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ORIGINAL ARTICLE

Diarrhoea risk factors in enterally tube fed critically ill patients: A retrospective audit

Leanne Jack[a,*], Fiona Coyer[a,1], Mary Courtney[b,2], Bala Venkatesh[c]

[a] Queensland University of Technology, School of Nursing, Victoria Park Road, Kelvin Grove, Queensland 4059, Australia
[b] Faculty of Health, Queensland University of Technology, Victoria Park Road, Kelvin Grove, Queensland 4059, Australia
[c] Department of Intensive Care, Princess Alexandra and Wesley Hospitals, Critical Care Endocrinology and Metabolism Research Unit, The University of Queensland, St Lucia, Queensland 4072, Australia

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Summary
Objective: Diarrhoea in the enterally tube fed (ETF) intensive care unit (ICU) patient is a multi-factorial problem. Diarrhoeal aetiologies in this patient cohort remain debatable; however, the consequences of diarrhoea have been well established and include electrolyte imbalance, dehydration, bacterial translocation, peri anal wound contamination and sleep deprivation. This study examined the incidence of diarrhoea and explored factors contributing to the development of diarrhoea in the ETF, critically ill, adult patient.
Method: After institutional ethical review and approval, a single centre medical chart audit was undertaken to examine the incidence of diarrhoea in ETF, critically ill patients. Retrospective, non-probability sequential sampling was used of all emergency admission adult ICU patients who met the inclusion/exclusion criteria.
Results: Fifty patients were audited. Faecal frequency, consistency and quantity were considered important criteria in defining ETF diarrhoea. The incidence of diarrhoea was 78%. Total patient diarrhoea days ($r = 0.422$; $p = 0.02$) and total diarrhoea frequency ($r = 0.313$; $p = 0.027$) increased when the patient was ETF for longer periods of time. Increased severity of illness, peripheral oxygen saturation (Sp02), glucose control, albumin and white cell count were found to be statistically significant factors for the development of diarrhoea.
Conclusion: Diarrhoea in ETF critically ill patients is multi-factorial. The early identification of diarrhoea risk factors and the development of a diarrhoea risk management algorithm is recommended.

* Corresponding author. Tel.: +61 7 3138 3901.
E-mail addresses: lc.jack@student.qut.edu.au, jackijack@optusnet.com.au (L. Jack), f.coyer@qut.edu.au (F. Coyer), m.courtney@qut.edu.au (M. Courtney), Bala_Venkatesh@health.qld.gov.au (B. Venkatesh).
[1] +61 7 3138 3895.
[2] +61 7 3138 9639.

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Introduction

Diarrhoea in the enterally tube fed (ETF) critically ill patient is a frequently experienced and multi-factorial problem (Thorson et al., 2008). Although rarely associated with mortality, diarrhoea is distressing to patients, visitors and staff (Martin, 2007).

Enteral tube feeding is often debated as a main cause of diarrhoea (Lee and Auyeung, 2003; Ukleja, 2010). Approximately 46—77% of all critically ill patients will receive enteral nutrition (EN) during their intensive care unit (ICU) admission (McKenna et al., 2001; Lee and Auyeung, 2003; Gramlich et al., 2004; Whelan et al., 2006; Whelan, 2007). The early commencement of EN is suggested to preserve the gut's immunological barrier, reduce bacterial translocation, reduce sepsis and multi-organ failure and improve wound healing (Davies and Bellomo, 2004; Marshall and West, 2004; Artinian et al., 2006; Nguyen et al., 2007; Lopez-Herce et al., 2008; Lopez-Herce, 2009; McClave and Heyland, 2009; Ukleja, 2010).

Incidence of diarrhoea

The reported incidence of ETF diarrhoea is suggested to vary between 2% and 68% (Bengmark, 2002; McNaught et al., 2005; Weisen et al., 2006; Luft et al., 2008; Whelan et al., 2009). However, diarrhoea in ETF critically ill patients is more diverse with the reported incidence varying between 2% and 95% of all patients (Whelan et al., 2009). The variability of diarrhoea incidence depends on the diagnostic criteria and definitions used to identify and quantify diarrhoea (Lopez-Herce, 2009).

Causes of diarrhoea in the ETF patient

Diarrhoea in ETF patients has previously been associated with physiologic responses to critical illness, altered colonic responses to intragastric feeding, microbial contamination of the ETF formulae, sterile ETF formulae, constant flow administration of ETF formulas, low fibre ETF formulas, hypoalbuminaemia, disturbances to intestinal flora, increased exposure to antibiotics, and concurrent pharmacotherapy such as aperients, prokinetics and histamine-2 medications (Weisen et al., 2006; Ferrie and East, 2007; Sabol and Carlson, 2007; Whelan, 2007; Lopez-Herce, 2009; Btaiche et al., 2010). In addition, the diagnosis, severity of illness and co-morbidities of patients can contribute to diarrhoea in critically ill patients (Thorson et al., 2008).

Diarrhoea management strategies

Inconsistent diarrhoea management practices are evident between different ICU's (Dorman et al., 2004; Ferrie and East, 2007). Strategies to manage ETF related diarrhoea include diarrhoea management algorithms, anti-diarrhoeal medications, electrolyte and fluid replacement, continuation of ETF, administration of probiotics, prebiotics and synbiotics, and the administration of glycopeptides and metronidazole for infectious diarrhoea (Whelan et al., 2006; Lopez-Herce, 2009). It could be argued that the variations in bowel care management strategies in ICU lead to diarrhoea in critically ill patients.

It was noted that the reported incidence of ETF related diarrhoea in critically ill patients is well established in regards to interventional research such as administration of fibre containing ETF formulas and probiotics (Bleichner et al., 1997; DeMao et al., 1998; Lee and Auyeung, 2003; Whelan et al., 2006; Lopez-Herce, 2009). However, there remains a paucity of literature addressing the incidence and frequency of diarrhoea in ETF critically ill patients in relation to ETF formulae, relationships between diarrhoea incidence and duration, hypoalbuminaemia, infection, antibiotic therapy and concomitant pharmacotherapy within in a single centre, tertiary referral ICU.

Methods

A 5-month, retrospective, repeated measures cohort study was undertaken.

Study aims and research questions

The primary aim of this study was to examine the relationships between ETF and diarrhoea in a single centre ICU. This study informed a larger, single centre cohort study that examined diarrhoea risk factors in critically ill patients. The research questions that guided this study include:

1. What is the incidence of ETF diarrhoea in the ICU?
2. Is the duration and incidence of diarrhoea related to the type of ETF administered?
3. Is the duration and incidence of diarrhoea related to the duration of ETF?
4. Do patients develop diarrhoea when the commencement of ETF is delayed?
5. Is diarrhoea incidence and duration influenced by age, gender and Acute Physiology and Chronic Health Evaluation (APACHE II) scores?
6. Does the duration of antibiotic therapy, aperients, prokinetic, sedation and neuromuscular blockade medication administration affect the incidence and duration of diarrhoea?
7. Is diarrhoea related to hypoxia, hypoalbuminaemia, hypoglycaemia and elevated white blood cell counts?

Setting

The research setting was a twenty-two bed, single site, Level III ICU of a major teaching and tertiary referral, metropolitan hospital in Brisbane, Australia. A Level III Australian ICU is a tertiary referral unit that provides comprehensive critical care services for critically ill patients who require multi-system life support for indefinite periods of time. These ICUs also demonstrate a commitment to academic education and research (Joint Faculty of Intensive Care Medicine (JFICM), 2003).

Table 1 Study data collected.

Data	Description
Demographic data	Age, gender, ethnicity, APACHE II scores Hospital/ICU admission/discharge dates/times ICU admission diagnosis
Enteral nutrition	EN commencement/cessation date/time EN formulae type Rates of administration Gastric residual volume
Bowel activity	Date/time initial bowel activity Frequency and consistency of daily bowel activity Aperient/prokinetic medications
Medication administration (type, amount and duration)	Sedation, neuromuscular blockade medications Antibiotic therapy
Routine investigation results	Daily arterial blood gases (ABG), full blood count, blood urea nitrogen, coagulation profiles Microbial investigations; e.g., urine, sputum blood cultures Routine multi-resistant organism (MRO) screening

Ethical approval

Ethical approval was obtained from the local hospital and university human research ethics committees.

Participants

Participants were recruited using non-probability, retrospective sequential sampling of all emergency admission ICU patients who met the inclusion/exclusion criteria. Patients were eligible for inclusion if they: (1) were enterally tube fed via continuous infusion; (2) $\geq$18 years of age; and (3) were expected to have an ICU length of stay (LOS) >5 days. Participants were excluded from the study if they were: (1) immunocompromised; (2) suffered burns/hepatic failure; and (3) elective post-operative patients. Consent was not obtained from participants as this study fulfilled the criteria of a quality assurance activity. Study participants were de-identified to a study number. A password protected enrolment log was maintained of study participants.

Data collection

Data were audited retrospectively by review of medical records. A data collection tool was developed for this study (see Table 1). Data were collected to a maximum of 14 days into the patients ICU admission or until the patient was discharge from ICU, whichever occurred first. It was deemed necessary to audit data for this length of time as diarrhoea is often not observed in the initial 5—7 days of a patient's ICU admission. For this study, diarrhoea was defined as the 'abnormal passage of loose or liquid stools more than three times daily and/or a volume of stool greater than 200 g/day during the patient's ICU admission' (Thomas et al., 2003, p. 2).

No validated diarrhoea measurement tool was used in the ICU at the time of this study. Faecal output was recorded subjectively by nursing staff using the CareVue computer information management system. Faecal volume was recorded by nurses as small (<100 ml), medium (100—200 ml) and large (<200 ml). Stool consistency was recorded as formed, semi-formed, loose or watery. Data for this study was audited retrospectively at one point in time; therefore, education of nurses regarding the use of a faecal output measurement tool was not appropriate. The consistency of nursing documentation was unable to be checked due to the retrospective methodological design of this study. Faecal volume and consistency were then cross-referenced by the researcher using the Bristol Stool Form Scale, which is a validated diarrhoea identification tool (Dorman et al., 2004).

Operational definitions used to guide this research include:

1. Diarrhoea: diarrhoea was either experienced or not experienced by the patient;
2. Diarrhoea episode: one event of diarrhoea experienced by a patient;
3. Diarrhoea duration: the number of days a patient experienced diarrhoea during their ICU admission;
4. Diarrhoea frequency: the total diarrhoea episodes experienced by a patient during their ICU admission;
5. Total diarrhoea days: the total number of days a patient experienced diarrhoea during their ICU admission.

Data analysis

Data analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 16. Descriptive statistics of patient demographics were performed using means and standard deviations (SD). Normality was assessed using Kolmogorov—Smirnov test. Univariate and bivariate correlations were assessed using the Pearson or Spearman Rho coefficient. Univariate associations were analysed using Chi square statistical test. A general linear model was used

Table 2 Patient demographics.

	Frequency *n*	Measure of dispersion
Age		Range 18—88 years Mean = 51 years, SD = 19.03
Gender		
Male	27	54%
Female	23	46%
ICU LOS	50	Range 5—83 days Mean = 13 days, SD = 11.9
APACHE II Score	50	Range 14—127 Mean = 55, SD = 29.53
Bowel activity		
Yes	46	92%
No	4	8%
Diarrhoea		
Yes	39	78%
No	11	22%
Diarrhoea		
Male	23	46% (85% of males)
Female	16	32% (70% of females)
Time delay from ICU admission to initial bowel activity	50	Range 5—206 hours Mean = 106 hours, SD = 51 hours
Infection		
Yes	33	66%
No	17	34%
Multi-resistant organism		
Yes	5	10%
No	45	90%

The primary ICU admission diagnoses included: cardiovascular: abdominal aortic aneurysm, dissected thoracic aorta, emergency coronary artery bypass grafting, cardiac arrest; respiratory: adult respiratory distress syndrome, asthma, pneumonia; neurological: subarachnoid haemorrhage; gastrointestinal: gastrointestinal surgery, diabetic ketoacidosis; trauma: multiple trauma ± head trauma, spinal cord injury; other: renal failure, sepsis.

to explore univariate relationships. The Kruskal—Wallis test was performed to explore the variance between skewed continuous variables across groups. The Mann—Whitney *U*-test was used to explore non-parametric means. Generalised estimated equations (GEE) modelling was used to analyse the within subject variation across the repeated measures analysis. For all analyses, a $p < 0.05$ was considered statistically significant.

Results

Fifty patients were retrospectively audited over 5 months (January to May 2007). In this study, there was no data missing when the patient's medical chart was audited. Patient demographic data are outlined in Table 2. The majority of patients ($n = 39$; 78%) developed diarrhoea. Diarrhoea was observed on 121 days (19%) of the 644 patient admission days. Single episodes of diarrhoea were observed 326 times (SD 7.3, range 0—29) over 449 ETF days (SD 3.3, range 3—14). Patients experienced 0—8 episodes of diarrhoea daily. However, the total single episodes of diarrhoea per patient admission varied between 0 and 29 episodes. Antibiotics, aperients, prokinetics and sedation were administered to most patients (Fig. 1). Individual intestinal pro-motility and sedation medications administered to patients in this study are outlined in Figs. 2 and 3.

No statistically significant difference between the patients' age and diarrhoea frequency ($r = 0.003$; $p = 0.982$) and diarrhoea duration ($r = 0.122$; $p = 0.397$) was observed.

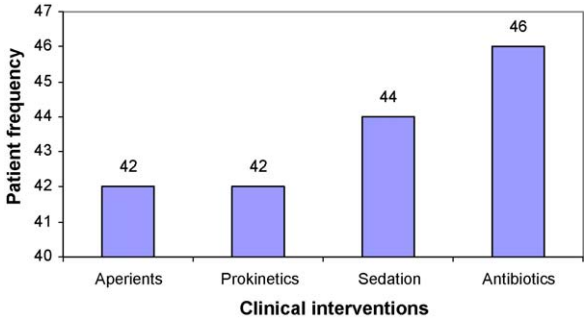

Figure 1 Associated drug therapies administered to patients ($n = 50$).

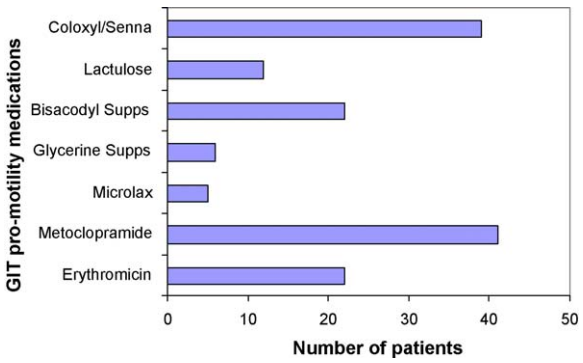

Figure 2 Gastrointestinal pro-motility medications administered to patients ($n = 50$)

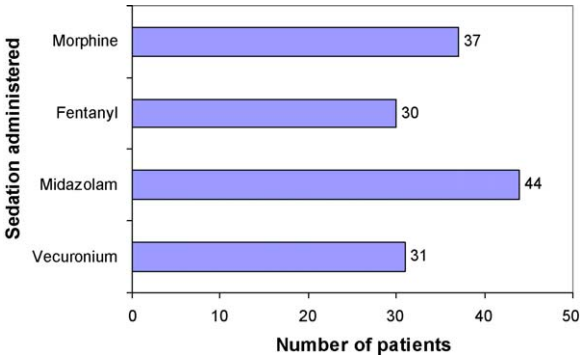

Figure 3 Sedation agents administered to patients ($n = 50$).

Gender did not influence diarrhoea ($\chi^2 = -0.188$; $p = 0.191$), diarrhoea frequency ($r = -0.207$; $p = 0.149$) or diarrhoea duration ($r = -0.183$; $p = 0.204$) (Table 3). Higher APACHE II scores were associated with a higher frequency of diarrhoea ($r = 0.334$; $p = 0.018$) and a longer duration of diarrhoea ($r = 0.372$; $p = 0.008$). Patients who had a longer ICU LOS were more likely to develop diarrhoea ($\chi^2 = 0.535$; $p < 0.01$) and experience a longer duration of diarrhoea ($\chi^2 = 0.915$; $p < 0.001$); however, statistical significance was not found between the ICU LOS and diarrhoea frequency (Table 3).

Enteral nutrition and incidence of diarrhoea

All patients received ETF at some point during their ICU admission. Enteral tube feeding formulas consisted of Jevity Plus ($n = 37$; 74%), Jevity ($n = 6$; 12%), Nepro ($n = 7$; 14%) or another formulae ($n = 0$) at the start of ETF. Nine patients (18%) had their ETF formula changed (Jevity Plus $n = 1$; Jevity $n = 1$; Nepro $n = 5$; Other $n = 1$) during their ICU admission. The ETF formula was not associated with the development of diarrhoea ($\chi^2 = 2.540$; $p = 0.281$). Additionally, no relationship was observed between diarrhoea and the changing of the ETF formula ($\chi^2 = 3.096$; $p = 0.542$). The duration ($\chi^2 = 3.469$; $p = 0.177$) and frequency ($\chi^2 = 3.633$; $p = 0.163$) of diarrhoea was not associated with the EFT formulae.

Total diarrhoea days ($r = 0.422$; $p = 0.02$) and diarrhoea frequency ($r = 0.313$; $p = 0.027$) increased when the patient was ETF for longer periods of time. Significant relationships were not found between diarrhoea ($r = -0.152$; $p = 0.291$), total diarrhoea days ($r = 0.032$; $p = 0.825$), diarrhoea frequency ($r = -0.067$; $p = 0.646$) and time delay from ICU admission to the commencement of ETF. Controlling for total ETF days did not demonstrate a relationship between the development of diarrhoea ($r = -0.036$; $p = 0.806$), total diarrhoea days ($r = 0.240$; $p = 0.096$) or diarrhoea frequency ($r = 0.191$; $p = 0.189$) with respect to the time delay from ICU admission to the start of ETF. Of particular interest was that the duration of diarrhoea was linearly associated with the frequency of diarrhoea ($\chi^2 = 0.915$; $p < 0.001$).

Table 3 Univariate analysis of total diarrhoea duration and total diarrhoea frequency.

	Univariate co-efficient	Univariate p value
Diarrhoea duration		<0.001*
Gender	−0.142	0.181
Time delay from ICU admission to initial bowel activity	−0.400	0.030*
Total antibiotic days	−0.143	0.258
Total ETF days	0.586	0.586
Total aperient days	−0.209	0.179
Total prokinetic days	−0.500	0.020*
Total opioid days	0.175	0.182
ICU LOS	0.320	0.023*
Diarrhoea frequency		0.010*
Gender	−0.142	0.244
Time delay from ICU admission to initial bowel activity	−0.361	0.016*
Total AB days	−0.085	0.552
Total ETF days	0.478	0.014*
Total aperient days	−0.248	0.164
Total prokinetic days	−0.504	0.039*
Total opioid days	0.132	0.375
ICU LOS	0.237	0.097

* Statistically significant at $p \leq 0.05$.

Table 4 GEE estimates for diarrhoea and total enteral tube fed days.

Variable	Estimated coefficient	Confidence interval	*p* value	Wald statistic
Infection (yes/no), antibiotics (yes/no)	0.067	0.036—0.099	<0.01	17.204
Glucose, mmol/l (low/normal)	0.063	0.033—0.093	<0.01	16.839
Albumin, g/l (low/normal)	0.063	0.033—0.093	<0.01	16.839
White cell count, 10^9/l (low/normal/high)	0.062	0.032—0.092	<0.01	16.605

Medications administered

An increased duration of diarrhoea was associated with total antibiotic days ($r = 0.300$; $p = 0.034$) and sedation days ($r = 0.363$; $p = 0.010$). Patients who developed an infection (Md = 3; $n = 33$) compared to those patients who did not develop an infection (Md = 2; $n = 17$) were more likely to experience an increased duration of diarrhoea ($U = 175$; $z = -2.200$; $p = 0.028$; $r = 0.31$). The duration of diarrhoea was not associated with the duration of aperients ($r = -0.033$; $p = 0.818$), prokinetics ($r = 0.135$; $p = 0.349$) and neuromuscular blockade medications ($r = 0.158$; $p = 0.274$) days.

Similarly, an increase in diarrhoea frequency was associated with total antibiotic days ($r = 0.320$; $p = 0.023$) and total sedation ($r = 0.362$; $p = 0.010$) days. Patients who developed an infection (Md = 7; $n = 33$) experienced an increased frequency of diarrhoea compared to those patients who did not experience an infection (Md = 1; $n = 17$) ($U = 162$; $z = -2.444$; $p = 0.015$; $r = 0.35$). The frequency of diarrhoea demonstrated no relationship with the duration of aperients ($r = -0.099$; $p = 0.493$), prokinetics ($r = 0.101$; $p = 0.486$), and neuromuscular blockade medications ($r = 0.203$; $p = 0.157$) days.

Physiological variables

This study applied Generalised estimated equations modelling for repeated measures of physiological data to describe the within subject variability that could not be explained using a repeated measures ANOVA test. Table 4 demonstrates that all binary and covariate physiological variables used in this study are significant. Positive associations were found between the dependent variable of diarrhoea and all explanatory variables of total ETF days, glucose, albumin, white cell counts.

Infectious diarrhoea (*Aeromonas hydrophilia* spp.) was observed in the first of two stool cultures in one patient. The stool cultures were collected on days four and seven of the patient's ICU admission. *Aeromonas* spp. infections have previously been associated with gastroenteritis in children; however, the role of this bacteria in relation to infection remains unclear and caution related to the aetiology of diarrhoea in this patient was applied (Forbes et al., 2007). No other infectious source of diarrhoea such as *Clostridium difficile*, *Salmonella* or *Shigella* was cultured.

Discussion

The key result of this retrospective clinical chart audit is that the high frequency of diarrhoea in ETF, critically ill patients ($n = 39$; 78%) is not associated with one diarrhoea risk factor. Rather, many factors influence the frequency and duration of diarrhoea in critically ill patients. The high frequency of diarrhoea in this study supports the findings of similar studies and suggests that diarrhoea is common in the ICU environment (Bengmark, 2002; Lebak, 2003; Ferrie and East, 2007).

No general consensus of diarrhoea definition is used in the clinical setting (Lebak et al., 2003; Whelan et al., 2003; Martin, 2007; Sabol and Carlson, 2007). Although a stringent definition of diarrhoea was used by this study, a similar definition was not used by clinicians in the ICU where the study was undertaken. Diarrhoea definitions that rely on clinical judgement in the absence of standardised criteria are fraught with complications (Lebak et al., 2003) and should be avoided. In the absence of a standardised diarrhoea definition, a taxonomy of definitions embracing stool frequency, consistency, duration and weight is suggested (Lebak et al., 2003). Diarrhoea prevalence is lower when stringent, measurable diarrhoea definitions are used (Lee and Auyeung, 2003; Whelan et al., 2003, 2008). The higher prevalence of diarrhoea in this study may have been influenced by the definition and diagnostic qualities of diarrhoea used in this study. Additionally, the high prevalence of diarrhoea in this study may be associated with the subjective assessment and the accuracy of reporting diarrhoea by health care practitioners.

Enteral nutrition has been previously associated as a risk factor for diarrhoea (Thorson et al., 2008; Whelan et al., 2009). Some risk factors related to enteral nutrition were controlled for in this study. The ETF formula was delivered via a closed sterile system. The ETF formula and administration flow sets were changed every 24 hours. All patients were fed via continuous infusion. Diarrhoea related to bolus feeding was therefore minimised. There was no report of infectious diarrhoea in this study.

In this study, the type or osmolality of the ETF formula was not found to affect the frequency or duration of diarrhoea. These findings are supported by research conducted by Pesola et al. (1990) who demonstrated that the osmolality of ETF formulas did not increase in the incidence of diarrhoea is healthy volunteers ($n = 5$) and ward ($n = 10$) and ICU patients ($n = 24$). Diarrhoea developed in only three ICU patients in Pesola's study (1990); however, these patients had an average albumin level of 2.8 g/dl. This diarrhoea finding was not statistically significant (Pesola et al., 1990). Similar to Pesola's study (1990), an average hypoalbuminaemia of <30 g/l was reported in 34% ($n = 17$) of patients in the clinical chart audit undertaken for this study. Statistical significance was also not observed in the clinical chart audit.

Several other diarrhoea risk factors have been identified in other studies and include APACHE II scores, longer ICU LOS, infection, bolus ETF, previous total parenteral nutrition (TPN), hypoalbuminaemia, fever or hypothermia (Heyland, 2000; Barbut and Meynard, 2002; Marshall and West, 2004; Thorson et al., 2008; Lopez-Herce, 2009). In this study, the presence of numerous risk factors including time delay to initial bowel activity, total ETF days, total antibiotic days, total prokinetic days and ICU LOS was associated with the frequency and duration of diarrhoea in critically ill patients.

Infection has been previously identified as a risk factor for diarrhoea in ETF critically ill patients. This study re-affirmed the significant relationships between infection and diarrhoea incidence and duration. However, caution must be exercised in regards to these relationships as the presence of infection in critical illness may also be influenced by higher severity of illness scores, antibiotic use and an increased ICU LOS.

High severity of illness scores including APACHE II scores was associated with an increased frequency and duration of diarrhoea. Critically ill patients who are more acutely ill may experience a hyper-metabolic stress response, altered gut pathophysiology such as increased intestinal lumen permeability, electrolyte imbalances, and altered immune responses (Ferrie and East, 2007; Thorson et al., 2008).

The significant relationships found between diarrhoea, duration of ETF, glucose control, albumin and white cell counts in this study have been inconsistently reported elsewhere. These findings require further examination in studies with larger sample sizes.

Strengths and limitations

Three major results were identified in this study. First, this study used a retrospective, single centre cohort clinical chart audit methodology, and as such the findings may not be generalisable to the wider ICU population. However, the longitudinal approach adopted and the extent of data collected and analysed has not been embraced in previous studies reviewed. A major strength of this study was that only emergency admission critically ill patients who were ETF were included and elective surgical patients or patients transferred to the ICU from a ward or another hospital were excluded. These criteria enabled clear identification of diarrhoea relationships in critically ill patients. Second, this study reinforces that diarrhoea in ETF, critically ill patients is associated with many risk factors. Finally, this study re-affirms previous research that indicates the high prevalence of diarrhoea in ETF, critically ill patients.

The single centre setting may be seen as both a strength and weakness. The limitation of the single centre is that study findings may not be generalised to the wider ICU community. Conversely, the strength of this approach is that bias between patient characteristics and local unit clinical protocols has not influenced the study findings.

Four notable limitations were observed in this study. First, no diarrhoea measurement tool was used by the ICU; therefore, clinicians based their subjective assessment of faecal stool output on professional opinion. Second, the accuracy of data audited in this retrospective clinical chart audit relied on the accuracy and consistency of practitioners reporting patient responses to critical illness. This was unable to be controlled for and may have resulted in an overestimation of diarrhoea. Third, the researcher retrospectively applied a faecal stool output measurement tool to the patient's faecal output which was recorded in the patient's medical record. Subjective assessment of faecal stool output has been associated with inaccurate stool quantification. The higher incidence of diarrhoea observed in this study may be in part, related to the subjective nature of stool assessment. The final limitation of this study is the study's oversight to examine the relationships between aerobic intestinal microflora, enteral nutrition and diarrhoea in critically ill patients.

Recommendations

The results of this study reinforce that diarrhoea in ETF critically ill patients is associated with many factors. Recommendations for clinical practice and future research arising from this study include (1) re-examine ETF related diarrhoea risk factors in all subsets of critically ill patients; (2) develop and validate a faecal output measurement tool that is appropriate for use in critically ill patients; (3) implement a diarrhoea measurement tool to quantify faecal output; and (4) conduct prospective exploratory research that examines the relationships between aerobic intestinal microflora, enteral nutrition and diarrhoea in critically ill patients.

Conclusion

This paper has presented findings related to diarrhoea risk factors and the prevalence of diarrhoea in a single centre ICU. The findings suggest that diarrhoea in ETF critically ill patients is associated with many risk factors; however, the degree of involvement of these diarrhoea risk factors varies between critically ill patients. The differences in diarrhoea risk factors may in part be related to the inconsistent approaches to defining diarrhoea. Few studies have examined aerobic bacteria, enteral nutrition and diarrhoea relationships in critically ill patients. This paucity of knowledge requires future research.

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