Paediatric intensive care nurses' decision-making around gastric residual volume measurement

Abstract

Background

Measuring gastric residual volume (GRV) to guide enteral feeding is a common nursing practice in intensive care units, yet little evidence supports this practice. In addition, this practice has been shown to potentially contribute to inadequate energy delivery in intensive care, which remains a problem in critically ill children.

Aims

We aimed to explore paediatric intensive care nurses' decision-making surrounding this practice.

Methods

A cross-sectional electronic survey in a single mixed general and cardiac surgical PICU in the UK.

Results

The response rate was 59% (91/154) and responding nurses were experienced, with a mean PICU experience of 10.5 years (SD 8.09). The three main reasons for stopping or withholding enteral feeds were: the volume of gastric residual volume obtained (67%), the appearance of this gastric aspirate (40%) and the overall clinical condition of the child (23%). Most

nurses reported checking GRV primarily to determine 'feed tolerance' (97%) as well as confirming feeding tube position (94%). Nurses' perceived harms from high GRV were: the risk of pulmonary aspiration (44%), malabsorption of feeds (20%) and the risk of vomiting (19%). GRV was measured frequently in this PICU, with 58% measuring GRV before every feed, 27% measuring 4 hourly and 17% measuring 6 hourly.

The majority of nurses (84%) stated they would be worried or very worried if they could not measure GRV routinely.

Conclusions

PICU nurses' decision-making surrounding initiating and withholding enteral feeds, and determining 'feed tolerance' remains heavily based on GRV. PICU nurses' have significant fears around patient harm if they do not measure GRV routinely.

Relevance to clinical practice

This nursing practice is likely to be one of the factors that impair the delivery of enteral nutrition in critically ill children and as such its validity and usefulness needs to be challenged and studied in future research.

INTRODUCTION

Underfeeding remains a constant problem in paediatric intensive care units (PICUs). A large international point prevalence study showed only 37% of children received their prescribed energy intake, and that it took nearly 12 days to achieve 90% of their calorie target (Mepta et al 2012). It is a common nursing practice to assess patient's 'tolerance' to enteral nutrition (EN) by measuring gastric residual volume (GRV) (Tume et al 2013; Valla et al 2015). GRV is known to be a significant factor in the decision to stop or hold enteral nutrition (Leong et al 2013). Interruptions to EN in the PICU are known to be one of the biggest barriers to delivering adequate nutrition (Mepta et al 2010; Leong et al 2013). Therefore, we wanted to explore PICU nurses' decision-making around the practice of GRV measurement.

METHODS

A cross-sectional electronic survey was conducted in a single mixed medical-surgical PICU in North West England. The survey instrument was developed by two PICU nurses and a dietician (LK,LNT, LL), as no previous instruments existed, to explore questions that had arisen from a previous study (Tume et al 2017). This 20 item instrument was tested on 10 nurses (both junior and senior) for clarity and face validity and changes were made to improve question clarity (Figure 1 Survey Instrument). The survey was input into electronic software (Survey Monkey ^{TM}) and tested again by an independent PICU nurse. After registration by the hospital (NHS trust) as audit (Reference No. 5339) it was sent out to all nurses (n= 152) and assistant practitioners (n=2) in the PICU in August 2016. Consent was

implied by return of the survey. Three reminders were sent, one week apart, to maximise response rates with a target response rate of 70%.

Inclusion criteria: Clinical nurses or assistant nursing practitioners who are working on PICU and make decisions around feeding. Exclusion criteria: non clinical nurses, nurses not working in bedside nursing roles and bank or agency staff.

Study Setting and standard practice

The PICU is a 23 bed intensive care unit which admits around 1000 children a year aged 0 – 17 years. The unit has a separate 15 bed high dependency unit staffed by different nurses; not included in the study. It is a mixed cardiac surgical and general intensive care unit and 86% of the patients receive invasive ventilation (PICANET 2016). The nurse to patient ratio is 1:1 for all invasively ventilated children and 52% of the nursing staff have a specialised post-graduate PICU nursing course. The unit has a detailed feeding protocol requiring 4-5 hourly GRV measurement and withholding feeds if this volume exceeds 5ml/kg to a maximum of 300ml. The unit is proactive in starting enteral feeding (guidelines state within 6 hours after PICU admission, unless contraindications exist). The unit is supported by a dedicated dietician who reviews patients daily and does weekly 'nutrition rounds' with a gastroenterologist. Our feeding protocol includes routine GRV assessment to assess 'tolerance' to enteral nutrition. Feeding delivery method is most commonly bolus gravity feeds in infants and continuous pump feeds in older children, but this decision is left up to the registered nurse.

Data analysis

In this small exploratory study, data was exported from a CSV file in Survey Monkey into Microsoft Excel and IBM SPSS version 22 for further analysis. Data was analysed primarily

descriptively, but inferential analysis (Chi square) was used to determine whether nurses' experience or speciality education impacted on key outcomes (categorical variables). P values <0.05 were considered significant and two tailed test were used. Free text responses in this survey, were to direct questions and so analysed by simple thematic analysis (Burnard et al 2008). Responses were categorised independently by LT and LK, who then met to agree the categorisation and groupings where any discrepancies were discussed and agreed.

RESULTS

The response rate was 58% (90/154) and responding nurses were experienced, with a mean PICU experience of 10.5 years (SD 8.09). 76% nurses had a specialist PICU nursing qualification. 63% were staff nurses, 27% senior staff nurses, 8% sisters or charge nurses and 2% assistant nursing practitioners. PICU nurses perceived their role in initiating, delivering and evaluating enteral nutrition as all highly important (Figure 2). The three highest perceived barriers to delivering adequate nutrition in this PICU were: Fluid restriction (52%, specifically in cardiac children), nurses' education, attitudes and knowledge (33%) and fasting for procedures (33%). The three main reasons for stopping or withholding enteral feeds were: the volume of gastric residual volume obtained (67%), the appearance of this gastric aspirate (40%) and the overall clinical condition of the child (23%).
Most nurses reported checking GRV primarily to determine 'feed tolerance' (97%) as well as confirming feeding tube position (94%). Nurses' perceived harms from high GRV were: the risk of pulmonary aspiration (44%), malabsorption of feeds (20%) and the risk of vomiting (19%) (Table 1). GRV was measured frequently in this PICU, with 58% measuring GRV before every feed, 27% measuring 4 hourly and 17% measuring 6 hourly.

The majority of nurses (84%) stated they would be worried or very worried if they could not measure GRV routinely, with their biggest concerns being: not able to measure feed 'tolerance' (55%), not being able to confirm feeding tube position (32%) and the risk of vomiting and aspiration (27%). Most nurses were aware of other ways they could assess feed tolerance, citing bowel movements (62%), abdomen appearance (59%), vomiting (38%), the presence of bowel sounds (25%), serum lactate level (21%) and signs of patient discomfort (16%) (Figure 3). When asked to consider NOT routinely measuring GRV as part of a research study, 50% of nurses were broadly negative, 43% were broadly positive (so long as clear guidance was provided) and 3% were indifferent. The majority of nurses who were positive towards a trial were significantly more experienced ($p =<0.000$) and had a PICU nursing qualification ($p=<0.000$).

DISCUSSION

This is the first study to our knowledge to attempt to explore PICU nurses' decision making around the practice of GRV measurement in the paediatric ICU. Other studies involved neonatal intensive care nurses (Hodges and Vincent 1993) or adult intensive care (Admad et al 2012). The practice of routine GRV measurement is increasingly being questioned across critical care as a whole (in neonates, children and adults) (Kuppinger et al 2013, Parker et al 2015; Li et al 2014; Bollineni et al 2011, Parish et al 2008). In a multicentre observational study in 19 adult ICUs in France, Quenot et al (2010) showed that just by measuring GRV, the risk of delivering inadequate energy goals increased by 38%.

We found nurses were very concerned about the risk of aspiration if they could not measure GRV. Others have also found that GRV featured heavily in healthcare professionals' beliefs that measuring GRV mitigates the perceived risk of pulmonary aspiration in mechanically

ventilated patients (Ahmand et al 2012), but this risk remains unquantified (McClave et al 2005). In adult intensive care trials, accepting a higher GRV (500ml compared to 200ml) (Montejo et al 2010) or not measuring GRV at all (Poulard et al 2010; Reignier et al 2013; Ozen et al 2016) did not adversely affect patient outcomes of ventilator associated pneumonia(VAP) or gastrointestinal complications, however did it increase the achievement of the patient's energy goals, and increase calorie delivery.

In this survey we found GRV was the main reason perceived by nurses for stopping enteral feeding. Interruptions to feeding have been cited by others as probably the biggest factor in delivering suboptimal nutrition in critically ill patients (Mehta et al 2010; Bockenkamp et al 2009). Nurses said they predominantly used GRV to determine feed 'tolerance', but the ability of this measurement to do this is questionable. Despite the widespread prevalence of this practice (Tume et al 2012, Valla et al 2015; Ahmad et al 2012) GRV has not been show to correlate with enteral feeding tolerance (McCLave et al 2002). In addition, the measurement of GRV is frequently inaccurate due to the position of the feeding tube in the stomach, patient position, the feeding method, the technique of aspiration and tube and syringe sizes used (McClave et al 2005; Bartlett-Ellis et al 2015; Elke et al 2015). Compounding this uncertainty is what volume constitutes an 'acceptable' level of GRV.

In our study nurses main cited reasons for impaired enteral feeding on the ICU were consistent with what others have found in terms of fluid restriction (Tume et al 2013; Floh et al 2016) and fasting for procedures (Mehta et al 2010; Bockenkamp et al 2009). It was notable however, that nurses themselves perceived that inadequate knowledge, education and attitudes impacted on enteral feeding. Marik (2014) reviewed the evidence for

commonly believed myths and misconceptions held by ICU staffs that contribute to underfeeding.

We found some confusion in nurses thinking surrounding confirming feeding tube position. Although a legal requirement in the UK to avoid misplaced tubes and inadvertent feeding into the airways, (National Patient Safety Agency 2011) nurses cited GRV was used to confirm tube position. However, the volume required to test gastric aspirate for ph. is very small, the whole stomach contents (GRV) does not have to be aspirated to do this, and yet it seemed this is what many believed was required. This is an area for educational intervention.

When asked to consider other indicators that could be used to assess the tolerance of enteral feeding, most (but not all) PICU nurses could cite other signs. This demonstrates that lack of any consistently valid method to assess feed tolerance in all critically ill patients, and therefore the reliance on, and the overestimation of, the ability of a fairly simplistic indicator, such as GRV, as a measurement to do this.

At least half of the nurses were very worried and gave negative responses about the idea of not measuring GRV as part of a research study. This is important to know when considering the design of any future research on this topic, as it may impact significantly on the compliance with study protocols. It is evident that PICU nurses' beliefs around GRV are strongly held and there would need to be considerable work done to overcome these.

There are a number of limitations that need acknowledgment, including those biases associated with self-report surveys including selection bias, self-report bias, confounding, lack of generalizability, and no means of data verification from participants. It is a single

centre survey and there may be unit-specific views that do not reflect PICU nurses in other units. In addition, we achieved a lower than expected response rate of 59%. Despite these limitations, this is the first study to attempt to explore in more detail PICU nurses' decision-making around this common practice.

CONCLUSIONS

Nurses play a vital role in the delivery of enteral nutrition for critically ill children. Their decision- making surrounding initiating and withholding enteral feeds, and determining 'feed tolerance' is heavily based on GRV, yet this practice is not supported by evidence. Most nurses cited the fear of pulmonary aspiration was their main concern if GRV was not measured. Further research needs to explore this beyond a single UK PICU, and researchers need to understand nurses' views if future trials to avoid this practice are planned.

What is known about this topic?

- Routine GRV measurement is a widespread nursing practice
- Both the accuracy and interpretation of GRV measurement however is not based on evidence and may impair the delivery of EN

What this paper adds?

- An early exploration of PICU nurses' decision-making around GRV measurement in a single UK centre
- To provoke further thought and research around this ritualistic nursing practice

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Figure 1 Survey instrument

1. What is your role on PICU?
Assistant practitioner
Band 5 nurse
Band 6 nurse
Band 7 nurse

2. How many years PICU experience do you have?

3. Do you have a PICU/ICU course?
Yes
No

4. In your opinion what is the potential harm from high gastric aspirates?

5. How frequently do you usually measure gastric aspirates in PICU?

6. What are your reasons for measuring gastric aspirates?
To check feed tolerance
To check/confirm naso-gastric tube position
Other please state

7. What factors affect your decision to DISCARD aspirates during enteral feeding on PICU?
Please rank the answers below in order of importance to you eg 10= most important to 1 not important
The amount (volume) obtained
If the aspirate looks undigested
The colour of the aspirate
The condition of the child

8. What factors affect your decision to REPLACE gastric aspirates?
Please rank the answers below in order of importance to you eg 10= most important to 1 not important
The amount (volume) obtained.
How digested the aspirate looks.
The colour of the aspirate
The condition of the child.

9. If you decide to withhold feeds based on the gastric aspirate, what factors do you base this decision on?

10. In what time frame would you restart feeds? What factors affect your decision?

11. In your opinion what are the biggest barriers to delivering adequate volumes of enteral feed on PICU?

12. On a scale of 1 to 10, how important do you think the nurse's role is in STARTING enteral feeding?
Please rate from 1= not important to10 = very important.

13. On a scale of 1 to 10, how important do you think the nurse's role is in DELIVERING (giving the feed) enteral feeding?
Please rate from 1= not important to10 = very important.

14. On a scale of 1 to 10 how important do you think the nurse's role is in EVALUATING enteral feeding?
Please rate from 1= not important to10 = very important.

15. Are you familiar with the XXXXX PICU guidelines around enteral feeding and gastric aspirates?
Yes
No
Other (please specify)

16. If yes, do you know what guidance they give around acceptable gastric aspirates and returning aspirates? Please write this below

17. How would you feel about NOT measuring gastric aspirates routinely?
Very worried
Worried
OK
Happy
Very happy

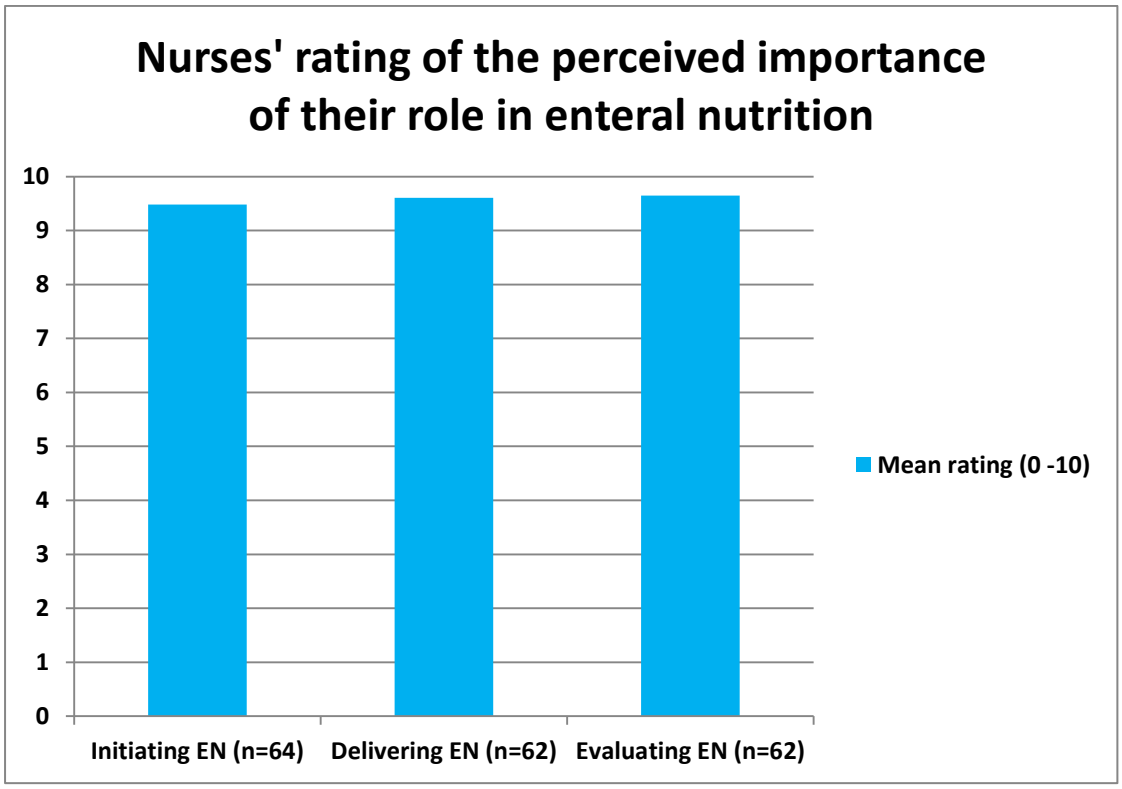
18. What would be your concerns about NOT measuring gastric aspirates?

19. If you could not assess gastric aspirate what would you use to assess feed 'tolerance'?

20. How would you feel about being part of a UK wide study where gastric aspirates were NOT measured compared to standard care (where gastric aspirates were routinely measured)?

21. Are there any other comments you would like to make regarding enteral feeding and gastric aspirates on PICU?

Figure 2 Nurses' perceived rating of the importance their role in enteral nutrition



Likert scale 0 – 10 (0 = not important to 10 = very important)
EN: Enteral Nutrition
n = Responses per question

Table 1
PICU Nurses' perceived harms from high Gastric Residual Volume (GRV)

Nurses' perceived harms	% (N)
Risk of aspiration	44% (40/90)
Malabsorption of enteral feeds	20% (18/90)
Risk of vomiting	19% (17/90)
Abdominal distention	10% (9/90)
Inadequate nutrition	6.6% (6/90)
Miscellaneous reasons	6.6% (6/90)
Abdominal discomfort	5.5% (5/90)
Necrotising enterocolitis (NEC)	2.2% (2/90)
Poor weight gain	2.2% (2/90)

Figure 3 Alternative indicators nurses reported they would use to assess feed tolerance without Gastric Residual Volume (GRV)