9		7/19 (37) GI bleed 12/19 (63) diarrhea 3/19 (16) vomiting	6/19 (32) GI bleed 9/19 (47) diarrhea 3/19 (16) vomiting
3) ID # 51 Davies 2002	13.9 ± 1.8 (34) ICU	10.4 ± 1.2 (39) ICU	NA	NA	Time to reach target rate (Mean ± SE) 23.2 ± 3.9 23.0 ± 3.4 Time to start feeds (Mean ± SE) 81.2 ± 13.4 54.5 ± 4.9		3/31 (10) GI bleed 4/31 (13) diarrhea	0/35 (0) GI bleed 3/35 (9) diarrhea
4) ID # 52 Esparaza 2001	NA	NA	NA	NA	Feed days (average) 3.6 4.1 Average daily % of goal 66 64		NA	NA
5) ID # 53 Neumann 2002	NA	NA	NA	NA	Time from initial attempt to start of feeding 27.0 ∨ 22.6 11.2 ∨ 11.0 Time to reach goal rate (from initial placement attempt) 43 ∨ 24.1 28.8 ∨ 15.9 Time to reach goal rate (from successful tube placement) 17.3 ∨ 15.7 17.0 ∨ 11.9		NA	NA
6) ID # 55 Kearns 2000	17 ± 2 (21) ICU 39 ± 10 (21) hospital	16 ± 2 (23) ICU 43 ± 11 (23) hospital	NA	NA	Calories (Kcal/kg/day) 18 ± 1 12 ± 2 Protein (gm/kg/day) 0.7 ± 0.1 0.4 ± 0.1 % REE delivered 69 ± 7 47 ± 7		3 days diarrhea	2 days diarrhea

Table 3. Randomized studies evaluating small bowel feeding vs. gastric in critically ill patients

Study	Population	Methods (score)	Intervention	Mortality # (%)†		Pneumonia # (%)‡	
				Small bowel	gastric	Small bowel	gastric
7) ID # 27 Minard 2000	Trauma GCS 3-10 N = 27	C.Random: not sure ITT: no Blinding: no (7)	Small bowel feeding vs gastric	1/12 (8)	4/15 (27)	6/12 (50)	7/15 (47)
8) ID # 56 Boivin 2001	Med/Surg/Neuro MV-98% Feed >96h APACHE-16 N=80	C.Random: not sure ITT: no Blinding: no (6)	Small bowel feeding vs gastric	18/39 (46)	18/39 (46)	NA	NA
9) ID # 80 Montejo 2002	14 ICU's APACHE ~18 Feed >5days N = 101	C.Random: not sure ITT: yes Blinding: no (6)	Small bowel feeding vs gastric	19/50 (38)	22/51 (43)	16/50 (32)	20/51 (39)
10) ID # 45 Taylor 1999	Head injured ventilated > 10 yrs n = 82	C.Random: not sure ITT: yes Blinding: no (10)	Small bowel feeding vs gastric	5/41(12.2) 6 months	6/41 (14.6) 6 months	18/41 (44) 25/41 (61)	Pneumonia 26/41 (63) total infections 35/41 (85)
11) ID # 90 Day 2001	Neurological ICU APACHE ~ 48 N=25	C.Random: not sure ITT: yes Blinding: no (5)	Small bowel feeding vs gastric	NA	NA	0/14	2/11 (18)

Table 4. Randomized studies evaluating small bowel feeding vs. gastric in critically ill patients

Study	LOS days		Ventilator days		Nutritional Outcomes		Other	
	Small bowel	gastric	Small bowel	gastric	Small bowel	gastric	Small bowel	gastric
7) ID # 27 Minard 2000	18.5 ± 8.8 (12) ICU 30 ± 14.7 (12) hospital	11.3 ± 6.1 (12) ICU 21.3 ± 14.7 (12) hospital	15.1 ± 7.5 (12)	10.4 ± 6.1 (15)	33 ± 15	84 ± 41	11/12 (92) diarrhea 1/12 (8) vomiting	8/15 (53) diarrhea 3/15 (20) vomiting
					1509 ± 45	1174 ± 425		
					13 ± 3.7	8 ± 4.5		
					# patients with > 50 % goal for ≥ 5 days 10/12 (83)	7/15 (47)		
8) ID # 56 Boivin 2001	NA	NA	NA	NA	304 minutes	13 minutes	NA	NA
					Time to goal rate achieved and maintained for 4 hours 33 hours	32 hours		
9) ID # 80 Montejo 2002	15 ± 10 (50) ICU	18 ± 16 (50) ICU	NA	NA	High gastric residuals 1/50 (2)	25/51 (49)	7/50 (14) diarrhea 4/50 (8) vomiting	7/51 (14) diarrhea 2/51 (4) vomiting
					Caloric intake (mean) 1286 ± 344	1237 ± 342		
					Volume ratio at day 7 (%) 80 ± 28	75 ± 30		
10) ID # 45 Taylor 1999	NA	NA	NA	NA	% energy needs met (mean) 59.2	36.8	37 % major complications	61 % major complications
					% nitrogen needs met (mean) 68.7	37.9	61 % had better neurological outcome at 3 months	39 % had better neurological outcome at 3months
11) ID # 90 Day 2001	NA	NA	NA	NA	Calories and protein received were significantly higher only on days 2 and 3 in the gastric group. No difference between the groups on Days 1, 4-10. Replaced tubes 16/14	9/11	7/14 (50) diarrhea	5/11 (45) diarrhea

C.Random: concealed randomization

ITT: intent to treat

† presumed ICU mortality unless otherwise specified

‡ refers to the # of patients with infections unless specified

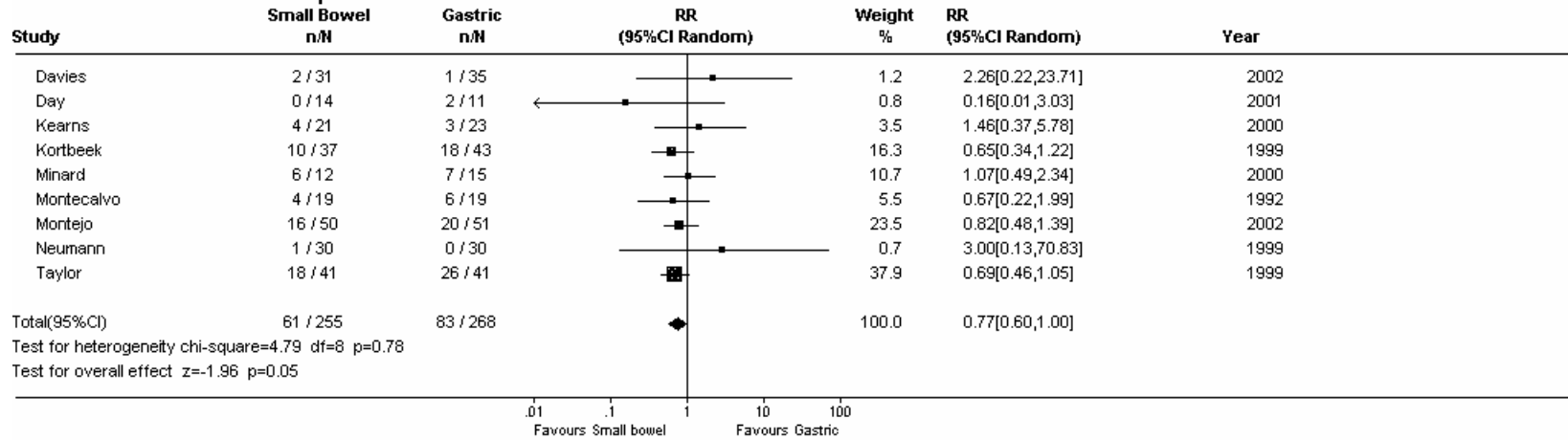
± () : mean ± Standard deviation (number)

(-) : median (range)

NA: not available

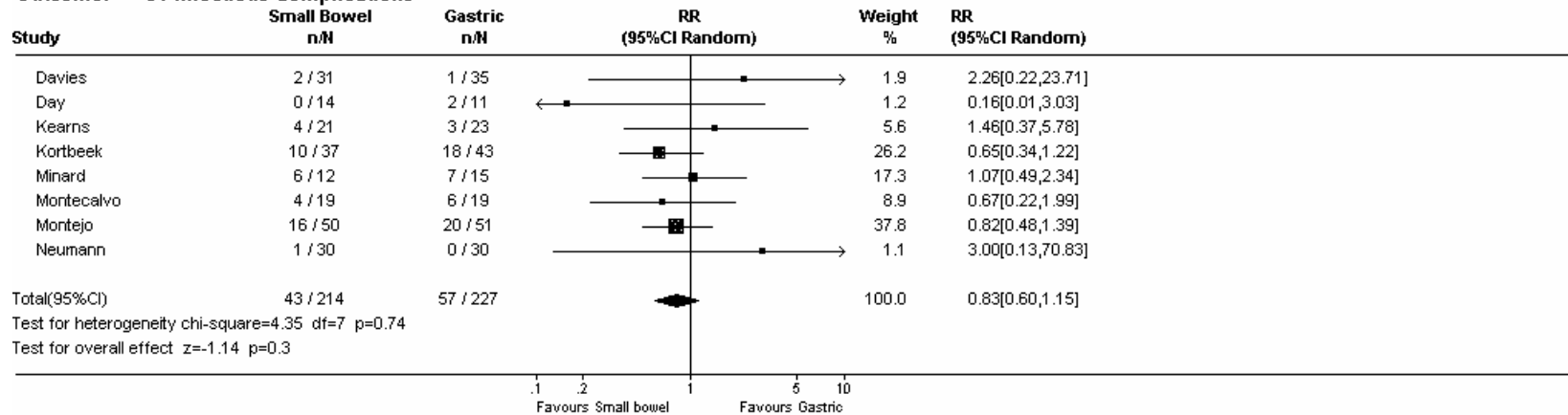
Cost : not reported

Comparison: 01 Small Bowel vs Gastric
Outcome: 01 Infectious Complications

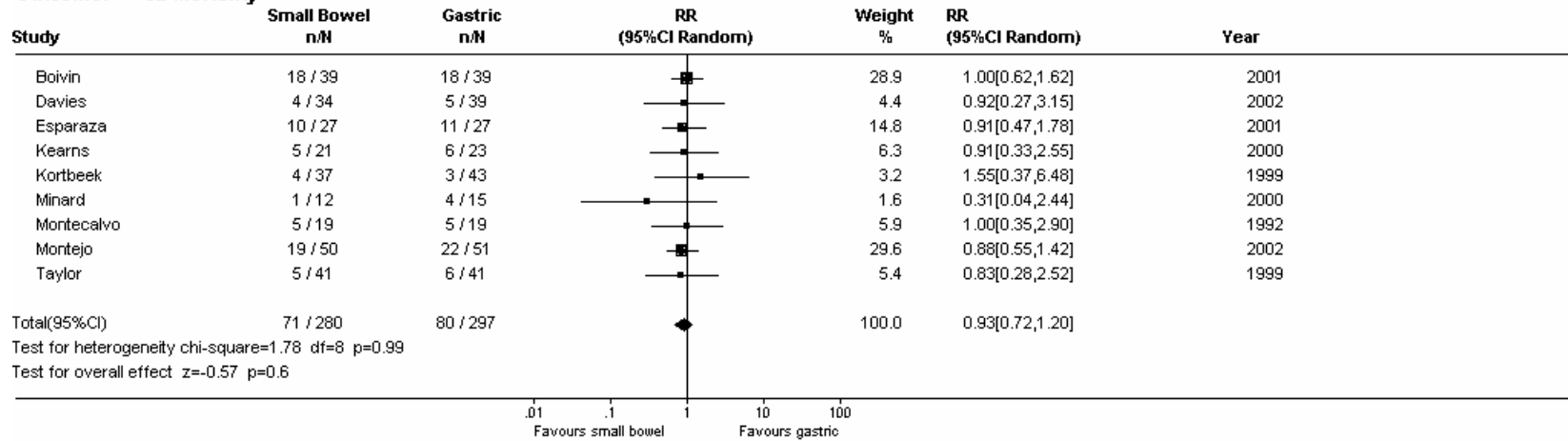


Infections without Taylor

Comparison: 01 Small Bowel vs Gastric
Outcome: 01 Infectious Complications

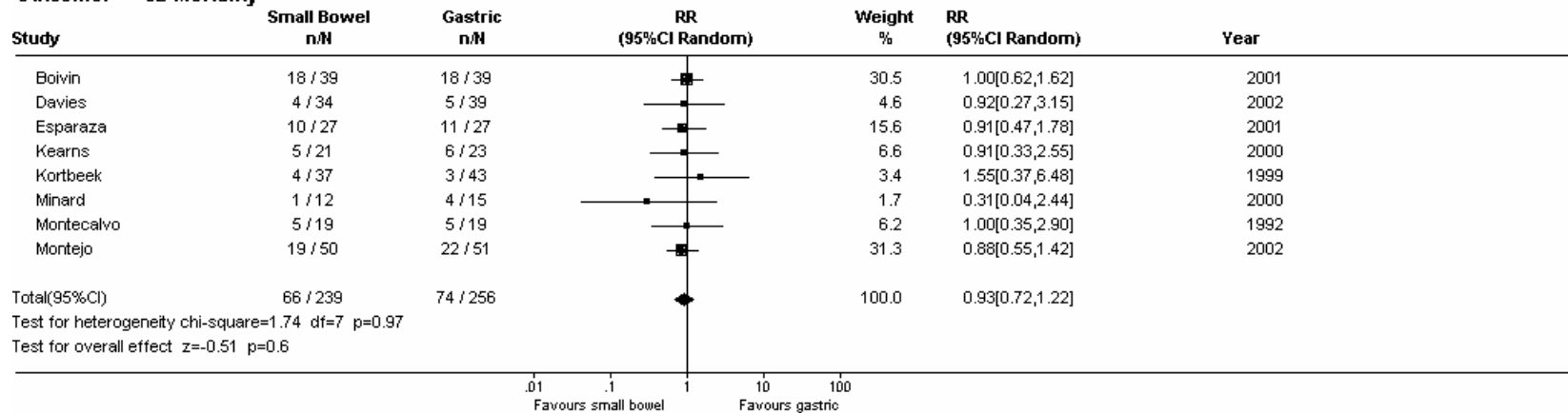


Comparison: 01 Small Bowel vs Gastric
Outcome: 02 Mortality



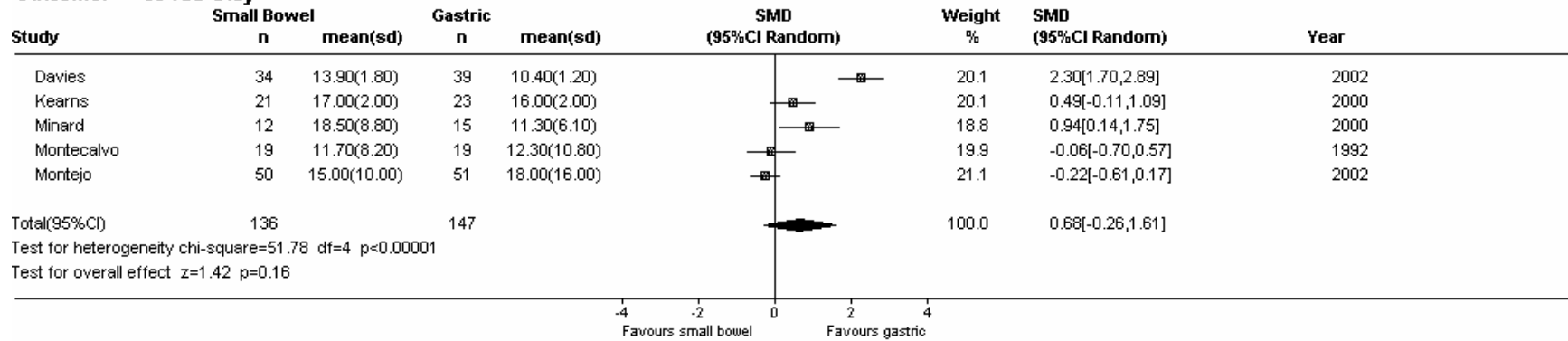
Mortality without Taylor

Comparison: 01 Small Bowel vs Gastric
Outcome: 02 Mortality



Comparison: 01 Small Bowel vs Gastric

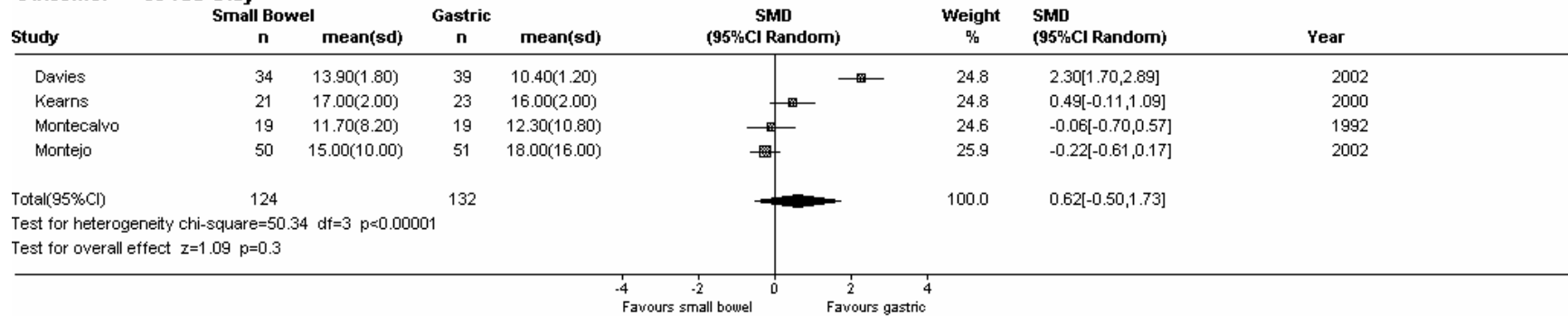
Outcome: 03 ICU Stay



ICU stay without Minard

Comparison: 01 Small Bowel vs Gastric

Outcome: 03 ICU Stay



TOPIC: 5.3 Small Bowel vs. Gastric

(Reviewers: John Drover & Jan Greenwood)

Article inclusion log

Criteria for study selection

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

ID #	Author	Journal	I	E	why rejected
49.	1.	Kortbeek	J Trauma 1999	√	
50.	2.	Montecalvo	CCMedicine 1992	√	
51.	3.	Davies	CCMedicine 2002	√	
52.	4.	Esparaza	Int Care Med 2001	√	
53.	5.	Neumann	CCM 2002	√	
55.	6.	Kearns	CCM 2000	√	
56.	7.	Boivin	CCM 2001	√	
27.	8.	Minard	JPEN 2000	√	
80.	9.	Montejo	CCM 2002	√	
45.	10.	Taylor	CCMedicine 1999	√	
90.	11.	Day	J of Neuroscience 2001	√	
	12.	Strong	JPEN 1992		√ Not ICU patients
	13.	Spain	J Trauma 1995		√ Not RCT
	14.	Heyland	CCMedicine 2001		√ No significant outcomes
	15.	Grahm	Neurosurgery 1989		√ Not RCT (pseudorandomized)

I = included, E = excluded