5.3c Strategies to Optimize the Delivery of EN: Frequency of Gastric Residual Volume Monitoring.

Question: Does less frequent monitoring of gastric residual volumes compared to more frequent result in better outcomes in the critically ill patient?

Summary of evidence: One study by Williams et al 2014 compared the frequency of monitoring GRVs up to every 8 hours to every 4 hours (300 mL threshold for both) while Büyükçoban et el., 2016 compared monitoring GRVs of 200ml q 8 hrs to 100 mL q 4 hrs. Both were single centre, level two studies.

Mortality: There was no difference in hospital mortality between the groups with GRVs monitored up to 8 hrs vs. every 4 hours (Williams 2014). When the data from both the studies on ICU mortality were aggregated, there were no differences between the groups that checked GRVs less frequently or more (RR 1.10, 95% CI, 0.73, 1.66, p=0.64, test for heterogeneity I^2 =8%; figure 1).

Infections: Only one of the studies reported on ventilator associated pneumonia rates and there were no significant differences between the groups that monitored GRVs up to every 8 hours vs. 4 hours (p=0.81, Williams 2014).

LOS & ventilator days: In one study, there were no difference in ICU LOS was observed between the group that monitored GRVs up to every 8 hours vs. 4 hrs (p=0.57, Williams 2014) but there was a trend towards a reduction in hospital LOS in the group that monitored GRVs less frequently (p=0.19). On the other hand, Büyükçoban et al., 2016 reported a trend towards an increase in ICU LOS in the less frequently monitored group (p=0.143).

Other: In the Williams (2014) study, there was significantly less vomiting/regurgitation in the group with GRVs monitored every 4 hours (p=0.02) but no difference was found in interruption to EN due to vomiting (p=0.24), or the number of patients who received >80% of goal EN volume (p=0.39). There was a significant reduction in the number of daily tube aspirations in the group with GRVs every 8 hours (p=<0.001). Büyükçoban et al., 2016 reported no statistical differences in the time to reach goal or the proportion of patients with either diarrhoea only or vomiting only. They did observe a significantly higher number of patients presenting with all gastrointestinal intolerances (diarrhoea and/or vomiting) in the group with less frequent checking of GRVs (200 mL q 8hrs) (p=0.028).

Conclusions:
In critically ill patients receiving enteral nutrition, less frequent checking of gastric residual volumes (q 8 hrs) compared to more frequent (q4 hrs):

1. Has no effect on mortality, VAP or length of stay indices
2. Has no effect on enteral nutrition delivery

3. May be associated with more gastrointestinal intolerance

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 frequency of monitoring gastric residual volumes in critically ill patients

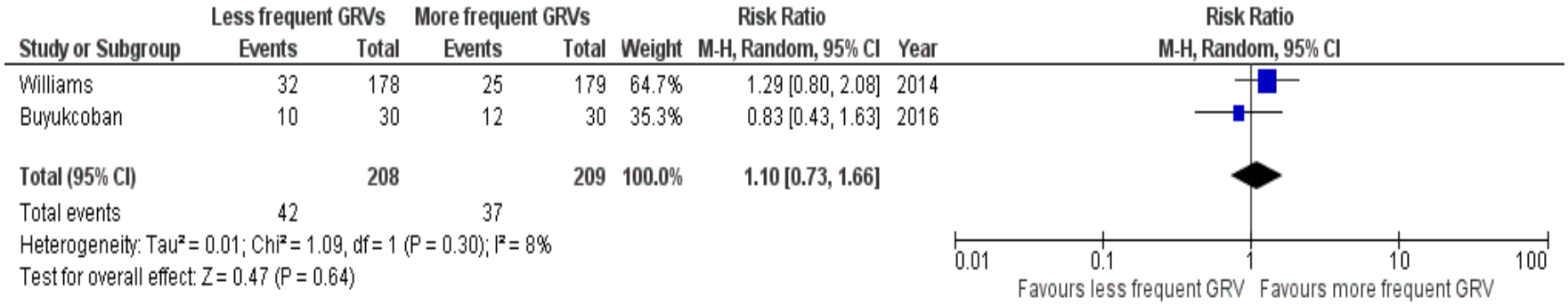
Study	Population	Methods (score)	Intervention	Mortality # (%)†	Infections # (%)‡
1) Williams 2014	Critically ill pts, single centre, LOS expected >48 hrs, EN expected >72 hrs N=357	C.Random: Yes ITT: Yes Blinding: No (9)	Monitoring GRVs for gastric feeds up to every 8 hrs vs every 4 hrs. For both groups, GRVs were returned if the volume was ≤300 mL and for GRV exceeding 300 mL, the first 300 mL was returned to the stomach and the remainder discarded.	**GRVs q8hr** **GRVs q4hr** **ICU** 32/178 (18) 25/179 (14) **Hospital** 39/178 (22) 34/179 (19)	**Pts with VAP** 13.2% 14.1%, p=0.81
2) Büyükçoban 2016	Adult critically ill patients (n=60), single centre, expected to remain on EN for at least 3 consecutive days	C.Random: Yes ITT: No Blinding: No (8)	Monitoring GRVs limit of 200 mLq8 hrs vs. 100 mLq 4 hours	**GRVs 200ml, q8hr** **GRVs 100ml, q4hr** **ICU** 10/30 (33) 12/30 (40); p=NS	**NR**

Table 1. Randomized studies evaluating frequency of monitoring gastric residual volumes in critically ill patients (continued)

Study	Length of Stay	Mechanical Ventilation	Other
1) Williams 2014	**GRVs q8hr** **GRVs q4hr** **ICU** 9 (6-14) 9 (5-15), p=0.57 **Hospital** 23 (12-38) 25 (13-41), p=0.19	NR	**GRVs q8hr** **GRVs q4hr** **Vomiting/regurgitation** 3.6% 2.1%, p=0.02 **EN interruption due to vomiting** 2.1% 1.5%, p=0.24 **Tube aspirations per day** 3.4 (1.3) 5.4 (1.3); p=<0.001 **≥80% EN volume received** 50% of pts 48% of pts, p=0.39
2) Büyükçoban 2016	**GRVs: 200ml, q8hr** **GRVs: 100ml, q4hr** **ICU** 17.8 ± 14.1 12.7 ± 12.4, p=0.143	NR	**GRVs: 200ml, q8hr** **GRVs: 100ml, q4hr** **Time to reach target goal, hrs** 22.1 ± 9.5, 24.5 ± 14.2; p=>0.05 **Time to reach target calories, hrs** 22.1 ± 9.5 21.3 ± 6.3, p 0.44 **Vomiting only** 5/30 (16.6%) 1/30 (3.3%); p=0.211 **Diarrhea only** 3/30 (10%) 2/30 (6.6%) , p=0.305 **Gastrointestinal intolerance (vomiting and/or diarrhea)** 10/30 (33%) 3/30 (10%) , p=0.028

C.Random: concealed randomization
† presumed hospital mortality unless otherwise specified
NR: not reported
GRV: gastric residual volume
ITT: intent to treat; NA: not available
± ( ) : mean ± Standard deviation (number)
ICU: intensive care unit
‡ refers to the # of patients with infections unless specified
RR: relative risk; CI: confidence interval
VAP: ventilator associated pneumonia

Figure 1. ICU Mortality



References

Included Studies

1. Williams TA, Leslie G, Mills L, Leen T, Davies H, Hendron D, Dobb GJ. Frequency of Aspirating Gastric Tubes for Patients Receiving Enteral Nutrition in the ICU: A Randomized Controlled Trial. JPEN J Parenter Enteral Nutr. 2014 Sep;38(7):809-16.

2. Büyükçoban S, Akan M, Koca U, Eğlen MY, Çiçeklioğlu M, Mavioğlu Ö. Comparison of Two Different Enteral Nutrition Protocol in Critically Ill Patients. Turk J Anaesthesiol Reanim. 2016;44(5):265-269. doi:10.5152/TJAR.2016.92499

Excluded Studies	Reasons
1. Taylor SJ, Fettes SB, Jewkes C, Nelson RJ. Prospective, randomized, controlled trial to determine the effect of early enhanced enteral nutrition on clinical outcome in mechanically ventilated patients suffering head injury. Crit Care Med. 1999;27(11):2525-2531. doi:10.1097/00003246-199911000-00033	See 3.2: Target Dose EN
2. Pinilla JC, Samphire J, Arnold C, Liu L, Thiessen B. Comparison of gastrointestinal tolerance to two enteral feeding protocols in critically ill patients: a prospective, randomized controlled trial. JPEN J Parenter Enteral Nutr. 2001;25(2):81-86. doi:10.1177/014860710102500281	See 5.1: Feeding Protocols
3. McClave SA, Lukan JK, Stefater JA, Lowen CC, Looney SW, Matheson PJ, Gleeson K, Spain DA. Poor validity of residual volumes as a marker for risk of aspiration in critically ill patients. Crit Care Med. 2005 Feb;33(2):324-30.	No clinical outcomes
4. Juvé-Udina ME, Valls-Miró C, Carreño-Granero A, et al. To return or to discard? Randomised trial on gastric residual volume management. Intensive Crit Care Nurs. 2009;25(5):258-267. doi:10.1016/j.iccn.2009.06.004	See 5.5d: GRV discarding
5. Montejo JC, Miñambres E, Bordejé L, Mesejo A, Acosta J, Heras A, Ferré M, Fernandez-Ortega F, Vaquerizo CI, Manzanedo R. Gastric residual volume during enteral nutrition in ICU patients: the REGANE study. Intensive Care Med. 2010 Aug;36(8):1386-93. Epub 2010 Mar 16.	See 5.5a: GRV Threshold
6. Poulard F, Dimet J, Martin-Lefevre L, et al. Impact of not measuring residual gastric volume in mechanically ventilated patients receiving early enteral feeding: a prospective before-after study. JPEN J Parenter Enteral Nutr. 2010;34(2):125-130. doi:10.1177/0148607109344745	Not RCT
7. Kuppinger DD, Rittler P, Hartl WH, Rüttinger D. Use of gastric residual volume to guide enteral nutrition in critically ill patients: a brief systematic review of clinical studies. Nutrition. 2013 Sep;29(9):1075-9.	Systematic review
8. Reignier J, Mercier E, Le Gouge A, Boulain T, Desachy A, Bellec F, Clavel M, Frat JP, Plantefeve G, Quenot JP, Lascarrou JB; Clinical Research in Intensive Care and Sepsis (CRICS) Group. Effect of not monitoring residual gastric volume on risk of ventilator-associated pneumonia in adults receiving mechanical ventilation and early enteral feeding: a randomized controlled trial. JAMA. 2013 Jan 16;309(3):249-56. doi: 10.1001/jama.2012.196377.	See 5.5b: GRV Monitoring
9. Chen S, Xian W, Cheng S, et al. Risk of regurgitation and aspiration in patients infused with different volumes of enteral nutrition. Asia Pac J Clin Nutr. 2015;24(2):212-218. doi:10.6133/apjcn.2015.24.2.12	No clinical outcomes
10. Ozen N, Tosun N, Yamanel L, Altintas ND, Kilciler G, Ozen V. Evaluation of the effect on patient parameters of not monitoring gastric residual volume in intensive care patients on a mechanical ventilator receiving enteral feeding: A randomized clinical trial. J Crit Care. 2016;33:137-144. doi:10.1016/j.jcrc.2016.01.028	See 5.5b: GRV Monitoring
11. Tume LN, Bickerdike A, Latten L, et al. Routine gastric residual volume measurement and energy target achievement in the PICU: a comparison study. Eur J Pediatr. 2017;176(12):1637-1644. doi:10.1007/s00431-017-3015-8	Not RCT; Pediatric patients

12. Pham CH, Collier ZJ, Garner WL, Kuza CM, Gillenwater TJ. Measuring gastric residual volumes in critically ill burn patients - A systematic review. Burns. 2019;45(3):509-525. doi:10.1016/j.burns.2018.05.011	Systematic review
13. Wang Z, Ding W, Fang Q, Zhang L, Liu X, Tang Z. Effects of not monitoring gastric residual volume in intensive care patients: A meta-analysis. Int J Nurs Stud. 2019;91:86-93. doi:10.1016/j.ijnurstu.2018.11.005	Meta-analysis