

Effect of Bowel Regimen Protocol on Gastrointestinal Complications among Patients on Mechanical Ventilator

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Abstract

Background: Several negative outcomes result from poor bowel management complications, such as longer duration on mechanical ventilation (MV), a longer stay in the intensive care unit (ICU), and could increase patient morbidity rate. **The Study Aim:** This study was to investigate the effect of bowel regimen protocol on gastrointestinal complications among patients on mechanical ventilator to evaluate length of ICU stay, mechanical ventilation duration and mortality rates. **Research Design and Setting:** A quiz experimental study was carried out between May 2021 and December 2021 in three intensive care units at Assiut University Main Hospital, Egypt. **Sampling:** A total of 60 patients were included in the study. **Study tools:** The researchers utilized three tools to gather the patients' data; patient assessment tool, bowel function assessment tool and patient outcomes assessment tool. **Results:** The incidence of gastrointestinal complications (diarrhea and constipation) among patients in the intervention group was statistically significantly reduced to 13.3 % when compared with control group with $P < 0.001$. There was significant improvement in general patients out comes (MV duration, length of (ICU) stay and mortality) in the intervention group in comparison with control group with (p .value < 0.05). **Conclusion:** Bowel regimen could significantly improve bowel function among patients in ICU, and consequently reduce constipation, diarrhea, decreases MV duration, ICU length of stay, and mortality rate. Therefore, bowel regimen should be standardized as bowel routine care in ICU.

Keywords: *Bowel regimen protocol, Gastrointestinal complications & Patients on mechanical ventilator*

Introduction

In critically ill patients, bowel dysfunction, such as constipation and diarrhea, is prevalent (Ferrie & East, 2007; Knowles et al., 2014) and it can result in number of negative outcomes such as increased duration of stay in ICU, weaning from mechanical ventilation takes longer than expected, dehydration, fluid and electrolyte imbalance, skin excoriation or contamination of wound, multi-organ failure, also could increase morbidity as well as result in life-threatening conditions (bowel ischemia, gastrointestinal tract perforation, gastrointestinal (GI) bleeding, and abdominal compartment syndrome) (Blaser et al., 2012; Camilleri et al., 2012; Reintam Blaser et al., 2013; & Ghosh et al., 2020). Patients in ICUs are at higher risk for constipation and diarrhea due to dehydration, the use of sedatives or analgesics, especially opioids; immobility; artificial respiration; or their underlying disease (Vincent, Jean-Louis, 2015; Smonig et al., 2016; & Moonen et al., 2018)

Despite the fact that patients in ICU are at a greater risk of bowel disturbance, it is generally a low priority in comparison with the life-threatening problems. Furthermore, physicians' bowel management recording and reporting rates have been

shown to be insufficient (McPeake et al., 2011). Also, physicians in intensive care units have expressed that they are not satisfied with the treatment of bowel function in their patients (Knowles et al., 2015).

Monitoring and documenting bowel activity is frequently considered a nurse's responsibility in the intensive care unit. Nurses are responsible for evaluating and reporting bowel activity, assessing the weight on admission and measurement of weight every week, evaluating fluid balance, and caring for enteral tubes during the duration of enteral feeding. Abdominal examinations, which evaluate bowel sounds and changes in abdominal girth, provide the nurse with more objective symptoms about GI complications (Urden et al., 2014).

It is essential for intensive care physicians and nurses to manage bowel function among patients on mechanical ventilator to reduce GI problems. Bowel management protocols are a technique for nurses to be guided to standardized bowel function assessment and management among patients on mechanical ventilator in ICUs. These Protocols should be applied with specific techniques to change the behavior of nurse toward care of such group of patients (Gagliardi & Brouwers, 2012).

Significance of the study

Bowel dysfunction complication, such as constipation and diarrhea, are common in patients in ICUs. The incidence of constipation is ranging from 16–50% and in one instance even as high as 83%; while diarrhea in intensive care is ranging from 15–36% (Knowles et al., 2014). Bowel regimen guidelines or protocols provide a technique to standardize bowel management procedures in ICUs (Ferrie & East, 2007). In spite of, clinicians' concerns that bowel management is a problem, bowel protocols or standards are rarely used in critical care units (Thorpe & Harrison, 2002; El-Saman & Ahmed, 2017). There has never been a prior assessment of the use of bowel protocols in our ICUs. So we carried out a study to assess the effect implementation of bowel regimen protocol on gastrointestinal complications among patients on mechanical ventilator.

Aim of the study

This study aims to investigate the effect of bowel regimen protocol on gastrointestinal complications among patients on mechanical ventilator and to evaluate length of ICU stay, mechanical ventilation duration and mortality rates.

Patients and methods

Study design and setting: A quiz experimental study was carried out between May 2021 and December 2021 in three intensive care units (ICU) at Assiut University Main Hospital, Egypt: general ICU (20 beds), trauma ICU (20 beds), and anesthesia ICU (20 beds).

Research Hypotheses:

H1: Patients who received a bowel regimen protocol would have fewer gastrointestinal complications than those who would not receive the bowel regimen protocol.

Null hypothesis: there is no effect of bowel regimen on patient's gastrointestinal complications

Sample:

The study sample size was calculated based on the Epidemiology Information 2000 statistical software. The expected enteral nutrition frequencies from previous studies with a 95 % confidence interval, 80 % study power, 95 % frequency of enteral nutrition, and a worst acceptable result 5%. A total of 65 patients were predicted to be included in the study.

The study sample Type; purposive sample, from adult male and female patients aged between 18 to 60 years old who were on mechanical ventilator, started enteral feeding (EN) within 24-48 hours and needed enteral nutrition for at least 5 days were included in this study. This study excluded patients with acute pancreatitis, recent bowel or abdominal surgery, known intestinal obstruction/ileus, reject to enteral nutrition, or pregnancy. Five patients were started parenteral nutrition on the third day of admission. So,

we excluded from statistical analysis of the data.

The patients in the study were not randomly divided to two groups: the control group (patients from trauma ICU, and anesthesia ICU) or the intervention group (patients from general ICU). The routine hospital care applied to the control group, whereas a bowel regimen protocol applied to the intervention group. All patients assigned to early enteral feeding.

Study tools: the researchers utilized three tools to collect the patients' data.

Tool 1: Patient assessment tool:

The researchers developed this tool after reviewing the literature (Knowles et al., 2014; Moonen et al., 2018) to get baseline data of the studied patients. This tool composed of three parts.

Part one: Patient demographic and clinical data

It included demographic data (age, sex), as well as clinical data (patient diagnosis, past medical diagnosis, date of ICU admission and discharge).

Part two: Acute physiology and chronic health evaluation (APACHE II score)

The APACHE-II scoring system utilized to determine the severity of a patient's disease in ICU. The APACHE-II score is divided into three sections. The first (biggest) component is derived from 12 clinical measurements gathered within the 24 hours after admission to intensive care unit. The second component is age adjustment, which adds one to six points for patients over 44 years old. The final component is a chronic health assessment. For patients with severe and chronic organ failure, a further adjustment is made (Rafiee et al., 2020)

Part three: Richmond Agitation Sedation Scale (RASS):

This tool was adopted from (Rasheed et al., 2019) and utilized to evaluate the anxiety and agitation of patients. One for an alert, calm state and additional levels for sedation quality, which consist of a ten-point, with 4 levels of anxiety or agitation from +1 to +4 (combative), one for a calm and alert state (0), and 5 levels of sedation from -1 to -5. Observation, response to verbal stimulation and response to physical stimulation are three sequential steps utilized.

Tool two: Bowel function assessment tool

The researchers developed this tool based on literatures to assess bowel function of critical ill patients. It included two parts:

Part one: Bristol Stool Form Scale (BSFS):

The Bristol Stool Chart was developed in 1997 (Lewis & Heaton, 1997) as a clinical evaluation tool of the human stool and adopted by (Abd-Elraheem et al., 2020). Bristol Stool Form Scale categorizes stools into one of seven types as illustrated in figure (1). Type (1-2) represent constipation, type (3-4) are ideal stools, and type (5-7) may represent diarrhea

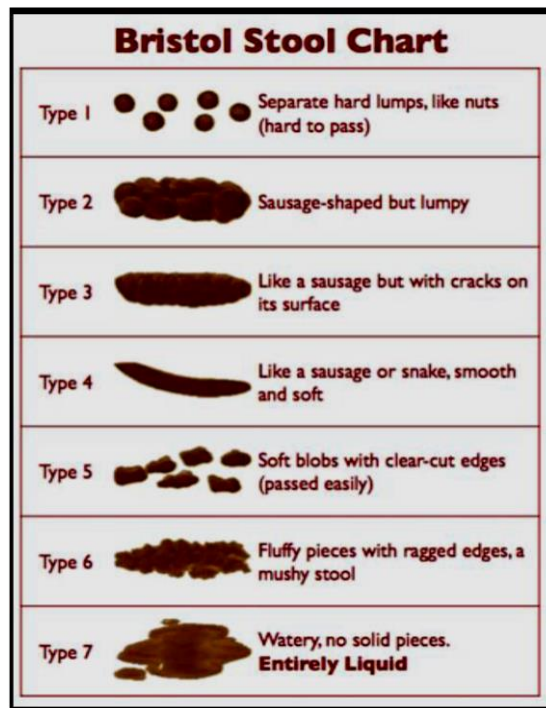


Figure (1): The Bristol Stool Chart (Lewis & Heaton, 1997; Abd-Elraheem et al., 2020)

Part two: Enteral feeding assessment: It included assessment the time of beginning enteral feeding and the identical technique for achieving the EN target.

Tool three: Patient outcomes assessment tools
After analyzing the literature (Ferrie & East, 2007; McPeake et al., 2011; Tirlapur et al., 2016), the researcher designed this tool to evaluate patient outcomes. It included two parts.

Part one: Primary outcome included gastrointestinal complications (diarrhea and constipation).

Part two: Secondary outcomes were utilized to evaluate length of ICU stay, mechanical ventilation duration and mortality rates.

Methods

- The researchers reviewed the literatures related to the study problem. This was accomplished through the use of textbooks, scientific journals and an online search.
- **Tools validity and Reliability:** A panel of five specialists in critical care nursing, anesthesia and intensive care medicine were tasked to assess the tools validity; three professors from critical care nursing department from Faculty of Nursing- Assiut University and two professors from anesthesia and intensive care medicine from Faculty of medicine, Assiut university assessed the content of the tools for comprehensiveness, accuracy, clarity, relevancy, and applicability. The suggested modifications were done. The scale content validity index was 0.94.

Reliability of the three tools were evaluated through assessing their internal consistency and stability measured by Cronbach's alpha coefficient ($r = 0.833$ & 0.829 & 0.865 respectively).

- The ethics committee of the faculty of nursing gave its approval to the study. The study was conducted in accordance with standard clinical research ethics and there was no risk to the study participants. One of the patient's relatives (father, mother, husband, or wife) granted informed consent after outlining the study's nature and objective, and confidentiality was assured.
- Official and non-official Administrative Approval to perform the study was obtained after explaining the study's purpose to the competent authorities at Assiut University Main Hospital.
- **Pilot study:** A six-patient pilot study (10 % of the sample) was done to evaluate the tools' applicability and calculate time needed to answer the tools before starting data collection. The necessary modifications were done and participants in the pilot study were excluded from the study sample and replaced by other patients.

Data collecting technique: The research was carried out these phase in three stages.

Assessment stage for the control and study groups:
In this phase, the researchers assessed:

- The patient's demographic and clinical data by using patient profile, assessment APACHE II score and RASS.
- The time of beginning of enteral feeding and the identical technique for achieving the EN target.
- The frequency of bowel movements as well as the quantity and form of feces of the studied patients by using Bristol Stool Form Scale.
- Visual inspection and palpation of abdomen: tenderness, pain, and distension.
- Presence or absence of bowel sounds.

Implementation stage for the study group:

- **The researchers ran the educational sessions** about bowel regime protocol over a one-month period to nurses and physicians worked in the study unit (general ICU). Education sessions were standardized with Microsoft PowerPoint slides, each session along about thirty minutes as in-service education and covered the following items:
 - Causes and incidence of bowel dysfunction in intensive care units
 - Possible complications associated with bowel dysfunction
 - The importance of bowel management in the intensive care unit
 - The bowel regime protocol's components
 - Flowchart stamp of protocol was placed on all patient profiles to allow nurses to check when bowel assessment finished each shift.

▪ The researchers applied Murdoch Bowel Protocol (Knowles et al., 2014) (Fig 2) for all patients in the study group based on the Bristol Stool Form Scale during the assessment stage. The Murdoch Bowel Protocol aims to respond quickly to decrease gastrointestinal complications and to start the appropriate algorithms (constipation or diarrhea) for ICU patients who are at risk for these complications.

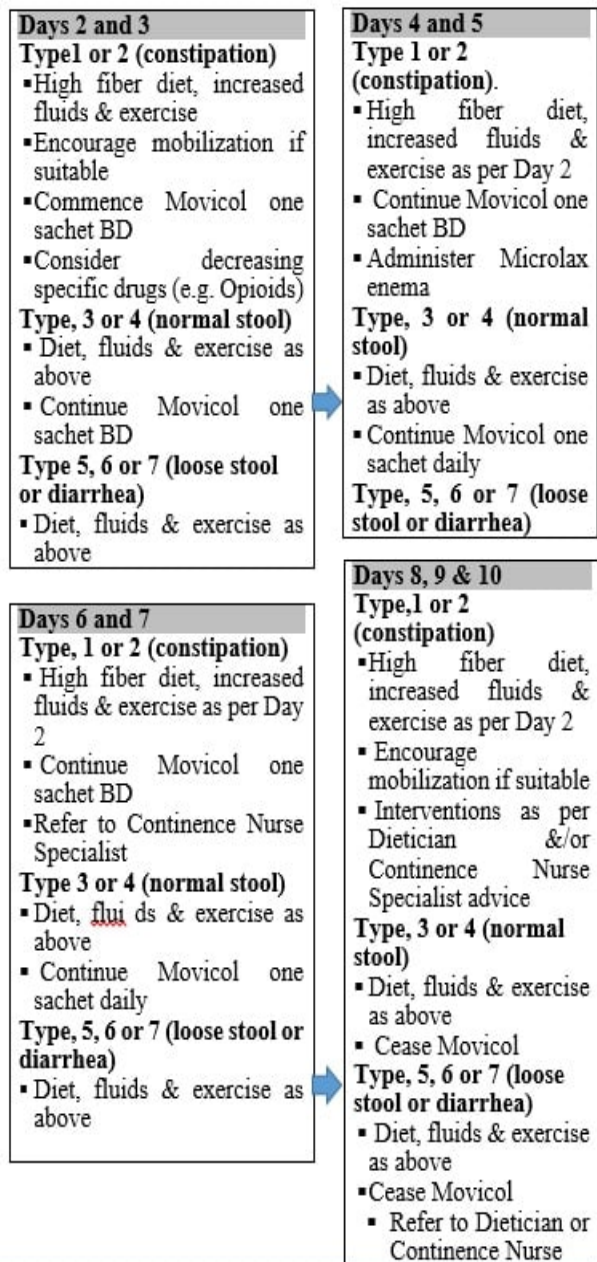


Figure (2): Murdoch Bowel Protocol adopted from (Knowles et al., 2014)

▪ The Murdoch Bowel Protocol was started on the second day of admission, when the patient's condition had stabilized, and continued for seven days, according to the evaluation results of Bristol Stool Form Scale.

▪ Each patient in study group started enteral feeding with a nutritional formula involved fibers. The appropriate method for obtaining the EN target, beginning with bolus EN dose at 25 mL/h and rising by 25 mL/h every 6 hours until the aim of 85 mL/h was reached. Patient positioned in bed semi fowler's as tolerated.

Evaluation phase:

The two groups were evaluated regarding the gastrointestinal complications including diarrhea, and constipation. In additional assess the length of stay in ICU, mechanical ventilation duration and mortality rates.

Statistical analysis:

Statistical Package for Social Sciences (SPSS) (ver.16) was utilized to computerize and analyze the data. The independent sample t-test was used to compare quantitative variables between the studied groups as well as the chi-square test was utilized to compare qualitative variables. The critical value of the tests "P" was considered statistically significant when p .value < 0.05.

Results

Table (1): Frequency distribution of studied patients regarding demographic characteristics and clinical data at admission (n=60):

Item		Control group (n=30)	Intervention group (n=30)
Age		46.83±13.70	41.96±16.04
Sex	Male	24(80%)	23(76.7%)
	Female	6 (20%)	7 (23.3%)
Diagnosis	Traumatic brain injury	11 (36.7%)	14 (46.6%)
	Renal failure	6 (20%)	8 (26.7%)
	respiratory failure	13 (43.3%)	8 (26.7%)

*Independent sample t-test**Chi-square test***Table (2): Frequency distribution of patients regarding acute physiology and chronic health evaluation and sedation score (n=60):**

Item	Control group (n=30)	Intervention group (n=30)	P- value
*APACHE 11 score	14±6.8	16.93±8.44	0.14
Sedation score	2.52±1.60	2.45± 1.66	0.91

APACHE II score: Acute Physiology and Chronic Health EvaluationIndependent sample t-test***Table (3): Comparison between the studied groups in relation to gastrointestinal complications (n=60):**

Item	Control group (n=30)	Intervention group (n=30)	P- value
Diarrhea			
Yes	12(40%)	4(13.3%)	.03*
No	18 (60%)	26 (86.7%)	
Constipation			
Yes	16(53.3%)	4(13.3%)	.002*
No	14 (46.7%)	26 (86.7%)	

*Chi-square test***Table (4): Comparison between the studied groups in relation to general patients out comes (n=60):**

Item	Control group (n=30)	Intervention group (n=30)	P-value
MV duration	9.73±3.50	6.26±3.20	<.001
Length of stay in ICU	13.30±3.56	10.20±4.02	0.003*
Mortality	12(40%)	4 (13.3%)	0.03*

MV: Mechanical ventilationIndependent sample t-test**Chi-square test*

Table (1): The basic characteristics reveal that the mean age of the intervention group was 41.96±16.04 and was 46.83±13.70 among the control group. Eighty percent of intervention and 26.7 % of the control patients were male. Traumatic brain injury and respiratory failure were the first reasons for admission into ICUs for patients in the intervention and control groups (46.6% and 43.3%, respectively).

Table (2): There was no statistically significant change in the APACHE II mean score and sedation score between the intervention and control groups.

Table (3): reveals that the incidence of gastrointestinal complications (diarrhea and constipation) among patients in the intervention

group was statistically significantly reduced to 13.3 % when compared with control group with $P < 0.001$.

Table (4): There was significant improvement in general patients out comes (mechanical ventilation duration, length of stay in ICU and mortality rate) in the intervention group versus the control group with (p .value < 0.05).

Discussion

Reducing constipation and diarrhea among critically ill patients is vital to limit the risk of complications, even if it isn't usually high on the clinical priorities list when compared to the needs of stabilizing a

critically ill patient. On the admission, intensive care clinicians should assess patients' bowel function and begin an appropriate bowel management plan (Jack et al., 2010; McPeake et al., 2011; & Pittman et al., 2012).

The study results documented that both the studied groups were identical to each other in demographic and clinical data. More than two thirds of patients in both groups were male, and the mean age ranged between 46.83 ± 13.70 for the control group and 41.96 ± 16.04 for the study group. This could be attributed to the patients in the study and control groups selected depending on inclusion and exclusion criteria. These results were in line with (Dionne et al., 2020), who reported in a study that there was no statistically significant differences between the studied groups' regarding the baseline data.

According to the findings of this study, APACHE II score of the control group ranged between 14 ± 6.8 and 16.93 ± 8.44 for study group without statistically significant differences between the both groups. This could be attributed to the patients in the both groups being admitted with similar diagnoses. These findings are supported by (Johnson et al., 2012) who reported that the mean and SD of APACHE II score for the studied patients were (22 ± 7) without statistically significant differences between both groups.

The implementation of bowel management protocol among the intervention group resulted in a significant decrease in the incidence of diarrhea in the intervention group than the control group in our study. This could be attributed to the dis-awareness of nurses and physicians who caring of patients in the control group of about the bowel management protocol, or their negligence to the importance of monitoring bowel function or bowel management protocol compared to focusing on patients' hemodynamic stability only. These results were in line with (Ferrie & East, 2007) who observed a statistically significant decrease in diarrhea from 36–23% of patients following implementation of the bowel management protocol into their ICU.

Furthermore, our study revealed a considerable decrease in the incidence of constipation among the intervention group versus control group. This is due to the effect a bowel regimen protocol on maintaining bowel motility. These results were in line with a recent before and after audit conducted by (McPeake et al., 2011) evaluating implementation of a bowel management protocol into one of intensive care unit and showed a decrease in the incidence of constipation from 58–37%. The current study result was in line with (Abd-Elraheem et al., 2020) who documented that nearly three fourth of

the control group had constipation versus less than one quarter only among the study group had constipation. Also, in this line a study conducted by (Thorpe & Harrison, 2002) reported that constipation incidence decreased by 20.7% after implementing the bowel management protocol.

The current study findings also revealed a significant reduction in duration of mechanical ventilation, length of stay in ICU and mortality rate among patients in the study group. This could be attributed that the bowel regimen assists patients' recovery by maintaining bowel function within normal and decreasing risk for constipation which increase abdominal distension and consequently impair pulmonary function. Also, Powel regimens decreased the incidence of diarrhea which disturb acid base and electrolytes which may result in long ICU stay and high mortality. This results supported by (De Souza Guerra et al., 2013; Prat et al., 2016; Tirlapur et al., 2016) who reported that patients with GI dysfunctions (constipation or diarrhea) needed mechanical ventilation for longer duration and sequential increase ICU duration.

Conclusion:

Bowel regimen could significantly improve bowel function among patients in ICU, and consequently reduce constipation, diarrhea, decreases MV duration, ICU length of stay, and morality rate.

Recommendations:

Bowel regimen protocol should be standardized as bowel routine care in ICU. Further research should be done to train critical care nurses in the assessment of GI function in ICU patients.

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Acknowledgment

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Conflict of interest

The authors declare no conflict of interest in this study.

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