Effect of Implementing Murdoch Bowel Protocol on the Occurrence of Constipation among Critically Ill Patients

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Abstract

Background: Constipation is a common complication identified among critically ill patients. It leads to a host of problems for patients admitted to critical care; it contributes to failure to feed, delayed weaning from mechanical ventilation and longer hospital stay. **The aim** of this study was to evaluate the effect of implementing Murdoch bowel protocol on the occurrence of constipation among critically ill patients. **Design:** A Quasi experimental design was utilized for this study**. Subject:** A purposive sample of 68 adult patients aged 20 years or more from both genders**. Setting**: The study was conducted at the Intensive care units at El-Fayoum University Hospitals. **Tools:** Three tools were used in the study (I) Patient's Demographic and Health Relevant Information which included (a), demographic characteristics, (b) health relevant information, (II) Bristol Stool Form Scale (BSFS), tool (III) Constipation Assessment Scale (CAS). **Results:** this study revealed that, near three quarter of the control group had constipation, versus one fifth in the study group. Moreover, above two fifth of the study group showed ideal stool versus less than one fifth of the control group. **Conclusion:** applying Murdoch bowel protocol showed significant improvement in reduction of the incidence of constipation among critically ill patients. **Recommendation**: Implementing Murdoch Bowel Protocol for critically ill patients and apply the Protocol steps on a regular basis. An assessment tool such as Bristol Stool Form Scale (BSFS) for assessment of patient's bowel condition should be incorporated as a part of routine care for critically ill patients.

Key Words: Constipation, Critically Ill Patients, Murdoch Bowel Protocol.

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Introduction

Constipation is a common complication among patients with critical illness. Constipation incidence is very variable due to lack of definition of such patients. In addition to the already known consequences of constipation, in recent years it has been observed that this complication may also be related to worse prognosis of those patients. It has been also noted that this disorder is require more attention among critically ill patients as well as development of protocols for diagnosis and management of those patients **(Azevedo and Machado, 2013).**

In critically ill patients, the function of upper gastrointestinal tract motility is important. However, little attention has been paid to lower gastrointestinal tract motility disorders and problems of failure to defecate (i.e. constipation) in critically ill patients are difficult to be determined. Patients who attended post-intensive care follow up clinic have delineated

constipation as a distressing part of intensive care **(Vazquez, Ghamande & Surani, 2017).**

Defecation is a basic body function. However, the medical staff in intensive care units that monitoring gastrointestinal functions record elements such as the volume of gastric aspirate and incidence of bowel opening rather than its absence that's constipation. Several nurses care for the same patient because of shift working and it isn't surprising that it can be difficult to keep a record of this function. Consequently, the incidence of constipation and its implications in critically ill patients may be unmarked, although constipation is a known health problem for critically ill patients **(Varghese, 2013).**

If constipation occurs, overgrowth of gram-negative bacteria in the digestive tract may induced due to fecal stasis. Translocation of bacteria and endotoxins may lead to infections and enhanced systemic inflammatory response. Critically ill patients already have a life threatening problem that may inhibit beginning feeding early and affect feeding route or type. They may also suffer from electrolyte disturbance or dehydration that may affect gastrointestinal dehydration and perfusion **(El-Saman and Ahmed, 2017)**.

Constipation should be prevented and treated because it can lead to complications such as abdominal distension, vomiting, restlessness, intestinal obstruction and perforation and others still poorly elucidated. Constipation was identified as an independent prognostic factor in the evolution of critically ill patients and its treatment can result in better prognosis **(Azevedo and Machado, 2013).**

Nurses in the critical care units provide care to patients in a holistic approach and formulate nursing care plan for them according to priority as they concentrating on interventions of life threatening problems and neglect patient's elimination problems unless it leads to marked fluid or electrolyte disturbance. Constipation is one of elimination problems encountered in intensive care units, so it is an area that requires nurse's consideration and plan to overcome undesired late consequences on patient's condition progress **(El-Saman and Ahmed, 2017)**.

Nurses had a vital role in assessing and managing elimination problems to confirm patient safety and comfort, they should carefully monitor parameters related to critically ill patients to assess occurrence of constipation among them **(Collins and O'Brien, 2015).**

The Murdoch Bowel Protocol is a clear, easy to use protocol which uses a validated tool (the Bristol Stool Chart "BSC") to standardize stool type. The Murdoch Bowel Protocol has been applied in clinical practice at the developer’s hospital for many years. In this period patient satisfaction has increased significantly, medical staffs have fully supported the implementation of the protocol and nursing staff enjoy having a clear protocol to guide patient's bowel care **(Ross- Adjie, 2012).**

Days 2 and 3

Type1 or 2 (constipation)

• High fiber diet, increased fluids & exercise
• Encourage mobilization if appropriate
• Commence Movicol one sachet BD
• Consider reducing specific medications (e.g. Opioids)

Type, 3 or 4 (normal stool)

• Diet, fluids & exercise as above
• Continue Movicol one sachet BD

Type 5, 6 or 7 (loose stool or diarrhea)

• Diet, fluids & exercise as above

Murdoch Bowel Protocol

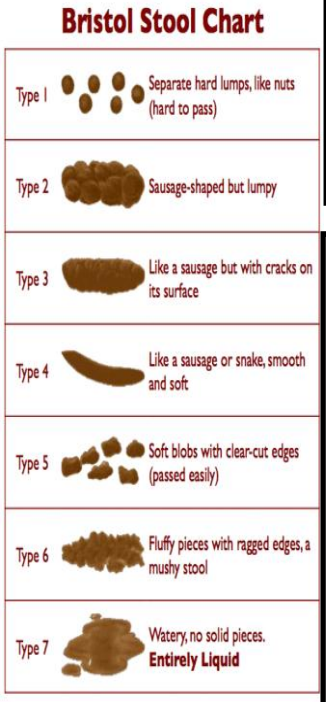

Figure (2) Bristol Stool Chart

Days 4 and 5

Type 1 or 2 (constipation).

• High fiber diet, increased fluids & exercise as per Day 2
• Continue Movicol one sachet BD
• Administer Microlax enema

Type, 3 or 4 (normal stool)

• Diet, fluids & exercise as above
• Continue Movicol one sachet daily

Type, 5, 6 or 7 (loose stool or diarrhea)

Days 6 and 7

Type, 1 or 2 (constipation)

• High fiber diet, increased fluids & exercise as per Day 2
• Continue Movicol one sachet BD
•Refer to Continence Nurse Specialist

Type 3 or 4 (normal stool)

• Diet, fluids & exercise as above
• Continue Movicol one sachet daily

Type, 5, 6 or 7 (loose stool or diarrhea)

• Diet, fluids & exercise as above

Days 8, 9 & 10

Type,1 or 2 (constipation)

• High fiber diet, increased fluids & exercise as per Day 2
• Encourage mobilization if appropriate
• Interventions as per Dietician &/or Continence Nurse Specialist advice

Type, 3 or 4 (normal stool)

• Diet, fluids & exercise as above
• Cease Movicol

Type, 5, 6 or 7 (loose stool or diarrhea)

• Diet, fluids & exercise as above
• Cease Movicol
• Refer to Dietician or Continence Nurse

Ross-Adjie, G. (2012). The effect of an evidence based bowel protocol on time taken to return to normal bowel function in post operative total hip and total knee replacement patients. Doctoral thesis, The University of Notre Dame, P 57-112. Retrieved from: https://researchonline.nd.edu.au/cgi/viewcontent.cgi?article=1088&context=theses in 22/10/ 2018 at 4pm.

Significance of the study

Incidence of constipation in critically ill patients according to **Guerra et al. 2013** is 72%. Another Surveillance was conducted in Royal Liverpool & Broadgreen University Hospitals, Liverpool, UK in the critical care units demonstrated that the prevalence of constipation was high. Among the 24 non-ventilated and 21 ventilated patients audited, 67% and 57% respectively were constipated **(Arpan and Emilia, 2017).**

During clinical practice of the investigator in Critical Care Units, it was found that constipation in critically ill patients is a very common problem which may necessitate an increased length of stay and lead to significant morbidity and occasionally mortality. The study has the significance across three main areas; minimizing or preventing increased length of stay for management of constipation, preventing readmission of the patients to hospital for management of faecal impaction, improved use of nursing resources currently used to manage constipation.

Aim of the study:

The aim of the present study was to evaluate the effect of implementing Murdoch bowel protocol on the occurrence of constipation among critically ill patients through the following objectives: -

1.Assess patient's bowel condition.

2.Implement Murdoch bowel protocol among the study group, according to the results of basic assessment.

3.Evaluate the effect of applying Murdoch bowel Protocol on the occurrence of constipation on the study group compared to control group.

Research Hypotheses

At the end of the study, Patients who will receive Murdoch bowel protocol will have lower incidence rate of constipation than those patients who will not receive the Murdoch bowel protocol.

Sample and Methods:

Design:

A quasi-experimental research design was utilized in this study.

Setting:

This study was carried out at the Intensive care unit at El-Fayoum University Hospitals.

Subjects:

A purposive sample of 68 adult patients aged 20 years or more from both genders who was included in the study at the Intensive care unit at El-Fayoum University Hospitals.

The sample size was calculated using **Epicalc 2000** software with the following inputs:

The minimal sample size will be 34 for each group

- Type I error (α) =5% with confidence level 95%

- Study power 90 % (power of test) with type error II 10% (Beta)

- The significance level (α) at 0.05*

Inclusion criteria:

Adult patients aged 20 years or more on enteral feeding and newly admitted (less than 3 days from admission to the ICU).

Exclusion criteria:

Patients were excluded from the study if Patients were on parenteral nutrition, who received sedative or muscle relaxant, with bowel surgery, with bowel disorder, and Patients who had chronic constipation (doesn't respond to dietary fiber or simple therapeutic meals).

Research tools:

Tool I: Patient's Demographic and Health Relevant data:

This tool was developed by the researcher based on literature review and included two parts.

Part I- Demographic Data:

It included the patient's data such as age, gender, marital status, educational level, occupation.

Part II- Health Relevant data:

It included patient's present diagnosis, past medical history, level of consciousness, mobility status, diet "fiber intake" and current history of medication.

Tool II: Bristol Stool Form Scale (BSFS):

This tool was adopted from **(Lewis & Heaton, 1997)** in **(Amarenco, 2014).** It's a diagnostic scale aid to classify the human stool form into seven distinct groups and include the following types. **Type1** separate hard lumps, like metal, hard to pass, **type 2** sausage shaped but lumpy, **type 3** like sausage but with cracks on its surface, **type 4** like sausage or snake, smooth and soft, **type 5** soft blobs with clear cut edges passed easily, **type 6** fluffy pieces with ragged edges, a mushy stool, **type 7** watery, no solid pieces. This tool used to delineate if the patient had constipation or not and it was used daily to determine the patient stool type every day.

The scoring system of this scale was as the following:

Type 1 and type 2 indicate constipation, type 3 and type 4 are the ideal stools and type 5, type 6 and 7 indicate diarrhea.

Tool III: Constipation Assessment Scale (CAS):

This tool was adopted from **(Abd-Elkader, 2008)** it included eight items that focus on the symptoms of constipation that are the most universal, these items are abdominal distension or bloating, change in amount of gases passed rectally, less frequent bowel movement, oozing liquid stool, rectal fullness or pressure, rectal pain with bowel movement, smaller stool size, urge but inability to pass stool. This tool used to delineate the severity of constipation.

The scoring system of this tool was as the following:

The total score range between 0 and 16, score from 2 to 6 indicates mild constipation, score from 7 to 10 indicates moderate constipation, while the score from 11 or more indicates severe constipation.

Content validity and reliability:

Validity

Content validity was conducted to determine whether or not the instrument measures what it is designed to measure. The tools were revised by a jury of 5 experts as the following ; Assistant Professor of Critical medicine faculty of medicine – Ain Shams University, Lecturer of nutrition in National Nutrition Institute - Cairo University, 2 Lecturers of medical surgical nursing from faculty of nursing - Fayoum University and lecturer of medical surgical nursing from faculty of nursing - Helwan University, who reviewed the content of the tools for comprehensiveness, accuracy, clarity, relevance and applicability. Minor modifications were done.

Reliability:

Reliability of the tool was tested to determine the consistency of the measurement instrument. The degree to which an instrument measures the same way each time it used under the same condition with the same subjects. The Cronbach's alpha model, which is a model of internal consistency, was used to test tool reliability. Reliability factor of tool II (Bristol Stool Form Scale BSFS) was (0.905) and tool III (Constipation Assessment Scale CAS) was (0.864). Statistical equation of Cronbach's alpha reliability coefficient normally ranges between 0 and 1; higher values (more than 0.7) denote acceptable reliability.

Pilot study:

A Pilot study was carried out with 10 patients from the sample under study to test the applicability, clarity and efficiency of the tools. The patients who participated in the pilot study excluded in the sample and replaced by other patients. After the pilot study a simple modification was done to the tool. The modifications were addition of diet "fiber intake" to the health relevant data. Moreover, classification of present history into systemic diseases.

Field work:

After obtaining the official permissions, the researcher started to recruit the sample of patients. The purpose of the study was simply explained to the patients or to their families who agreed to participate in the study prior to any data collection. Sampling was started from March 2018 until the end August 2018 until the end of October.

Field work included three phases:

First Phase (Assessment Phase):

Firstly; assessment of demographic characteristics, health relevant information and bowel condition of the studied patients. This occurred through:

Objective data: using medical record to obtain patient's demographic data and investigation results, objective data also included assessment of the stool type using tool II to determine the occurrence of constipation, this step took about 30 minutes for each patient.

Subjective data: through patient interview using tool I and III to assess the patient bowel condition and to determine the severity of the constipation. This step took about 30 minutes for each patient.

Secondly; Daily assessment for the studied patients using tool II. During which, the patients assessed daily for the occurrence of constipation through determining the type of stool. This step took about 15 minutes for each patient.

Second Phase (Implementation Phase):

Based on the first and second assessment, Murdoch Bowel Protocol was applied for each patient in the study group that included 34 patients who met the predetermined criteria.

Implementation of Murdoch Bowel Protocol began from the second day of admission, after stabilization of patient's condition and persisted for ten days according to the results of first and second assessment: the intervention in this protocol was determined mainly according to the type of the stool (that was assessed by Bristol Stool Form Scale BSFS) and the hospitalization day as in Murdoch Bowel Protocol as the following:

In second and third day; if the patient was constipated (type 1 or 2) the following measures were applied "encouraging high fiber diet, increasing fluids intake, doing exercise, encouraging mobilization if appropriate, commencing lactulose according physician order and consider reducing specific mediations (e.g. Opioids)". If the patient had an ideal stool (type 3 or 4) the following measures were applied " diet, fluids and exercise as the above and continuing lactulose according to physician order". If the patient had a diarrhea (type 5, 6 or 7) the following measures were applied "diet, fluids and exercise as the above".

In fourth and fifth day; if the patient was constipated (type 1 or 2) the following measures were applied "encouraging high fiber diet, increasing fluids intake, doing exercise, continuing lactulose according to physician order and administer enema with lactulose". If the patient had an ideal stool (type 3 or 4) the following measures were applied "diet, fluids and exercise as the above and continuing lactulose according to physician order". If the patient had a diarrhea (type 5, 6 or 7) the following measures were applied "diet, fluids and exercise as the above and ceasing lactulose".

In sixth and seventh day; if the patient was constipated (type 1 or 2) the following measures were applied "encouraging high fiber diet, increasing fluids intake, doing exercise, continuing lactulose according to physician order and Referral of the patient to internal medicine physician)". If the patient had an ideal stool (type 3 or 4) the following measures were applied "diet, fluids and exercise as the above and continuing lactulose according to physician order". If the patient had a diarrhea (type 5, 6 or 7) the following measures were applied "diet, fluids and exercise as the above and ceasing lactulose".

In eighth, ninth and tenth day; if the patient was constipated (type 1 or 2) the following measures were applied "encouraging high fiber diet, increasing fluids intake, doing exercise, encouraging mobilization if appropriate, interventions as per Dietician and/or internal medicine physician advice". If the patient had an ideal stool (type 3 or 4) the following measures were applied " diet, fluids and exercise as the above and ceasing lactulose". If the patient had a diarrhea (type 5, 6 or 7) the following measures were applied "diet, fluids and exercise as the above, ceasing lactulose and Referral to dietician or internal

medicine physician if necessary prior to discharge".

Third Phase (Evaluation Phase):

Patients in both groups were evaluated as the following:

Daily evaluation; for the studied patients in both groups, based on this evaluation the Murdoch bowel protocol was applied to the intervention group.

Final evaluation; this evaluation was done at the tenth day using tool II and III.

Comparison between control and study group in relation to bowel care outcome was done to test the effectiveness of the implementation of Murdoch Bowel Protocol.

Ethical consideration:

An approval was obtained from a scientific research ethics committee of the faculty of nursing at Helwan University and an oral consent was obtained from the study subjects individually before starting the study. The aim and objectives of the study was clarified to the patients included in the study by the researcher. Participants were assured that anonymity and confidentiality would guarantee. Patients were informed that they are allowed to choose to participate or withdraw from the study at any time. Ethics, culture, values were respected.

Statistical Analysis:

Data obtained from this study were coded and stored with the aid of the computer. Statistical presentation and analysis of the present study was conducted by (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.) Following data entry, checking and verification process were carried out to avoid any errors during data entry. Chi-square; The hypothesis that the row and column variables are independent, without indicating strength or direction of the relationship. Pearson chi-square and likelihood-ratio chi-square. Fisher's exact test and Yates' corrected chi-square are computed for 2x2 tables. The P value >0.05 Non significant, <0.05* significant and <0.001** High significant

Results:

Table (I) shows that, there was no statistically significant difference between the two groups regarding demographic data. However 57.4% patients in both groups were male. 44.1% of the subjects in control and study group, their age ranged between 50-<60 years with the mean age were 45.11 ± 11.66 year & 49.47 ± 8.46 year respectively. More than half of patients was married (55.9% & 61.8%) respectively. about two thirds of patients in both groups were illiterate and have basic education.

Table (II) shows that, there was no statistically significant difference between the two groups regarding health relevant information. Nearly quarter of the studied patients in the both groups had heart diseases especially heart failure (16.2%). 48.5% of the studied patients had hypertension. 41.2% of the studied patients were semiconscious and other 41.2% were conscious. 48.5% of the studied patients were immobile and 63.2% of the whole studied patients didn't have fiber in their diet.

Table (III) shows that, there was no statistically significant difference between the two groups regarding Bristol Stool Form Scale (BSFS) in the first day

(P-value = (0.452). while there was statistically significant difference in the tenth day (P-value = 0.002).

In the control group; in the first day, the majority of the patients had an ideal stool "type 3 and 4" (91.2%), versus in the tenth day as the majority of the patients were constipated "type1 and 2" (73.5%). In relation to study group; in the first day, the majority of the patients had an ideal stool "type3 and 4" (76.5%), while in the tenth day (44.1%) divided between "type3 and 4" of stool and (35.3%) had a diarrhea "type 5, 6 and 7".

Table (IV) shows that, there was a high statistically significant difference between the two groups in relation to Bristol Stool Form Scale (BSFS) (P-value = <0.001). It shows that the nearly three fourth of the control group had constipation 73.5%, versus 20.6% in the study group. Moreover, 44.1% of the study group showed ideal stool versus the control group 14.7%. It was also found that 35.3% of the study group had a diarrhea while 11.8% only of the control group.

Table (V) shows that 52.0% of the patients who suffered from constipation were female and 60% of patients who had an ideal stool were male. Regarding age, 52% of patients who suffered from constipation their age ranged between 50-<60 years and 60% of patients who had an ideal stool their age ranged between 30-<40 years. In relation to marital status, more than half of the patients who suffered from constipation were married (56%) and nearly two thirds of patients who had an ideal stool were single (60%). Finally, about half of the patients who suffered from constipation were illiterate (52%) and not working (44%), while 40% of the patients who had an ideal stool were had a secondary education and 60% working.

Table (VI) there was no statistically significant difference among the study group subjects regarding Bristol Stool Form Scale (BSFS) by their demographic characteristics except by occupation (P-value = <0.013), as 42.9% of the patients who suffered from constipation were not working, while 73.3% of patients who had an ideal stool were working.

Table (VII) shows that, there was no statistically significant difference among the control group subjects regarding Bristol Stool Form Scale (BSFS) by their health relevant information except by mobility status (P-value = <0.001) and diet "fiber intake" (P-value = <0.001), as 72% of patients who suffered from constipation were immobile, while 60% of the patients who had an ideal stool were independent. Moreover, 84% of the patients who suffered from constipation hadn't fiber in their diet, while all patients who had an ideal stool had fiber in their diet.

It was also found that 24% of the patients who suffered from constipation had a diagnosis of heart failure (HF) and 52% of the patients who suffered from constipation had hypertension, while 60% of the patients who had an ideal stool hadn't past medical history. In relation to level of consciousness, 56% of the patients who suffered from constipation were semiconscious while 80% of the patients who had an ideal stool were conscious.

Table (VIII) shows that, there was no statistically significant difference among the study group subjects regarding Bristol Stool Form Scale (BSFS) by their health relevant information except by hepatic cellular carcinoma (HCC) (P-value = <0.049), level of consciousness (P-value = <0.001) and mobility status (P-value = <0.001). As quarter of the

patients who had diarrhea diagnosed with hepatic cellular carcinoma (HCC) and 28.6% of the patients who suffered from constipation had a diagnosis of liver cirrhosis, while 26.7% of patients who had an ideal stool had heart failure. Moreover, among the seven patients who suffered from constipation, six patients were comatose (85.7%), versus among the 15 patients who had an ideal stool, 13 patients were conscious (86.7%). As well, among the seven patients who suffered from constipation, six patients were immobile (85.7%), while among the 15 patients who had an ideal stool, 10 patients were independent (66.7%).

Discussion:

The results of the present study revealed that, the studied patients from study and control group were homogenous related to their demographic characteristics and health relevant information. This could be related to, the selection of the patients based on inclusion and exclusion criteria, then divided randomly into two groups. These findings were similar to **Müller, Rykx, Kerstens & Vandeplassche, (2010)** entitled "A double blind, placebo controlled study of prucalopride in elderly patients with chronic constipation" who reported that, the two groups were similar to each other in socio-demographic and medical data.

The present study revealed that nearly three fourth of the control group had constipation versus less than one quarter of the study group had constipation. This could be related to; medical staff gave attention to life threatening problems as a priority and neglect problems regarding patient's elimination. This finding agreed with **Abd-Elkader, (2008)** in master thesis in medical surgical entitled, "Effect of Implementing Nursing Practice Guidelines for Bowel Care on Occurrence of Constipation for Critically Ill Patients" This study was conducted in Surgical Intensive Care Unit at Mansoura University Hospital and General Intensive Care Unit at Mansoura International Hospital. Who stated that more than three fourth of the control group was constipated and less than one quarter of the study group had constipation.

This finding also in-consistent with another study that has been used Murdoch Bowel Protocol in their study. This study was conducted in The University of Notre Dame Australia, Fremantle **(Ross-Adjie, 2012).** in a doctoral thesis, entitled "The effect of an evidence based bowel protocol on time taken to return to normal bowel function in post operative total hip and total knee replacement patients" which reported that about two thirds of the patients who received Murdoch Bowel Protocol had returned to normal bowel function by day five compared with about quarter only of the control group.

The finding also related to factors which may lead to constipation in ICUs such as immobility, fluid and electrolyte disturbances, adverse effects of medication and sepsis. This finding also supported by **Spodniewska & Guha, (2013)** entitled "Constipation in critically ill patients and its relationship to feeding and weaning from respiratory support" who reported that about two thirds of the studied patients were constipated.

The finding also supported by **Guerra, Mendonca & Marshall, (2013)** entitled "Incidence of constipation in an intensive care unit" who reported that the most of the studied patients were constipated. Moreover, this finding agreed with **El-Saman and Ahmed (2017)** entitled "Constipation Occurrence among Critically Ill patients" who

mentioned that nearly two thirds of the studied patients were constipated.

The present study also noted that more than third of the study group suffered from diarrhea this finding agreed with **Abd-Elhafez, (2012)** in a doctoral thesis, entitled "The effect of intermittent enteral feeding schedule on the occurrence of gastrointestinal complications and hospital stay among critically ill patients" who stated that about third of the studied patients had diarrhea.

The findings of the present study revealed that; more than half of constipated patients of the control and study group were female. This may due to the slower movement of female which lead to slower absorption of food through a woman's intestines, as well as with the effects of female hormones on the GI tract. These findings agreed with **Kosako, Akiho, Miwa, Kanazawa & Fukudo, (2018)** entitled "Impact of symptoms by gender and age in Japanese subjects with irritable bowel syndrome with constipation (IBS-C): a large population-based internet survey" who reported that common constipation occur more frequently in female than in male.

The findings of the present study also revealed that; more than half of the constipated patients in the control group and most of constipated patients in the study group were between 50-65 years. This has been attributed to many factors as reduced gut motility, reduced saliva production, poor dentition or poor-fitting dentures, which alter chewing and swallowing and therefore decrease dietary intake. This finding agreed with **Suares and Ford, (2011)** entitled "Prevalence of, and risk factors for, chronic idiopathic constipation in the community: systematic review and meta-analysis" who stated that occurrence of constipation increases with age. On the other hand, this finding disagreed with **Meinds, Meegdenburg, Trzpis & Broens, (2017).** Entitled "On the prevalence of constipation and fecal incontinence, and their co-occurrence, in the Netherlands" who found that the constipation occurred commonly in the younger age groups.

Moreover, the present finding indicated that less than one quarter of the constipated patients had diagnosis of heart failure and about half of them had past history of hypertension. This may have related to, the individual can stimulate the defecation reflex by taking a deep breath and contracting the abdominal muscle (valsalva maneuver) which occurs during straining to pass a harden stool and may cause serious problems in patients with congestive heart failure, hypertension and coronary artery disease. As well it may be related to reduced fluid intake, reduced mobility, administered medications, loss of appetite (and poor fiber intake) and reduced blood flow to the digestive tract. This finding agreed with **Salmoirago, Crawford, Jackson, Ockene & Ockene, (2011)** entitled "Constipation and risk of cardiovascular disease among postmenopausal women" and also with **Bassotti, (2016)** entitled "Being constipated: A bad omen for your cardiovascular system?" who reported that there was a relation between constipation and cardiovascular diseases.

Concerning level of consciousness, this study shows that more than half of the constipated patients in the control group were semiconscious and most of them in the study group were comatose. This finding may be related to, decreased cognitive and functional ability of thus patients, which increase the risk of delaying defecation. Also this finding may related to unavailability of toilet and position which may lead to suppress the

urge to defecate. This finding agreed with **Evans & Best, (2015)** entitled "The nurse's role in patient nutrition and hydration" who reported that decreased level of consciousness can lead to lack of sensation of rectum fullness and defecations that resulted in constipation.

Regarding mobility status; the present study that revealed the majority of the constipated patients was immobile in both control and study group. This may be due to the effect of bed restriction, hospitalization and immobility as it enhances the bowel motility, limits access to toilet, need of personal assistance for toileting and limit correct positioning for defecation. This finding agreed with **Erichsén, Milberg, Jaarsma & Friedrichsen, (2016)** entitled "Constipation in specialized palliative care: factors related to constipation when applying different definitions" who noted that limited mobility and limited access to toilet increase the risk of constipation.

The findings of the present study revealed that the majority of the constipated patients in the control group hadn't fiber intake in their diet. This may be related to, Fiber intake prevents constipation, stimulate bowel motility and facilitate defecation. This finding agreed with **Dreher, (2018)** entitled "Fiber in Laxation and Constipation. In Dietary Fiber in Health and Disease" Who reported that the consumption of adequate dietary fiber (>25 g/day) is beneficial in prevention and alleviating constipation.

Table (I): Frequency distribution of demographic characteristics for the control and study groups (N = 68).

	Control (N = 34)		Study (N = 34)		Total (N = 68)		Chi-square	
	N	%	N	%	N	%	X^2	P-value
Gender								
Male	18	52.9	21	61.8	39	57.4	0.541	0.462
Female	16	47.1	13	38.2	29	42.6		
Age								
20 - <30	5	14.7	2	5.9	7	10.3	3.146	0.370
30 - <40	6	17.6	3	8.8	9	13.2		
40 - <50	9	26.5	13	38.2	22	32.4		
50 - <60	14	41.2	16	47.1	30	44.1		
Mean ± SD	45.11 ± 11.66		49.47 ± 8.46		47.29 ± 10.35			
Marital status								
Single	9	26.5	2	5.9	11	16.2	6.039	0.110
Married	19	55.9	21	61.8	40	58.8		
Divorced	2	5.9	4	11.8	6	8.8		
Widow	4	11.8	7	20.6	11	16.2		
Level of education								
Illiterate	13	38.2	11	32.4	24	35.3	1.678	0.642
Basic education	8	23.5	12	35.3	20	29.4		
Secondary	9	26.5	6	17.6	15	22.1		
University	4	11.8	5	14.7	9	13.2		
Occupation								
Not working	14	41.2	12	35.3	26	38.2	1.191	0.755
Working	13	38.2	14	41.2	27	39.7		
Housewife	7	20.6	7	20.6	14	20.6		
Others	0	0.0	1	2.9	1	1.5		

*: Significant at $P \leq 0.05$

Table (II) Frequency distribution of the health relevant information for the control and study groups (N = 68).

	Control (N = 34)		Study (N = 34)		Total (N = 68)		Chi-square	
	N	%	N	%	N	%	X^2	P-value
Present diagnosis								
Heart diseases								
Heart failure (HF)	6	17.6	5	14.7	11	16.2	0.108	0.742
Acute coronary syndrome (ACS)	2	5.9	2	5.9	4	5.9	0.000	1.000
Arrhythmias	1	2.9	1	2.9	2	2.9	0.000	1.000
Respiratory diseases								
Respiratory failure	3	8.8	4	11.8	7	10.3	0.159	0.690
Chronic obstructive pulmonary disease (COPD)	2	5.9	1	2.9	3	4.4	0.349	0.555
ng cancer	1	2.9	2	5.9	3	4.4	0.349	0.555
Hepatic diseases								
Liver cirrhosis	3	8.8	4	11.8	7	10.3	0.159	0.690
Hepatic cellular carcinoma (HCC)	2	5.9	3	8.8	5	7.4	0.216	0.642
Renal diseases								
Renal failure	3	8.8	5	14.7	8	11.8	0.567	0.452
Head trauma	6	17.6	3	8.8	9	13.2	1.153	0.283
Stroke	3	8.8	4	11.8	7	10.3	0.159	0.690
Others	2	5.9	0	0.0	2	2.9	2.061	0.151
Past medical history								
HTN	16	47.1	17	50.0	33	48.5	0.059	0.808
DM	4	11.8	7	20.6	11	16.2	0.976	0.323
Non	8	23.5	6	17.6	14	20.6	0.360	0.549
Others	6	17.6	4	11.8	10	14.7	0.469	0.493
Level of consciousness								
Comatose	4	11.8	8	23.5	12	17.6		
Semiconscious	17	50.0	11	32.4	28	41.2	2.762	0.251
Conscious	13	38.2	15	44.1	28	41.2		
Mobility status								
Independent	4	11.8	12	35.3	16	23.5		
Require assistance	4	11.8	2	5.9	6	8.8	5.501	0.139
Wheelchair	7	20.6	6	17.6	13	19.1		
Immobile	19	55.9	14	41.2	33	48.5		
Diet: fiber intake								
Yes	13	38.2	12	35.3	25	36.8	0.063	0.801
No	21	61.8	22	64.7	43	63.2		
Current history of medication								
Anti-inflammatory	30	88.2	26	76.5	56	82.4	1.619	0.203
Analgesics	28	82.4	22	64.7	50	73.5	2.720	0.099
Laxatives	9	26.5	14	41.2	23	33.8	1.643	0.200
Diuretics	28	82.4	30	88.2	58	85.3	0.469	0.493
Antiepileptic	10	29.4	8	23.5	18	26.5	0.302	0.582

*: Significant at $P \leq 0.05$

Table (III) Comparison between control and study group in relation to Bristol Stool Chart (BSC) in first and tenth day.

	Type of stool	Control (N = 34)		Study (N = 34)		Total (N = 68)		Chi-square	
		N	%	N	%	N	%	X2	P-value
Day1	2	1	2.9	4	11.8	5	7.4	4.715	0.452
	3	21	61.8	14	41.2	35	51.5		
	4	10	29.4	12	35.3	22	32.4		
	5	1	2.9	2	5.9	3	4.4		
	6	0	0.0	1	2.9	1	1.5		
	7	1	2.9	1	2.9	2	2.9		
Day 10	1	7	20.6	3	8.8	10	14.7	20.931	0.002*
	2	18	52.9	4	11.8	22	32.4		
	3	3	8.8	8	23.5	11	16.1		
	4	2	5.9	7	20.6	9	13.2		
	5	1	2.9	6	17.6	7	10.3		
	6	1	2.9	4	11.8	5	7.4		
	7	2	5.9	2	5.9	4	5.9		

*: Significant at $P \leq 0.05$

Table (IV) Comparison between the control and study group in relation to Bristol Stool Chart (BSC) in the tenth day (N = 68).

BSC	Control (N = 34)		Study (N = 34)		Total (N = 68)		Chi-square	
	N	%	N	%	N	%	X^2	P-value
Constipation	25	73.5	7	20.6	32	47.1	19.125	<0.001**
The ideal stool	5	14.7	15	44.1	20	29.4		
Diarrhea	4	11.8	12	35.3	16	23.5		
Total	34	100.0	34	100.0	68	100.0		

*: Significant at $P \leq 0.05$

Table (V) Frequency distribution of patient's Bristol Stool Chart (BSC) among the control group by their demographic characteristics (N = 34).

Control Group	Bristol Stool Chart (BSC)						Chi-square	
	Constipation (N = 25)		The ideal stool (N = 5)		Diarrhea (N = 4)			
	N	%	N	%	N	%	X^2	P-value
Gender								
Male	12	48.0	3	60	3	75.0	1.126	0.569
Female	13	52.0	2	40	1	25.0		
Age								
20 - <30	4	16.0	0	0.0	1.0	25.0	10.109	0.120
30 - <40	2	8.0	2	40.0	1.0	25.0		
40 - <50	6	24.0	3	60.0	0.0	0.0		
50 - <60	13	52.0	0	0.0	2.0	50.0		
Marital status								
Single	4	16.0	3	60.0	2	50.0	6.724	0.347
Married	14	56.0	2	40.0	2	50.0		
Divorced	2	8.0	0	0.0	0	0.0		
Widow	5	20.0	0	0.0	0	0.0		
Level of education								
Illiterate	12	52.0	1	20.0	1	25.0	4.244	0.644
Basic education	6	24.0	1	20.0	1	25.0		
Secondary	4	16.0	2	40.0	2	50.0		
University	3	12.0	1	20.0	0	0.0		
Occupation								
Not working	11	44.0	1	20.0	2	50.0	1.547	0.818
Working	9	36.0	3	60.0	1	25.0		
Housewife	5	20.0	1	20.0	1	25.0		

*: Significant at $P \leq 0.05$

Table (VI) Frequency distribution of patient's Bristol Stool Chart (BSC) among the study group by their demographic characteristics (N = 34).

Study Group	Bristol Stool Chart (BSC)						Chi-square	
	Constipation (N = 7)		The ideal stool (N = 15)		Diarrhea (N = 12)			
	N	%	N	%	N	%	X^2	P-value
Gender								
Male	3	42.9	11	73.3	7	58.3	1.970	0.374
Female	4	57.1	4	26.7	5	41.7		
Age								
20 - <30	1	14.3	1	6.7	0	0.0		
30 - <40	0	0.0	2	13.3	1	8.3	12.019	0.062
40 - <50	0	0.0	9	60.0	4	33.3		
50 - <60	6	85.7	3	20.0	7	58.3		
Marital status								
Single	1	14.3	1	6.7	0	0.0		
Married	2	28.6	11	73.3	8	66.7	10.327	0.112
Divorced	0	0.0	2	13.3	2	16.7		
Widow	4	57.1	1	6.7	2	16.7		
Level of Education								
Illiterate	4	57.1	2	13.3	5	41.7		
Basic education	2	28.6	6	40.0	4	33.3	6.077	0.415
Secondary	0	0.0	4	26.7	2	16.7		
University	1	14.3	3	20.0	1	8.3		
Occupation								
Not working	3	42.9	1	6.7	8	66.7		
Working	2	28.6	11	73.3	1	8.3	16.104	0.013*
Housewife	2	28.6	2	13.3	3	25.0		
Others	0	0.0	1	6.7	0	0.0		

*: Significant at $P \leq 0.05$

Table (VII) Frequency distribution of patient's Bristol Stool Chart (BSC) among the control group by their health relevant data (N = 34).

Control Group	Bristol Stool Chart (BSC)							
	Constipation (N = 25)		The ideal stool (N = 5)		Diarrhea (N = 4)		Chi-square	
	N	%	N	%	N	%	X2	P-value
Present diagnosis								
Heart diseases								
Heart failure (HF)	6	24.0	0	0.0	0	0.0	3.036	0.219
Acute coronary syndrome (ACS)	1	4.0	1	20.0	0	0.0	1.638	0.441
Arrhythmias	1	4.0	0	0.0	0	0.0	0.429	0.807
Respiratory diseases								
Respiratory failure	2	8.0	1	20.0	0	0.0	0.853	0.653
Chronic obstructive pulmonary disease (COPD)	1	4.0	1	20.0	0	0.0	1.638	0.441
Lung cancer	0	0.0	1	20.0	0	0.0	4.808	0.090
Hepatic disease								
Liver cirrhosis	2	8.0	0	0.0	1	25.0	1.889	0.389
Hepatic cellular carcinoma (HCC)	2	8.0	0	0.0	0	0.0	0.885	0.642
Renal failure	2	8.0	0	0.0	1	25.0	1.889	0.389
Head trauma	3	12.0	1	20.0	1	25.0	0.596	0.742
Stroke	3	12.0	0	0.0	1	25.0	1.343	0.511
Others	2	8.0	0	0.0	0	0.0	0.885	0.642
Past medical history								
HTN	12	52.0	1	20.0	2.0	50.0	1.389	0.499
DM	5	20.0	0	0.0	0.0	0.0	2.110	0.348
Non	4	16.0	3	60.0	1.0	25.0	2.970	0.227
Others	4	16.0	1	20.0	1.0	25.0	0.169	0.919
Level of consciousness								
Comatose	5	20.0	0	0.0	0	0.0	6.860	0.143
Semiconscious	14	56.0	1	20.0	2	50.0		
Conscious	6	24.0	4	80.0	2	50.0		
Mobility status								
Independent	1	4.0	3	60.0	0	0.0	26.911	<0.001**
Require assistance	0	0.0	1	20.0	2	50.0		
Wheelchair	6	24.0	1	20.0	1	25.0		
Immobile	18	72.0	0	0.0	1	25.0		
Diet: "fiber intake"								
Yes	4	16	5	100.0	4	100.0	19.772	<0.001**
No	21	84.0	0	0.0	0	0.0		
Current history of medication								
Anti-inflammatory	20	80.0	5	100.0	4	100.0	1.889	0.389
Analgesics	20	80.0	5	100.0	2	50.0	4.183	0.124
Laxatives	5	20.0	2	40.0	2	50.0	1.675	0.433
Diuretics	18	72.0	5	100.0	4	100.0	3.036	0.219
Antiepileptic	6	24.0	2	40.0	2	50.0	1.086	0.581

*: Significant at $P \leq 0.05$

Table (VIII) Frequency distribution of patient's Bristol Stool Chart (BSC) among the study group by their health relevant data (N = 34).

Study Group	Bristol Stool Chart (BSC)							
	Constipation (N = 7)		The ideal stool (N = 15)		Diarrhea (N = 12)		Chi-square	
	N	%	N	%	N	%	X^2	P-value
Present diagnosis								
Heart disease								
Heart failure (HF)	1	14.3	4	26.7	0	0.0	3.781	0.151
Acute coronary syndrome (ACS)	0	0.0	1	6.7	1	8.3	0.584	0.747
Arrhythmias	0	0.0	0	0.0	1	8.3	1.889	0.389
Respiratory diseases								
Respiratory failure	0	0.0	3	20.0	1	8.3	2.049	0.359
Chronic obstructive pulmonary disease (COPD)	0	0.0	0	0.0	1	8.3	1.889	0.389
Lung cancer	0	0.0	2	13.3	0	0.0	2.692	0.260
Hepatic disease								
Liver cirrhosis	2	28.6	1	6.7	1	8.3	2.416	0.299
Hepatic cellular carcinoma (HCC)	0	0.0	0	0.0	3	25.0	6.032	0.049*
Renal disease								
Renal failure	1	14.3	3	20.0	1	8.3	0.725	0.696
Head trauma	1	14.3	1	6.7	1	8.3	0.350	0.839
Stroke	2	28.6	0	0.0	2	16.7	4.183	0.124
Past medical history								
HTN	3	42.9	7	46.7	7	58.3	0.543	0.762
DM	1	14.3	3	20.0	3	25.0	0.316	0.854
Non	2	28.6	3	20.0	1	8.3	1.348	0.510
Others	1	14.3	2	13.3	1	8.3	0.215	0.898
Level of consciousness								
Comatose	6	85.7	1	6.7	1	8.3	36.299	<0.001**
Semiconscious	1	14.3	1	6.7	9	75.0		
Conscious	0	0.0	13	86.7	2	16.7		
Mobility status								
Independent	0	0.0	10	66.7	2	16.7		
Require assistance	0	0.0	2	13.3	0	0.0	21.907	<0.001**
Wheelchair	1	14.3	3	20.0	2	16.7		
Immobile	6	85.7	0	0.0	8	66.7		
Diet: "fiber intake"								
Yes	5	71.4	3	20.0	4.0	33.3	5.559	0.062
No	2	28.6	12	80.0	8.0	66.7		
Current history of medication								
Anti-inflammatory	5	71.4	11	73.3	10	83.3	0.495	0.781
Analgesics	5	71.4	11	73.3	6	50.0	1.764	0.414
Laxatives	4	57.1	3	20.0	7.0	58.3	4.972	0.083
Diuretics	7	100.0	13	86.7	10	83.3	1.247	0.536
Antiepileptic	3	42.9	3	20.0	2	16.7	1.871	0.392

*: Significant at $P \leq 0.05$

Conclusion

Based upon the study findings, we can conclude that; Murdoch bowel protocol reduces the incidence of constipation among critically ill patients. It was found that significant improvement in the patient's bowel condition in the study group than in control group after implementing of Murdoch bowel protocol.

Recommendations

In the light of the findings of the current study, the following recommendations were suggested:

For clinical practice:

- Implementing Murdoch Bowel Protocol for critically ill patients and apply the Protocol steps on a regular basis.
- An assessment tool such as Bristol Stool Form Scale (BSFS) for assessment of patient's bowel condition should be incorporated as a part of routine care for critically ill patients.
- Enhancing early mobility, doing exercise and having high fiber diet to decrease the risk for constipation.

For further researches:

- Replication of the study on larger probability samples selected from different geographical area in Egypt is recommended to obtain data of more generalizability of findings.
- Further research must be carried out in order to assess nursing knowledge, practice and attitude regarding bowel care for critically ill patients.
- Further research must focus on the occurrence of diarrhea as a result of implementing Murdoch Bowel Protocol in critically ill patients.

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Conflicts of Interest Disclosure

The authors declare that there is no conflict of interest.

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