

# Bowel motions in critically ill patients: a pilot observational study

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Mechanical ventilation is theoretically associated with a number of gastrointestinal complications, including stress ulcers, hypomotility and diarrhoea.<sup>1-5</sup> Other aspects of critical illness or the therapies used to treat it may further affect gastrointestinal function.<sup>6-9</sup> Most studies of gastrointestinal function in critically ill patients focus on delayed gastric emptying and the use of prokinetic therapy. However, little information exists on the frequency of abnormal small intestinal motor activity in patients in the intensive care unit<sup>10</sup> and the factors affecting it. Although gastrointestinal dysfunction is often not a priority in the critically ill, intestinal hypomotility may lead to malabsorption, vomiting and aspiration pneumonia, as well as bacterial overgrowth and endotoxaemia.<sup>1</sup>

Lack of bowel motions is sometimes treated with laxatives to prevent clinically important constipation.<sup>8</sup> However, previous studies<sup>2</sup> suggest that diarrhoea is also an important problem during critical illness. Diarrhoea affects about a third of ICU patients, depending on the definition used. Diarrhoea may lead to patient discomfort, electrolyte and fluid balance disorders, and wound contamination, as well as perianal excoriation.<sup>10</sup> It also increases nursing labour and the cost of caring for patients.<sup>10</sup>

In light of these issues and the lack of prospective information, we assessed the frequency and appearance of bowel actions in a heterogeneous population of mechanically ventilated ICU patients.

## Methods

### Setting

Austin Health is a teaching hospital of the University of Melbourne. It has an ICU with 21 medical/surgical beds that admits about 2000 patients per year. The ICU operates according to the "closed" ICU model, where only ICU physicians can prescribe treatment.

The hospital human research ethics committee approved our study and waived the need for informed consent.

### Patients and data collection

Patients were eligible for enrolment in our study if they had been mechanically ventilated for more than 24 hours and were deemed likely to receive mechanical ventilation for at least a further 24 hours. Patients were screened by the ICU

## ABSTRACT

**Background:** Limited information exists on the factors affecting bowel motions and the physical characteristics of stools in mechanically ventilated patients in the intensive care environment. We hypothesised that most stools in critically ill patients are not formed and that both diarrhoea and non-defecation are common.

**Design, setting and patients:** Pilot prospective observational study of 44 patients in a tertiary intensive care unit who were mechanically ventilated for more than 24 hours.

**Methods:** We collected data on the frequency and appearance (Bristol stool chart) of bowel motions, and administration of nutrition, narcotics, anti-emetics, prokinetics and laxatives.

**Results:** Forty-four patients (31 male) with a mean age of 60.3 years were monitored for 274 ventilation days. There were 168 days (61.3%) with no defecation. During the 106 days (38.8%) with bowel motions, there were 101 days (36.9%) with loose stools and 33 days (12.0%) with at least one episode of diarrhoea. Formed stools were present on only 5 days (1.8%). No patients developed clinical or radiological evidence of constipation or pseudo-obstruction. Treatment with lactulose ( $P=0.009$ ) and ondansetron ( $P=0.02$ ) was associated with a day with bowel motions, while use of morphine ( $P=0.025$ ) was associated with non-defecation. Lactulose treatment was the only factor associated with stool volume ( $P<0.001$ ). A higher rate of enteral nutrition was associated with looser stools ( $P<0.001$ ), while morphine was negatively associated with looser stools ( $P<0.001$ ).

**Conclusions:** Among patients receiving mechanical ventilation for more than 24 hours, lack of bowel motions (non-defecation) was the most common physiological state. However, diarrhoea was also relatively common, and formed stools were rare.

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charge nurse every day and, when appropriate candidates were identified, the bedside nurse was asked to complete a specific case report form with data for each shift.

Data collected included information on sex; age; presence of mechanical ventilation during a given study day; administration of narcotics, anti-emetics (eg, metoclopramide and ondansetron), prokinetics and laxatives (eg, lactulose, docusate sodium with sennosides A and B); use of enteral or parenteral nutrition; amount of nutritional fluid given; number of bowel motions; nature of bowel motions (using a Bristol stool chart; Figure 1); and amount of bowel motions (by weight).

Diarrhoea was defined by the presence of >200 mL of bowel motions/day, with stools classified as 5, 6 or 7 on the Bristol stool chart.<sup>11</sup> In addition, information on any stool cultures ordered for the presence of *Clostridium difficile* toxin and the findings of such cultures were obtained.

**Statistical analysis**

Descriptive data are presented as mean (SD) for numerical variables, and as percentages of overall cases for nominal variables.

Multivariable regression analysis was performed using StatView statistical software (Abacus Concepts, Berkeley, Calif, USA). A P value <0.05 was considered statistically significant.

**Results**

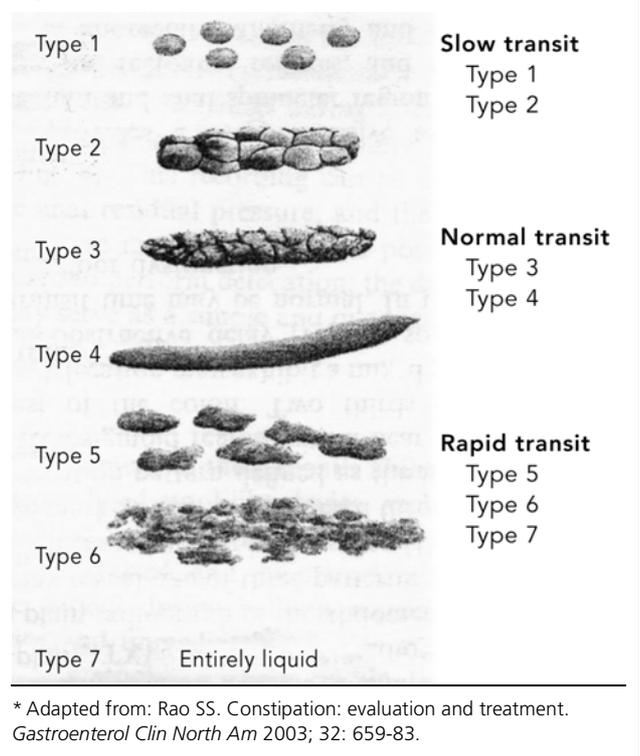
Forty-four patients (31 male and 13 female) with a mean (SD) age of 60.3 (16.6) years were monitored for a total of 274 ventilation days (Table 1).

Narcotics were given on 158 days (57.6%), with morphine being the most common agent. Prokinetic or anti-emetic agents were administered on 98 days (35.8%), with metoclopramide (84.7%) being more commonly used than ondansetron (15.3%). Laxatives were used during 60 study days (21.9%) and were associated with bowel motions on 22 days. The two most common laxatives used were lactulose (27 days) and docusate sodium with sennosides A and B (25 days).

Enteral nutrition was administered during 227 (82.8%) of the study days. The enteral nutrition preparation administered was either Isosource (81.9%) or Fibresource (18.1%) (Nestle Health-Care Nutrition, Minnetonka, Minn, USA), at a mean rate of 50 (SD, 33) mL/h. Total parenteral nutrition was administered on 9 study days (3.2%), and no nutrition was administered for the remainder of the time (13.9% of study days).

There were no bowel actions (non-defecation) during 168 study days (61.3%). During the 106 study days (38.7%) with bowel motions, loose stool (Bristol stool types 5–7) were identified on 101 days (36.9%), and formed stool (Bristol stool types 1–2) were present on only 5 days (1.8%). Diarrhoea occurred on 33 study days (12.0%). No patients developed pseudo-obstruction or had *C. difficile* infection during the study period.

**Figure 1. Bristol stool chart\***



\* Adapted from: Rao SS. Constipation: evaluation and treatment. *Gastroenterol Clin North Am* 2003; 32: 659-83.

**Table 1. Characteristics of study patients (n = 44), and observations during study**

Age (years), mean (SD)	60.3 (16.6)
Male	31
APACHE II score, mean (SD)	22 (8.5)
Body mass index (kg/m <sup>2</sup> ), mean (SD)	27.7 (9.6)
Narcotics administered (days)	158
Laxatives administered (days)	60
Enteral nutrition (days)	227
Total parenteral nutrition (days)	9
No nutrition (days)	38
No bowel action (days)	168
Loose stools (Bristol types 5–7) (days)	101
Formed stools (Bristol types 1–2) (days)	5
Diarrhoea (days)	33

APACHE = Acute Physiology and Chronic Health Evaluation.

On logistic regression analysis, lactulose (P=0.009) and ondansetron (P=0.02) use were associated with a bowel motion day. In contrast, morphine administration was negatively associated with a bowel motion day (P=0.025). Administration of lactulose was the only factor associated with daily volume of bowel motions (P<0.001).

A higher rate of enteral nutrition was strongly associated with a looser type of stools according to the Bristol classification ( $P < 0.001$ ), while use of morphine was negatively associated with looser stools ( $P < 0.001$ ).

## Discussion

We conducted this pilot prospective observational study of bowel motions in critically ill patients who were mechanically ventilated for more than 24 hours to better understand the epidemiology of bowel motions in such patients and the factors that might affect their occurrence, amount and nature. We found that the bowel motions of critically ill patients differed from normal patterns in at least four different ways. First, on most days, our patients had no bowel motions, despite the administration of enteral nutrition on more than 80% of study days, of laxatives on more than 20% of study days, and of prokinetics on more than 30% of study days. Second, when patients did have bowel motions, stools were rarely formed (<2%) and diarrhoea was relatively common (>10%). Third, use of lactulose correlated with bowel motion activity (but not predictably on the same day of administration), while morphine inhibited such activity. Finally, the amount of enteral nutrition strongly predicted the presence of looser stool production.

The fact that no bowel motions occurred on most days may not be entirely surprising.<sup>8</sup> Many critically ill patients have decreased bowel activity because of disease and the administration of narcotic drugs such as morphine.<sup>12-14</sup> However, our study is the first to quantify this level of “non-defecation”. Non-defecation must be distinguished from constipation, its major differential diagnosis. Constipation is characterised by marked faecal loading on palpation and/or abdominal x-ray, abdominal distension, a full rectum on rectal examination, the patient experiencing the desire to evacuate the bowel but being unable to do so, and, when laxatives are administered, the evacuation of faeces in substantial quantity.<sup>15,16</sup> Although we acknowledge that some of these diagnostic aspects are difficult to evaluate in mechanically ventilated patients, none of the diagnostic features of constipation were detected in our patients.

The lack of defecation in our study occurred despite the administration of enteric feeding in the majority of patients and frequent use of prokinetic agents and laxatives. Several factors may account for this phenomenon. First, many critically ill patients are admitted to hospital after being unwell for several days (with limited oral intake) or after elective surgery associated with bowel preparation. Thus, they have little bulk left to evacuate. Second, patients are nursed in supine position, which removes the impact of gravity on evacuation. Third, they frequently receive narcotics, which delay gastrointestinal motility. Fourth, enteric feeds are fluid in nature and typically do not provide the bulk

necessary to lead to the formation of solid faeces that may then trigger an evacuation reflex.

The nature of the feeding preparation may also contribute to the watery nature of the faeces produced during days of defecation, with essentially no bowel motion in our patients being “formed” in nature. In this regard, our study showed that the rate of enteral nutrition was a strong positive predictor of a looser type of stools, while the use of morphine was a negative predictor. This observation is of some importance, because it highlights the fact that, in these patients, almost all bowel motions are diarrhoea-like in appearance, and even more so if increased amounts of enteric feeding are given. Therefore, the diagnosis of diarrhoea in these patients is difficult and should logically rely on the amount of faeces produced — an infrequently measured variable.

An important contributing factor to the presence of watery, unformed stools in our patients was the use of laxatives, which occurred on about 20% of study days and was associated with both defecation and the amount of faeces produced. Laxatives were prescribed to patients because of non-defecation, concern about the presence of constipation, and fear that pseudo-obstruction might develop. Of note, laxatives did not induce any bowel action on the day of administration in most patients. This lack of immediate response invites repeated (and probably unnecessary) administration, which contributes to subsequent diarrhoea, as shown in our study. However, a recent randomised controlled trial did not find any effect of laxatives on the incidence of gastrointestinal complications in critically ill patients.<sup>8</sup> In the absence of Level 1 evidence of what constitutes best practice in critically ill patients, it is not surprising that the use of laxatives currently remains outside the boundaries of evidence-based medicine and that practice varies greatly according to the medical and nursing staff involved in the care of patients. In particular, while a logical case can be made for using laxative therapy in patients with spinal injury,<sup>17-19</sup> the therapy has potential adverse effects (patient discomfort, perianal skin excoriation) in other patients that may outweigh its benefits. More studies are needed in this area to provide a more rational basis for clinical practice.

Other interventions affected bowel motions in our study. Prokinetic or anti-emetic agents, for example, were frequently prescribed, and one of them, ondansetron, was found to be a significant predictor of a bowel motion day. This known side effect of ondansetron<sup>20</sup> has not previously been reported in critically ill patients. This evidence suggests that such drugs targeting the upper gastrointestinal tract may also affect lower gastrointestinal activity, and clinicians need to consider their possible effects on the lower gastrointestinal tract when considering the cause of watery stools in a mechanically ventilated patient. On the other hand, narcotics were given on around 60% of study days, with morphine being the most common agent. The use of morphine was a negative predic-

tor of bowel motions occurring and a positive predictor of any stools passed being formed in nature.

Our findings have clinical relevance. They demonstrate that an expectation of faeces of normal consistency in critically ill patients is unjustified and that watery stools are essentially ubiquitous. As such, their presence cannot be used to diagnose diarrhoea. Conversely, non-defecation is common and cannot be reliably distinguished from true constipation or be used to indicate a high risk of obstruction or pseudo-obstruction. No such event occurred in our patients despite 168 days of non-defecation, making it, by definition, less common than 1 per 100 non-defecation days. This information should be useful in shaping clinicians' perceptions of how to treat this physiological state. Similarly, the observation that defecation occurs only on a minority of days when laxatives are administered may help clinicians wait longer before giving another laxative dose.

Our study has both strengths and limitations. It was only an observational study, yet was prospective in design and, to our knowledge, is the most comprehensive so far in the literature. It was limited in size and therefore has limited power to detect unusual complications of both laxation and lack of treatment of non-defecation. However, it provided detailed information on close to 300 days of observation in mechanically ventilated patients — also, to our knowledge, a first in the literature. It was not a randomised controlled trial and thus cannot be used to help clinicians decide where the use of laxatives is necessary, beneficial or dangerous. However, it provides useful information on the consequences of a practice style that involves using laxatives in a targeted population when considered clinically appropriate.

Much more research is needed on this aspect of the care of critically ill patients, where only one randomised controlled trial has been conducted.<sup>8</sup> This lack of data is unfortunate because bowel care is of practical importance and can affect patient dignity, comfort and perianal care. Our observations and the findings of the trial<sup>8</sup> justify consideration of a large, multicentre, randomised controlled trial comparing laxative care using lactulose with placebo to determine whether treatment of non-defecation in mechanically ventilated patients without objective evidence of true constipation is beneficial, dangerous or unimportant in their care.

In conclusion, in mechanically ventilated patients, lack of bowel motions is the most common physiological state for the lower gut. When bowel motions occur they are rarely formed, and diarrhoea is seen in slightly more than 10%. Laxatives have some effect, while morphine inhibits defecation. The amount of enteral nutrition strongly predicts the presence of looser stool production. Pseudo-obstruction, obstruction and bacterial diarrhoea were not seen. These findings provide the necessary context for future randomised controlled trials.

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