

Assessing the bowel function of critically ill children: a pilot study

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Altered bowel habits, particularly constipation, are a common reason for seeking the advice of a paediatrician or paediatric gastroenterologist (3%–5% and 35% of referrals, respectively),¹ and in children who are admitted to hospital with previously normal bowel habits, any variation is deemed significant. There are international definitions of constipation, for example, the Paris Consensus on Childhood Constipation Terminology, which defines constipation as a period of 8 weeks with at least two of the following symptoms:

- defecation frequency less than three times per week
- faecal incontinence frequency greater than once per week
- passage of large stools that clog the toilet
- palpable abdominal or rectal faecal mass
- stool-withholding behaviour
- painful defecation.²

Another definition is similar, but shortened to a time frame of 2 weeks.³ The adage “if you don’t poo every day, you’ll die” is well known to acute care staff, and medical and nursing staff will try hard to induce a “good result” if a patient has days with no bowel motion. However, is there any evidence for this practice (given the chronicity in the definitions) and, if so, do we follow it? What is clear is that there is a very wide range in the time frame of reduced bowel movements between being labelled normal or abnormal. For children who are critically unwell in the intensive care unit, do these definitions apply, and is aggressive induction of bowel movements warranted and without risk?

Evidence is available for subjects related to this topic, for example, the use of parenteral and enteral feeding in critically ill children (including when parenteral nutrition should be considered,⁴ comparison of continuous and bolus regimens⁵ and barriers to providing adequate energy, for example, the need for vasoactive medications⁶) but there is a surprising absence of specific evidence for clinical questions about constipation in these children in the medical literature. This may be because local practice is handed down anecdotally within ICUs. No reports commenting on the importance or management of observed bowel function are available.

We reviewed an Australian tertiary hospital guideline⁷ as a baseline guide to proposed management of children’s gastrointestinal function in the ICU. A report on the adult

ABSTRACT

Objective: To describe the bowel function of critically ill children.

Design, setting and participants: A prospective, observational study, in a regional tertiary intensive care unit, of children under 16 years of age who were admitted for more than 24 hours. We collected demographic data and captured information on bowel function and stool form and on factors that may affect these, such as medicines and nutrition.

Main outcome measures: Bowel activity and duration of administration of aperients and narcotics.

Results: Forty-seven patients (28 boys) with a median age of 3.66 years (IQR, 1–7.62 years) were enrolled and monitored for 219 ICU days, 134 (61.2%) of which were ventilation-bed days. There were no bowel motions seen on 123 days (56.2%), and of the days when motions were passed, the predominant stool form was loose or watery (22%). One patient had clinical features of constipation (0.5%). Aperients were used, predominantly docusate, on 38 days (17.4%), and prokinetics on 28 days (12.8%). Narcotics were used on 156 days (71.2%), and narcotic duration was significantly associated with non-defecation days (Spearman $\rho = 0.55$, $n = 33$, $P < 0.01$). Clinically, reduced gut motility (recorded as absent bowel sounds or increased gastric residual volumes) was seen on a total of 31 days (68.9%).

Conclusions: Critically unwell children needing more than 24 hours of intensive care have a state of non-defecation for most of the time, with formed stools being rare. Further observational studies will better define bowel function in critically unwell children.

Crit Care Resusc 2014; 16: 202–205

experience of this same problem was found,⁸ which comments on the lack of evidence and followed with a prospective pilot study assessing the bowel function of adults with critical illness. The authors concluded that it is usual for no bowel motion to occur in critically unwell adults, and that when they do open their bowels, the stools are different from their usual pattern. This can be compounded by attempts at inducing defecation; some inter-

Table 1. Demographics and collected data on the study cohort (n = 47)

Variable	Data
Boy/girl ratio	28/19
Mean age, years (IQR)	3.66 (1–7.62)
Mean weight, kg (IQR)	15 (10.5–26)
Median PIM2 score (IQR)	–4.17 (–4.88 to –3.05)
Median PIM2 derived risk of death (IQR)	1.11% (0.64%–4.51%)
Narcotics administered, days (%)	156 (71.2%)
Prokinetics administered, days (%)	28 (12.8%)
Aperients administered, days (%)	38 (17.4%)
Enteral nutrition, days (%)	157 (71.7%)
Total parenteral nutrition, days (%)	11 (5%)
Bowel motions, days (%)	
No bowel action	123 (56.2%)
Hard (Bristol type 1–2)	1 (0.5%)
Formed (Bristol type 3–4)	11 (5%)
Loose (Bristol type 5–6)	38 (17.4%)
Watery (Bristol type 7)	10 (4.6%)
Evidence of reduced peristalsis, n (%)	
Incr. GRV (> 10 mL/kg or > 200 mL)	14 (31.1%)
Absent bowel sounds	17 (37.8%)
Unrecorded bowel sounds	14 (31.1%)

PIM = paediatric index of mortality. IQR = interquartile range. Incr. = increased. GRV = gastric residual volume.

national protocols escalate up to infusions of neostigmine in order to achieve the desired effect.^{9,10}

We investigated these questions in children with critical illness as a pilot study. We aimed to describe usual bowel function in children in the ICU and assess factors that may affect it. We also aimed to describe the effects of aperients and promotility agents, positive and negative, during the child's hospital stay. We hypothesised that the most common state of bowel movements in critically unwell children would be that of non-defecation. We also expected to see a correlation between opiate use and non-defecation days. We aimed to examine trends in medicine orders for the interpretation of non-defecation days and expected to see an overuse of aperients (which we defined as a greater proportion of patients receiving aperients than the proportion with clinical signs of constipation other than absent bowel motions).

Methods

Setting

Townsville Hospital opened a paediatric ICU (PICU) in September 2012. The PICU currently operates out of the

general ICU, which has 18 medical and surgical beds and admits about 1300 patients per year. In the past calendar year, 182 children were admitted to our PICU, which is staffed by a separate medical roster on a closed ICU model of care. Two paediatric intensivists are responsible for unwell children. There is not a current feeding or bowel management algorithm that defines standard practice in our PICU. Ethics approval was sought and granted for this study from the local ethics review committee (HREC/13/QTHS/132). The study was lodged with the local data registry (ACTRN12613000810718).

Patients and data collection

We prospectively enrolled all patients who were admitted to our PICU and who remained there for more than 24 hours, in a 6-month period (mid August 2012 to mid March 2013). We collected daily data on the previous 24 hours after the ward round. We defined Day 1 as from admission until the first ward round, and the final day was counted as the last complete 24-hour period in the PICU. Data collected included information on sex; age; weight; underlying condition; use of mechanical ventilation during the study day; administration of narcotics, aperients and antiemetics or prokinetics; use of supplementary nutrition; number of bowel motions; and the nature of bowel motions based on the Bristol stool chart.¹¹

Statistical analysis

We collected data using Office Excel 2003 (Microsoft) and stored securely. Data were analysed using SPSS, version 22.0 (IBM) and were first checked for normality for continuous variables. Based on the outcome of the normality test, parametric or non-parametric tests were carried out for continuous variables. Spearman rank correlation ρ values were determined and $P < 0.05$ was considered statistically significant. Results are stated as medians and interquartile ranges (IQRs) or as a percentage of total ventilator days, unless otherwise specified.

Results

During the data collection period, 47 patients were admitted to the PICU for more than 24 hours, all of whom were enrolled in the study. Most patients were boys, the median age of all patients was 3.66 years (IQR, 1–7.62 years) and their median weight was 15 kg (IQR, 10.5–26 kg) (Table 1). Twenty-two admissions (47%) were for respiratory illnesses, nine (19%) were for trauma or injury, eight (17%) were for neurological illness (non-trauma), and four (9%) were admitted after gastrointestinal surgery. The remaining four admissions (9%) were for conditions such as unwitnessed cardiac arrests (ultimately diagnosed as sudden infant death

syndrome) and sepsis. The median paediatric index of mortality (PIM)2 score for the cohort was -4.17 (IQR, -4.88 to -3.05), which correlated with a risk of death of 1.11% (IQR, 0.64% – 4.51%).

The total number of bed-days in the PICU was 219 days, with 134 days (61.2%) being invasively ventilated bed-days, reflecting the general level of critical care seen in the cohort. Narcotics (almost exclusively morphine infusions) were administered on 156 days (71.2%). Prokinetics and aperients were infrequently prescribed to our patients (prokinetics were prescribed on 28 days [12.8%] and aperients on 38 days [17.4%]). When aperients were used, the most common form was docusate (28.3%), docusate and sennasoids (21.7%), or glycerin suppositories (19.6%). Enemas were used on 6.5% of occasions. Administration of aperients was associated with a bowel motion in 20 aperient days (52.6%). Of the days with aperient-associated bowel motions, a watery or loose stool (Bristol stool chart scale 5–7) was produced on 15 days (75%).

We provided gastric enteral nutrition on 157 days (71.7%), and total parenteral nutrition on a further 11 days (5%). The most common preparations used for enteral feed were Infatrini and Nutrison (Nutricia Advanced Medical Nutrition), reflecting the different feeds used for infants and older children, respectively. Other preparations were used for intermediate age groups and for specific medical reasons.

Of the 219 bed-days, no bowel motions were recorded on 123 days (56.2%). Hard stools (Bristol stool chart scale, 1–2) were seen on only 0.5% of bed-days, formed stool (Bristol stool chart scale, 3–4) on a further 5% of bed-days, and loose or watery stool (Bristol stool chart scale, 5–7) on 22% of bed-days. Ileostomy fluid or unclassified stool-form recordings accounted for 16.8% of bed-days. Evidence of reduced peristalsis was recorded on 68.9% of days: as 4-hourly gastric residual volumes > 10 mL/kg (or > 200 mL) on 31.1% of days, and as absent bowel sounds on 37.8% of days. Only four patients (9%) were admitted after gastrointestinal surgery, suggesting that most reduced peristalsis was pharmacologically induced or a result of critical illness, rather than from direct handling of the bowel or gastrointestinal pathology. There was a statistically significant correlation between the duration of opiate therapy and number of days of non-defecation (Spearman $\rho = 0.55$, $n = 33$, $P < 0.01$).

Discussion

Our research is, to our knowledge, the first published account attempting to define normal observed bowel function in paediatric critical illness. Our pilot study highlights the fact that no bowel motions are seen on

most bed-days in our PICU, and that when motions do occur they are predominantly loose or watery (Bristol stool chart scale, 5–7). Although a feature of constipation is a hard-to-pass stool with or without discomfort, hard stools (Bristol stool chart scale, 1–2) — the usual indication for treatment with aperients — were recorded on $< 1\%$ of bed-days. Nevertheless, aperients were administered on 17.4% of bed-days. This difference suggests that staff are concerned by a lack of observed bowel motion sooner than the definitions of constipation provide for. This study was not large enough to show this to be harmful or a problem in itself, but the discrepancy provides a focus for further study. Signs of reduced or absent motility were observed on about one-third of bed-days, yet prokinetics were only administered on 12.8% of bed-days. Reduced gut motility and lack of regular bowel function could be explained by the use of narcotics (as seen in our results) and by the physiological response to critical illness.¹² A more frequent and looser stool can be associated with enteral feed provision,¹³ but further clarity on these issues would demand a follow-up trial of larger populations. A comparison with the data of other PICUs would also be of great value. Our study shows that we could significantly improve our understanding when it comes to deducing the cause of absent bowel motions, and a management algorithm to support gastrointestinal function needs to be created. Skin excoriation, a recognised consequence of diarrhoea,¹⁴ was seen in one patient (2%), who needed emollient cream therapy to aid healing. An evidence-based algorithmic approach may help eliminate this complication completely by preventing unnecessary induction of defecation.

The limitations of our study were the small number of patients and the single-centre setting. Our PICU has only two full-time clinicians, and as one of them was an author and the principal researcher, the risk of observer bias cannot be completely eliminated. Given that this is the first published article on this subject, it is hoped that future larger, multicentre research could consider randomly assigning patients to an aperient arm or a non-intervention arm and evaluate any harm caused by the use or non-use of aperients, eg, impaired nutrient absorption, bacterial translocation or sepsis from longer periods of reduced bowel events, or unexpected side effects from attempts to induce defecation.

Conclusions

Our study shows that most critically unwell children do not open their bowels every day, or with normally formed stools, while in the ICU. Explanations for this include the duration of use of narcotics. Aperients and prokinetics are

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currently administered unsystematically and usually with the only effect of inducing a loose or watery stool. An evidence-based algorithm should be developed from a larger multi-centre study to guide more appropriate management of constipation in the PICU.

Competing interests

None declared.

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