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Constipation Occurrence among Critically Ill patients

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Abstract
Background: *Various researches had studied the occurrence of constipation among general population but little concentrated on its occurrence among critically ill patients. Critically ill patients have different consequences that can affect gastrointestinal motility resulting in bowel movement disturbance as constipation.*
Aim: *To assess constipation occurrence among critically ill patients.*
Methods: *A descriptive study was conducted on 105 critically ill adult patients at Causality Care Unit I and General Intensive Care Unit III of Teaching Main university Hospital, Alexandria University, Egypt.*
Tool: *"Constipation occurrence contributing factors assessment" tool was used.*
Results: *illustrated that 58.1% of the studied patients were males, (52.4%) aged between 30 - 50 years old plus 40% of them had no past medical or surgical comorbidities. Trauma is the most common cause of admission (22.9%). The majority of the studied patients (89.5%) were started their enteral feeding ≤ 24 hours from admission. Based on comparisons among the studied groups regarding certain parameters and its relation to constipation occurrence, the results reveled that there were no significant differences among the studied groups regarding level of consciousness, laxative use, presence of edema, APACHE II score, glucose level, hematocrit value, temperature, heart rate, and respiratory rate. On the other hand, there were significant differences among the studied groups in relation to MV mode, mean arterial pressure, central venous pressure, type of feeding, serum sodium, serum potassium, blood urea nitrogen and serum osmolality.*
Conclusions: *Critically ill patients are greatly risk for occurrence of constipation.*
Recommendations*: it is recommended that critical care nurses should assess carefully patient's bowel pattern though the shift. They have to monitor and manage fluid balance of critically ill patients continuously especially for unconscious and mechanically ventilated ones. Further studies should be applied to examine the correlation between constipation occurrence and the vital parameters, electrolytes and blood chemistry parameters on larger number.*
Key words: *constipation, critically ill patients, critical care nurse, occurrence.*

I. Introduction

Disturbance related to gastrointestinal system occurs commonly in critically ill patients as delayed gastric empting and diarrhea which are well discussed in different studies, but constipation still has less attention. In other settings other than intensive care units (ICUs), constipation is a common symptom, upsetting 2% to 27% of population and its incidence in ICU settings are variable, ranging from 15% to 83%. [(1)] Constipation has been defined as absence of bowel movements within 3 or 6 days. Other health related personnel described constipation as less than 3 bowel movements through one week. Constipation description still changed in various studies due to shortage of consistent definition criteria. This can explain the different described incidence in multiple studies. [(2)]

Constipation symptoms varying through abdominal pain or discomfort, distention, cramps, painful bowel movements, burning sensation, tearing in rectum during defecation, incomplete evacuation, too hard or small bowel movement, straining and false sensation of defecation. As many of critically ill patients have disturbed in level of consciousness, so it is difficult for those patients to verbalize constipation symptoms. Therefore, definition of constipation in critically ill patient in the current study is limited to absence of passage stool for 2 days or more. Based on these reasons; critical care nurses (CCNs) are the corner stone in the care of constipated critically ill patients. [(3)]

In constipated patient, fecal stasis induces overgrowth of gram-negative bacteria in the digestive tract. Translocation of bacteria and endotoxins may lead to infections and enhanced systemic inflammatory response. Critically ill patients are different from other patients; they have a life threatening problem that may inhibit starting feeding early, affect feeding route or type. These patients may suffer from dehydration, electrolyte disturbance that may affect gastrointestinal perfusion and motility. Additionally, they may need mechanical ventilation that may affect all body systems. For example; gastric distention (from air swallowing), hypomotility and ileus (from immobility and the use of narcotics or analgesics) can occur. Furthermore, some drugs as sedatives, muscle relaxant and prokinetics are used commonly in ICUs which can disturb GIT motility. [(1,4,5)] hence, critically ill patients are exposed to many factors altering GIT motility and may cause constipation.

Critical care nurses provide care to patients in a holistic approach. They formulate nursing care plan for them concentrating on interventions of life threatening problems as a priority and neglect problems regarding patients' elimination unless result in vigorous fluid or electrolyte disturbance. Constipation as one of elimination problems encountered in intensive care units is an area that requires nurses' consideration and action to overcome undesired late consequences on patients' condition progress.[6,7] Based on that CCNs assume a vital role in assessing and managing elimination alterations to ensure patients' safety and comfort, they should carefully monitor parameters related to critically ill patients to assess occurrence of constipation among them.

Aim of the study

- To assess constipation occurrence among critically ill patients.

Research question

- Why can constipation occur among critically ill patients?

Operational definition

- Constipation in this study refers to failure to pass stool for two consecutive days or more.

II. Materials and Method

Materials

Research design

A descriptive design was used in carrying out this study.

Setting

The study was achieved at Causality Care Unit namely unit one and General Intensive Care Unit namely unit three of Main university Hospital, University of Alexandria, Egypt.

Subjects

A convenience sample of 105 critically ill adult patients of both genders through the first 24 hours from admission were involved in the study for three consecutive days based on the power analysis (Epi-Info program) with the following information (population size = 250 over 6 months, expected frequency = 50%, acceptable error = 5%, confidence coefficient = 95%. Inclusion criteria: received oral feeding or enteral feeding by nasogastric or orogastric tube. Exclusion criteria: patients with (1) unstable hemodynamics; (2) nothing by mouth, parenteral nutrition and stop oral or enteral feeding before completion of three study days; (3) bowel surgery, gastrointestinal bleeding, intestinal fistula, diarrhea; (4) receiving anticholinergic, sedatives, muscle relaxant and prokinetic agents. [6]

Tool:

A used tool was **"Constipation occurrence contributing factors assessment".** It was developed by the researchers after reviewing the related literature. [7-9] The tool was used to assess critically ill patient's parameters and identify its relation to constipation occurrence. It consisted of six parts:

Part I: **Demographic and clinical data**; it includes age, sex, date of admission, past health history and current diagnosis.

***Part II*: Health related data**; it includes Acute Physiology and Chronic Health Evaluation II (APACHE II) score, level of consciousness, attaching with mechanical ventilation, laxative therapy and fluid shifting to third space (edema).

***Part III*: Vital parameters:** it includes vital signs as respiratory rate (RR), heart rate (HR), mean arterial blood pressure (MAP)[10], temperature (temp) and central venous pressure (CVP).

***Part IV:* Nutritional parameters:** it includes time of starting feeding if less or more than 24 hours, type of feeding; oral (balanced diet) or enteral feeding (routine formula according to hospital routine diet as milk, fruit juice, and sometimes homemade mashed green vegetables, high protein, high fiber formula.

***Part V*: Electrolytes and Blood Chemistry parameters:** it includes electrolytes as sodium, potassium and blood chemistry as hematocrit, blood urea nitrogen, serum glucose, and serum osmolality.[11]

***Part VI:* Defecation frequency record:** it includes recording frequency of passage stool per day.

Method

- An official permission to conduct the study was obtained from "head of Critical Care & Emergency Nursing Department", and "Nursing Ethical Committee" of Nursing Faculty- Alexandria University and hospital authority "Medical Ethical Committee" after explaining the aim of the study.
- The tool was developed after reviewing the related literature. The content validity of the tool was tested by 5 experts in the field of critical care and emergency nursing and critical care medicine and necessary modifications were done. Content reliability of tool was calculated using Cronbach's Alpha coefficient $\alpha = 0.721$, which indicates an accepted reliability of the tool.
- A pilot study was carried out on 10 patients after securing patients' consents to test feasibility and applicability of the tool and necessary modification was done to prepare the tool for final form. These patients were recruited from study subjects.

- Data related to health condition, vital signs, electrolytes and blood chemistry were collected from patients once daily at the end of each study day for three consecutive days using part II, III and V of the developed tool. APACHE II score was calculated once at the first day of the study.
- Data related to nutrition and defecation frequency were collected from patients through each study day for three consecutive days using part IV and VI of the developed tool.
- The studied subjects were divided into 3 groups according to defecation frequency: - Group1contained patients who had defecation frequency of zero or passed stool < 2 days (not constipated). Group 2 contained patients who had defecation frequency of zero for 2 and <3 days (constipated for 2 days). Group 3 contained patients who had defecation frequency of zero for 3 days (constipated for 3 days)**.** To assess constipation occurrence among critically ill patients, comparison was done between the three groups regarding data of demographic, clinical, health related condition, vital signs, nutritional, electrolytes and blood chemistry parameters.
- Data of the study was collected from July 2015 to January 2016.

Ethical consideration:

Informed written consent was obtained from conscious patient or family member (if unconscious patient) after explanation of the study purpose. Anonymity and privacy of the study subjects was assured and confidentiality of the collected data was maintained.

Statistical analysis

Data were fed to the computer and analyzed using IBM SPSS software package version 20. Analysis and interpretation of data were done using the following; Reliability Statistics was assessed using Cronbach's Alpha test. Qualitative data were described using number and percent. Quantitative data were described using minimum and maximum, mean and standard deviation. Comparisons were done using Chi square test, Monte Carlo for Chi square test and ANOVA test. P is significant if ≤ 0.05.

III. Results

Table 1 illustrates that more than half of studied patients (58.1%) were males, (52.4%) aged between 30 - 50 years old plus 40% of them had no past medical or surgical comorbidities. The most common cause of admission to ICU was Trauma (22.9%). Additionally, there was no significance difference among the studied groups regarding gender, age and diagnosis.

Table 2 shows comparison among the studied groups regarding health related data and its relation to constipation occurrence. The results revealed that about half of patients in group 3 were unconscious though 1st, 2nd and 3rd study days (46.7%, 50.5% and 49.5%). While, 42.9% of patients in group 3 didn't receive laxative agents throughout the study period. Concerning fluid shifting to the third space (edema), it was clear that there was ascending percent increase of patients with edema in the studied groups through the study days and the higher percent of patients with edema belonged to group 3 in 2nd and 3rd days (33.3% and 38.1%). Regarding APACHE II score, its mean was 21.71±7.29. Finally, there were no statistical significance differences among the studied groups regarding level of consciousness, laxative use, presence of edema and APACHE II score.

Concerning mechanical ventilation (MV) modes, most of the studied patients were on Bi-level positive airway pressure (BIPAP) mode in 1st day (31.43) and Synchronized intermittent mandatory ventilation (SIMV) mode in 2nd and 3rd days (28.57%, 30.48% respectively). There was statistical significant difference among the studied groups in relation to MV mode in 1st study day (P = 0.008) as a higher percent of patients in group 3 were on BIPAP mode (22.9%).

Table 3 represents comparison among the studied groups regarding to vital parameters and its relation to constipation occurrence. The table showed that there was no statistical significant difference among the studied groups in relation to temperature, heart rate, and respiratory rate. On the other hand, there was a statistical significance difference among the studied groups regarding mean arterial pressure (MAP) in 1st and 2nd study days (P=0.010 and 0.021) and central venous pressure (CVP) 2nd day (P=0.024) as group 3 whose patients were constipated for 3 days had less mean MAP in 1st and 2nd study days and higher mean CVP in 2nd day.

Table 4 documents comparison among the studied groups regarding nutritional parameters and its relation to constipation occurrence. The table showed that the majority of the studied patients (89.5%) were started their enteral feeding within ≤ 24 hours from admission. Concerning feeding type, around 60% of the studied patients received low fiber diet and there was a significant relation between type of feeding and constipation occurrence in 2nd day (p=0.038) as large percent of patients in both of groups 2 and 3 (12.4% and 41.9% respectively) received low fiber diet.

Table 5 reflects comparison among the studied groups regarding electrolytes and blood chemistry parameters and its relation to constipation occurrence. The results approved that there was significant difference among the studied groups in relation to serum sodium (Na^+) in 1st study day (p= 0.015) as group 1 whose patients were not constipated had a higher mean sodium level (154.54±37.57). About serum potassium, there was significant

difference among the studied groups in relation to serum K^+ in 1st study day (p= 0.042) as group 3 had more mean K^+ level (3.96 ± 0.73). Regarding blood urea nitrogen (BUN), there was a significant relation between BUN level and constipation occurrence all over the study days (p= 0.015, 0.045 and 0.044 respectively) as evidenced by patients of group 3 had higher mean BUN level though 1st, 2nd and 3rd study days (34.72±27.96, 33.58±29.37 and 33.76±29.67 respectively). Concerning serum osmolality, the results showed that there was significant relation among the studied groups. On the other hand, there was no significant relation between glucose or hematocrit values with constipation occurrence through the study period.

Table (1): Comparison among the studied groups regarding to demographic and clinical data

Items	Total		The studied groups according to constipation occurrence (n=105)						Test of sig. χ^2	^{MC}p
			Group 1 (not constipated) (n=13)		Group 2 (Constipated for 2 days) (n=29)		Group 3 (Constipated for 3 days) (n=63)			
	No.	%	No.	%	No.	%	No.	%		
Age										
<30	22	21.0	2	1.9	6	5.7	14	13.3	1.187	0.906
30 – 50	55	52.4	6	5.7	16	15.2	33	31.4		
> 50	28	26.7	5	4.8	7	6.7	16	15.2		
Sex										
Male	61	58.1	7	6.7	18	17.1	36	34.3	0.308	0.857
Female	44	41.9	6	5.7	11	10.5	27	25.7		
Past medical or surgical comorbidities										
No	42	40.0	5	4.8	12	11.4	25	23.8	10.028	0.724
Cardiovascular disease	30	28.6	5	4.8	9	8.6	16	15.2		
Respiratory disease	7	6.7	0	0.0	1	1.0	6	5.7		
Renal disease	3	2.9	0	0.0	1	1.0	2	1.9		
Neurological disease	5	4.8	2	1.9	0	0.0	3	2.9		
Respiratory and cardiovascular	5	4.8	0	0.0	2	0.0	3	3.8		
Gastrointestinal	4	3.8	0	0.0	0	1.9	4	2.9		
Others	9	8.6	1	1.0	4	3.8	4	3.8		
Current patient diagnoses										
Cardiovascular disease	16	15.2	1	1.0	3	2.9	12	11.4	14.961	0.294
Respiratory disease	15	14.3	1	1.0	4	3.8	10	9.5		
Renal disease	2	1.9	0	0.0	1	1.0	1	1.0		
Neurological disease	21	20.0	3	2.9	4	3.8	14	13.3		
Gastrointestinal disease	3	2.9	0	0.0	0	0.0	3	2.9		
Trauma/ Burn	24	22.9	5	4.8	7	6.7	12	11.4		
Others	20	19.0	1	1.0	10	9.5	9	8.6		
Cardiovascular and respiratory	4	3.8	2	1.9	0	0.0	2	1.9		

χ^2, p: χ^2 and p values for Chi square test MC: Monte Carlo for Chi square test
*: Statistically significant at $p \leq 0.05$

Table (2): Comparison among the studied groups regarding to health related data.

Item	Day of study	Total		The studied groups according constipation occurrence (n=105)						χ^2	P
				Group 1 (not constipated) (n=13)		Group 2 (Constipated for 2 days) (n=29)		Group 3 (Constipated for 3 days) (n=63)			
		No.	%	No.	%	No.	%	No.	%		
Level of consciousness	**First**										
	Unconscious	85	80.95	11	10.5	25	23.8	49	46.7	1.044	0.593
	Conscious	20	19.05	2	1.9	4	3.8	14	13.3		
	Second										
	Unconscious	86	81.90	11	10.5	22	21.0	53	50.5	0.989	0.610
	Conscious	19	18.10	2	1.9	7	6.7	10	9.5		
	Third										
	Unconscious	83	79.5	11	10.5	20	19.0	52	49.5	2.487	0.288
	Conscious	22	20.95	2	1.9	9	8.6	11	10.5		
APACHE II score											
Min. – Max.		8 – 42		9 – 42		8 – 36		8 – 35		F= 0.19	0.83
Mean ± SD.		21.71 ± 7.29		22.09 ± 7.33		21.55 ± 6.3		20.08 ± 6.4			
Laxative										3.074	0.215

	Yes	37	35.24	6	5.7	13	12.4	18	17.1		
	No	68	64.76	7	6.7	16	15.2	45	42.9		
Fluid shifting to third space (edema)	**First**										
	No	63	60	7	6.7	19	18.1	37	35.2	0.615	0.735
	Yes	42	40	6	5.7	10	9.5	26	24.8		
	Second										
	No	49	46.67	6	5.7	15	14.3	28	26.7	0.424	0.809
	Yes	56	53.33	7	6.7	14	13.3	35	33.3		
	Third										
	No	40	38.10	5	4.8	12	11.4	23	21.9	0.201	0.905
	Yes	65	61.90	8	7.6	17	16.2	40	38.1		
Modes of Mechanical Ventilator	**First**										
	No	8	7.6	1	1.0	3	2.9	4	3.8	23.222*	0.008*
	CMV	5	4.8	0	0.0	1	1.0	4	3.8		
	SIMV	31	29.53	2	1.9	15	14.3	14	13.3		
	CPAP	19	18.10	1	1.0	4	3.8	14	13.3		
	PSV	9	8.57	3	2.9	3	2.9	3	2.9		
	Bi-PAP	33	31.43	6	5.7	3	2.9	24	22.9		
	Second										
	No	8	7.62	1	1.0	3	2.9	4	3.8	13.627	0.215
	CMV	7	6.7	0	0.0	2	2.0	5	4.8		
	SIMV	30	28.57	2	1.9	12	11.4	16	15.2		
	CPAP	22	20.95	2	1.9	6	5.7	14	13.3		
	PSV	9	8.57	3	2.9	3	2.9	3	2.9		
	Bi-PAP	29	27.62	5	4.8	3	2.9	21	20.0		
	Third										
	No	13	12.38	1	1.0	5	4.8	7	6.7	10.917	0.466
	CMV	3	2.9	0	0.0	1	1.0	2	1.9		
	SIMV	32	30.48	2	1.9	10	9.5	20	19.0		
	CPAP	22	20.95	2	1.9	7	6.7	13	12.4		
	PSV	9	8.57	3	2.9	2	1.9	4	3.8		
	Bi-PAP	26	24.76	5	4.8	4	3.8	17	16.2		

χ^2, p: χ^2 and p values for Chi square test. F, p: F and p values for ANOVA test. *: Statistically significant at $p \leq 0.05$ CMV: Control mode. SIMV: Synchronized intermittent mandatory ventilation. CPAP: Continuous positive airway pressure. PSV: Pressure support ventilation. Bi-PAP: Bi-level positive airway pressure.

Table (3): Comparison among the studied groups regarding to vital parameters

Parameter	Day of study	The studied groups according to constipation occurrence (n=105)			F	P
		Group 1 (not constipated) (n=13)	Group 2 (Constipated for 2 days) (n=29)	Group 3 (Constipated for 3 days) (n=63)		
Temp Min. – Max. Mean ± SD.	**First**	37.0 – 40.0 37.85 ± 0.93	35.0 – 40.0 37.59 ± 1.0	36.0 – 40.0 37.69 ± 0.88	0.367	0.694
	Second	37.0 – 40.0 37.94 ± 1.07	35.0 – 40.0 37.90 ± 1.11	36.0 – 40.0 37.78 ± 0.80	0.244	0.784
	Third	37.0 – 39.0 37.69 ± 0.56	36.0 – 39.0 37.77 ± 0.76	36.0 – 40.0 37.80 ± 0.77	0.107	0.899
HR Min. – Max. Mean ± SD.	**First**	71.0 – 120.0 89.69 ± 14.45	37.0 – 150.0 101.07 ± 23.59	36.0 – 160.0 100.46 ± 27.46	1.082	0.343
	Second	70.0 – 120.0 89.62 ± 16.61	62.0 – 190.0 102.14 ± 26.05	38.0 – 158.0 104.08 ± 22.49	2.148	0.122
	Third	72.0 – 123.0	9.0 – 140.0	56.0 – 160.0	1.252	0.290

		99.46 ± 14.12	101.17 ± 28.93	107.59 ± 19.97		
MAP Min. – Max. Mean ± SD.	**First**	60.0 – 130.0 94.23 ± 21.81	53.0 – 130.0 89.34 ± 22.54	13.0 – 133.0 78.42 ± 19.64	4.779*	0.010*
	Second	86.0 – 130.0 97.62 ± 11.30	50.0 – 123.0 94.03 ± 21.14	10.0 – 133.0 84.09 ± 20.67	4.018*	0.021*
	Third	86.0 – 123.0 96.85 ± 9.49	50.0 – 150.0 92.68 ± 20.15	10.0 – 133.0 84.18 ± 23.46	2.815	0.065
RR Min. – Max. Mean ± SD.	**First**	1.0 – 36.0 21.62 ± 8.17	13.0 – 40.0 23.86 ± 8.45	13.0 – 46.0 21.98 ± 6.75	0.730	0.485
	Second	13.0 – 35.0 23.0 ± 6.70	14.0 – 41.0 25.72 ± 7.99	11.0 – 40.0 22.71 ± 6.81	1.813	0.168
	Third	13.0 – 40.0 23.08 ± 8.67	11.0 – 45.0 26.14 ± 9.85	11.0 – 44.0 23.67 ± 6.49	1.167	0.315
CVP Min. – Max. Mean ± SD.	**First**	2.0 – 20.0 10.23 ± 6.0	2.0 – 28.0 12.76 ± 6.31	2.0 – 27.0 12.98 ± 6.75	0.968	0.383
	Second	1.0 – 20.0 10.54 ± 5.72	1.0 – 28.0 12.79 ± 6.0	3.0 – 28.0 15.32 ± 6.52	3.879*	0.024*
	Third	2.0 – 22.0 12.62 ± 6.16	2.0 – 28.0 13.41 ± 7.53	3.0 – 28.0 14.13 ± 6.91	0.295	0.745

F,p: F and p values for ANOVA test *: Statistically significant at $p \leq 0.05$

Table (4): Comparison among the studied groups regarding to nutritional parameters

Parameter	**Day of study**	**The studied groups according to constipation occurrence (n=105)**								χ^2	MCp
		Total (n=105)		**Group 1 (not constipated) (n=13)**		**Group 2 (Constipated for 2 days) (n=29)**		**Group 3 (Constipated for 3 days) (n=63)**			
		No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**		
Time of starting feeding											
	≤ 24 hrs	94	89.5	13	12.4	25	23.8	56	53.3	1.521	0.518
	≥ 24 hrs	11	10.5	0	0.0	4	3.8	7	6.7		
Type of Feeding	**First**										
	NOP	**11**	10.5	0	0	4	3.8	7	6.7		
	Juices	23	21.9	1	1.0	10	9.5	12	11.4	10.051	0.085
	High protein	7	6.7	3	2.85	1	1.0	3	2.9		
	High fiber	1	1.0	0	0.0	1	1.0	0	0.0		
	Low fiber	63	60	9	8.6	13	12.4	41	39.0		
	Second										
	Juices	19	18.1	0	0.0	7	6.7	12	11.4		
	High protein	14	13.3	4	3.8	4	3.8	6	5.7	11.919*	0.038*
	High fiber	5	4.8	2	1.9	2	1.9	1	1.0		
	Low fiber	67	63.8	7	6.7	16	15.2	44	41.9		
	Third										
	Juices	20	19.0	0	0.0	6	5.7	14	13.3		
	High protein	14	13.3	3	2.85	5	4.8	6	5.7	10.460	0.066
	High fiber	3	2.9	2	1.9	0	0.0	1	1.0		
	Low fiber	68	64.8	8	7.6	18	17.1	42	40.0		

χ^2, p: χ^2 and p values for Chi square test MC: Monte Carlo for Chi square test
*: Statistically significant at $p \leq 0.05$ NPO: Nothing given by mouth

Table (5): Comparison among the studied groups regarding to electrolytes and blood chemistry parameters

Parameter		Day of study	The studied groups according to constipation occurrence (n=105)			F	p
			Group 1 (not constipated) (n=13)	Group 2 (Constipated for 2 days) (n=29)	Group 3 (Constipated for 3 days) (n=63)		
Electrolytes	Na_ Min. – Max. Mean ± SD.	First	134.0 – 274.0 154.54 ± 37.57	129.70 – 160.0 143.08 ± 7.32	140.60 – 170.0 138.48 ± 15.42	4.385*	0.015*
		Second	109.0 – 166.0 140.27 ± 14.02	126.0 – 160.0 141.66 ± 9.0	116.0 – 170.0 142.46 ± 10.29	0.254	0.776
		Third	109.0 – 151.0 139.0 ± 11.52	128.0 – 160.0 142.26 ± 8.93	116.0 – 170.0 142.84 ± 11.27	0.694	0.502
	K_ Min. – Max. Mean ± SD.	First	2.60 – 4.94 3.63 ± 0.66	2.20 – 5.80 3.60 ± 0.62	2.0 – 5.80 3.96 ± 0.73	3.265*	0.042*
		Second	3.20 – 4.70 3.85 ± 0.40	2.60 – 5.10 3.79 ± 0.57	2.50 – 5.30 3.86 ± 0.70	0.104	0.901
		Third	3.0-4.60 3.74 ± 0.59	2.30-4.80 3.56 ± 0.60	2.0-5.50 3.83 ± 0.68	1.684	0.191
Blood Chemistry	Glucose Min. – Max. Mean ± SD.	First	82.0 – 511.0 191.46 ± 108.17	61.0 – 475.0 192.10 ± 94.48	47.0 – 598.0 196.48 ± 109.43	0.024	0.976
		Second	69.0 – 511.0 169.54 ± 112.06	55.0 – 367.0 193.72 ± 84.60	35.0 – 522.0 188.30 ± 99.23	0.280	0.756
		Third	80.0 – 511.0 198.77 ± 151.14	90.0 – 315.0 160.79 ± 64.89	35.0 – 411.0 179.35 ± 82.55	0.057	0.945
	BUN Min. – Max. Mean ± SD	First	6.0 – 47.0 20.0 ± 15.91	5.0 – 65.0 20.99 ± 15.15	5.0 – 119.0 34.72 ± 27.96	4.380*	0.015*
		Second	4.0 – 49.0 21.38 ± 16.97	5.0 – 62.0 20.88 ± 15.09	5.0 – 152.0 33.58 ± 29.37	3.192*	0.045*
		Third	3.0 – 53.0 20.92 ± 16.94	6.0 – 81.0 21.12 ± 15.13	6.0 – 160.0 33.76 ± 29.67	3.216*	0.044*
	Osmolality Min. – Max. Mean ± SD.	First	276.1 – 366.80 315.93 ± 30.47	274.8 – 381.8 310.87 ± 21.46	200.0 – 368.0 306.67 ± 25.91	0.254	0.776
		Second	271.4 – 364.0 309.43 ± 26.68	268.9 – 381.8 308.29 ± 23.34	202.0 – 398.0 309.63 ± 27.90	0.694	0.502
		Third	270.0 – 367.4 310.14 ± 25.55	248.0 – 381.8 305.92 ± 27.59	268.9 – 418.0 309.99 ± 27.41	4.380	0.015*
	Hct_ Min. – Max. Mean ± SD.	First	21.80 – 47.60 35.09 ± 7.61	20.70 – 55.20 34.47 ± 8.71	11.90 – 55.20 35.07 ± 8.15	0.057	0.945
		Second	15.0 – 40.20 31.45 ± 7.03	23.70 – 47.80 34.20 ± 6.41	11.70 – 50.0 33.74 ± 8.14	0.629	0.535
		Third	15.0 – 40.20 30.60 ± 6.76	20.70 – 53.0 34.46 ± 7.41	10.90 – 51.0 33.29 ± 7.68	1.187	0.309

F,p: F and p values for ANOVA test *: Statistically significant at $p \leq 0.05$

IV. Discussion

The current study demonstrated that about half of patients in group 3 were traumatized males aged between 30 - 50 years old. Additionally, there was no significance difference among the studied groups regarding gender, age and diagnosis. These findings are supported by Spodniewska *et al.* [12] who considered their patients were constipated if they failed to open their bowels for 3 continuous days. While, Olsen *et al.*[13] commented that traumatic patients usually have gastrointestinal dysfunction especially enteral feeding intolerance. Moreover, Nassar *et al.*[1] stated that constipation is occurred in the majority of their studied patients with no significance in terms of age, sex and admission diagnosis. Similarly, Mostafa *et al.* [14] Spodniewska *et al.* [12] and Guerra *et al.* [15] have reported that the most of their studied patients were constipated. On the other hand, these findings were unsupported by Meinds *et al.*'s [16] findings who found that the constipation occurred commonly in the younger age groups with both sex.

The present study highlights that about half of patients in group 3 were unconscious though 1st, 2nd and 3rd study days. This is in consistent with Rohney *et al.*[17] and Kadamani *et al.*[6] who concluded that decreased level of consciousness can lead to limited sensation of rectum fullness and defecations that resulted in constipation. Moreover, the present results revealed that there were no statistical significance differences among the studied groups regarding APACHE II score. In the same line, De Azevedo *et al.* [18] who applied a multivariate analysis to identify relation between APACHE II score and constipation and found that in ICU patients, constipation has been associated with increased worsening of organ dysfunctions (which can be estimated by APACHE II score) even increased mortality. Additionally, Spodniewska *et al.*[12] found that APACHE II score for constipated and non-constipated patients was the same.

The current data shows that nearly half of patients in group 3 didn't receive laxative agents throughout the study period. Our findings were congruent with De Azevedo *et al.*[19] who reported that laxative therapy enhanced the daily defecation for the mechanically ventilated patients. Also, these data was stressed by Van der Spoel *et al.* [20] who mentioned that patients who received both lactulose and polyethylene glycol were defecating promptly and effectively than placebo. This is on the same line with Masri *et al.*[21] Lacy *et al.* [22] Webster *et al.*[23] Bharucha *et al.*[2] and Fennessy *et al.* [24] who recommended that use of prophylactic laxatives had a clinical benefits and can be successfully prevent constipation in critically ill patients.

The present findings focused on the effect of mechanical ventilation (MV) mode on constipation occurrence. There was significant difference as a higher percent of patients in group 3 were on Bi-level positive airway pressure (BIPAP) mode. This can be attributed to that BIPAP is a pressure controlled mode which increase intrathoracic pressure during inspiration. Transmission of increased intrathoracic pressures leads to impeding venous return, and cardiac output. It was found that positive pressure induced by MV depressed cardiac output, intestinal blood flow which contributes to constipation development. [25, 26] From the view of Masri *et al* [21] the delayed bowel movement more than 5 days is associated with long ventilation period, compared with early bowel movement less than 5 days. On the same view, other studies as Nassar *et al.*[1] stated that constipation was associated with difficult weaning from mechanical ventilator. Additionally, Guerra et al.[15] who conducted an observational study in a Brazilian Public ICU. They found a higher constipation rate among the mechanically ventilated patients. As above Gacouin *et al.*[27] and Spodniewska *et al.*[12] observed that the mechanical ventilation duration is higher in constipated patients

The current study represents that there was a significance difference among the studied groups regarding mean arterial pressure (MAP) and central venous pressure (CVP) as group 3 whose patients were constipated for 3 days had less mean MAP and higher mean CVP. This can be due to hypotension which decreases intestinal blood flow exacerbating constipation development. Moreover, high CVP may be due to accumulation of fluids and increased preload which in turn decrease cardiac output and later on decreases intestinal blood flow intensifying constipation occurrence. Another study was done trying to explain relationship between MAP and constipation occurrence. Webster *et al.* [23] who reported that the increased intra-abdominal pressure due to long term constipation can increase the mean arterial pressure. Moreover, the high MAP can lead to gastric congestion and lack of motility causing constipation.

Based on the fact that early nutrition maintains the structure and function of gastrointestinal mucosa. The present results approved that the majority of the studied patients were started their enteral feeding within ≤ 24 hours from admission that was positively associated with constipation occurrence. In addition, there was a significant relation between type of feeding and constipation occurrence as large percent of patients in both of group 2 and 3 received low fiber diet. A lot of Studies that have shown association between early nutrition and constipation is associated with a decreased incidence of constipation.[16] in harmony, Nassar *et al.* [1] mentioned that early feeding is a protective factor that associated with constipation reduction. In the same line, Webster,[23] and Fennessy *et al.* [24] concluded that early enteral feeding was beneficial for critically ill patients with low motility. Also, Guerra *et al.*[15] reported a higher constipation rate within patients who had received nutritional support within 72 hours of admission. Webster *et al.* [23] and Bharucha *et al.* [2] stated that constipation was associated with low or lack of dietary fiber intake or due to reduction of gastrointestinal tract motility in critically ill patients. Finally, Spodniewska *et al.* [12] attributed that failure to feed were greater in constipated than non-constipated patients.

The results approved that there was significant difference among the studied groups in relation to serum sodium (Na^+) in 1st study day as group 1 whose patients were not constipated had a higher mean sodium level. This result can be attributed to that patients of group 1 had elevated mean body temperature which promoted water loss and higher Na^+. But for the same group in 2nd and 3rd study days, Na^+ returned to normal level due to proper fluid and electrolytes replacement. Regarding blood urea nitrogen (BUN), there was significant difference among the studied groups as group 3 had higher mean BUN level. In addition, the results showed that there was a significant relation among the studied groups. This can be explained by that BUN is one component of calculating serum osmolality so when it is high, serum osmolality will increase. Therefore increased BUN and serum osmolality can indicate dehydration that is associated with constipation development.

Water is very important for GIT motility and digestion. Dehydration is one of the most risk factors that lead to constipation. So, Webster *et al.* [23] stressed that the lack or inadequate provision of fluids can lead to constipation. According to Arnaud *et al.* [28] and Beck *et al.* [29] noted that restricted or loss of fluid as hypo-hydration increase constipation incidence; while euhydration through oral or intravenous route prevent it. In addition, Hsieh *et al.* [30] mentioned that effective hydration is a corner stone in improving and maintaining bowel motility. The lack of fluid intake can aggravate the risk of constipation. Further studies [31,32] have provided evidence that low hydration is associated with high incidence of constipation. So, fluid intake reduction may play a high role in developing fecal impaction.

Unfortunately, no studies examined the relation between the incidence of constipation and electrolytes and blood chemistry. Only Fukuda *et al.* [33] reported that late bowel evacuation was associated with bad critically ill patient's clinical outcomes. Finally, our findings highlighted that the majority of the studied patients had a poor defecation frequency. This indicates that frequency is a good predictor for constipation occurrence. These findings are disapproved by Meinds *et al.*'s [16] findings who reported that the majority of their studied patients had normal defecation frequency.

V. Conclusion

Critically ill patients have multi consequences contributing to constipation development. Some causes have direct effect and others are indirect. Therefore constipation occurrence was high among the studied groups. Nearly up to 60% of them were constipated throughout the study days. Unconscious patients with mechanical ventilation and unable to express their thirst feelings were more liable for constipation than others. Moreover, most of patients receiving delayed enteral feeding and low fiber diet was constipated. Finally, Hypotension, presence of fluid shift to third space (edema) and increased blood urea nitrogen were evident contributing factors to constipation occurrence.

VI. Recommendations

It is suggested from the current study that the nurses should assess carefully patient's bowel pattern daily. They have to monitor and manage fluid balance of critically ill patients continuously especially unconscious and mechanically ventilated ones. Additionally, they should start feeding soon considering high fiber diet. Although, the current study reporting vital parameters, electrolytes and blood chemistry parameters revealed a significant relation to the incidence of constipation but still unclear. So, we recommend for further researches to examine the correlation between constipation occurrence and these parameters.

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