IOSR Journal of Nursing and Health Science (IOSR-JNHS)
e-ISSN: 2320–1959.p- ISSN: 2320–1940 Volume 9, Issue 2 Ser. III (Mar - Apr. 2020), PP 60-65
www.iosrjournals.org

The Effect of Implementing Fluids Management Guidelines on the Cumulative Fluids Balance among Critically Ill Patients

Shimmaa Mohamed[1], Nagwa Ahmad[2]Ahmed Nabil[3] Eman Arafa[4]
[1](Critical Care and Emergency Nursing, clinical instructor / Faculty of Nursing University, Alexandria)
[2] (Critical Care and Emergency, Professor / Faculty of Nursing University, Alexandria)
[3](Critical medicine, Lecture / Faculty of Medicine, Alexandria)
[4](Critical Care and Emergency, Lecture / Faculty of Nursing University, Alexandria)

Abstract: *Critical care nurses are members of the multidisciplinary team for the complex fluids management. Proper fluids management has both financial and clinical effects. T**he clinical effects included** fluids volume deficit associated complications (hypotension, tachycardia, acute kidney injury, shock and multiorgan failure), and the fluids volume excess associated complications (tissue edema, poor tissue repair, delayed recovery, respiratory failure, and hypertension). **While, the financial effects**, it was found that the global intravenous (IV) therapy market in Egypt estimated the cost of IV therapy to be valued at 29 billion USD by 2021 with a compound annual growth rate of 6.1% which increase the health care expenditure. The National Institute for Health and Care Excellence developed guidliness to guide health care providers in managing fluids of critically ill patients.*

Materials and Method*: A quasi experimental research design was used to conduct this study. A convenience sample of 60 newly admitted critically ill adult patients were included in this study. Patients were assigned into two equal groups of 30 patients; group A which is the control group who received the routine fluid management of the mention settings and group B which is the study group who received the NICE fluids management guidelines. Patients with severe chronic kidney disease (stage 4 or 5), end stage liver failure, heart failure, and diabetic ketoacidosis were excluded from the study.*

Results*: The current study findings showed that the patients who were subjected to the NICE fluids management lower accumulative fluid balance than patients who subjected to the routine fluids management(X^2=1.92, P<0.001). The cut point of the positive cumulative fluids was indicated by 1000ml. findings of the current study revealed that 95.7 % of the control group had positive fluid balance more than 1000ml, while, 92.6% of the intervention group had positive cumulative balance which was less than 1000ml. There was a statistical significance difference between the both studied groups in relation to the positive cumulative fluids balance (X2=38.74, p<0.001).*

Conclusion: *National Institute for Health and Care Excellence (NICE) fluids management guidliness had good effect on the intervention group received fluid management guidelines in relation to the cumulative fluid balance.*

Key Word*: **Fluids management; cumulative; fluid balance.***

Date of Submission: 11-03-2020 Date of Acceptance: 25-03-2020

I. Introduction

Fluids management in critically ill patients has come under the spotlight in recent years. Intravenous fluids (IV) are routinely used in intensive care units (ICUs) in order to restore effective blood volume and maintain organ perfusion. The amount and composition of fluids used in the ICU have directly impact the patients outcomes [1]. Moreover, the high cost for intravenous fluids management used in the routine fluids maintenance was found to be a major complication[2]. The Infusion Nurses Society set up infusion nursing care standards that cover all aspects of fluids therapy from patient assessment, maintenance and documentation. Standard 32 of infusion nursing standards of practice suggests that the nurse should collaborate with the other health care providers to determine fluids therapy needs for each patient[3]. The National Institute for Health and Care Excellence (NICE) guidelines development group seeks to lower its cost [2]. The NICE developed guidelines for health care providers to make sure that the fluids management has the best possible quality. The NICE guidelines are based on systematic reviews, explicit consideration of cost effectiveness and expert opinions [4, 5].

The National Institute for Health and Care Excellence advocates that nurses should be able to start IV fluids according to the organizational policy until they are prescribed by a relevant practitioner [6]. These

guidelines consist of the new "**five Rs of IV fluids therapy**" resuscitation; routine maintenance; replacement; redistribution; and reassessment. **Fluids resuscitation** aims to urgent restoration of the perfusion of the vital organs. **Fluids maintenance** is different from fluids replacement. **Fluids maintenance** indicates to meet the basic physiologic needs of the patient including both sensible and insensible fluids losses, while, **fluids replacement** goes beyond the normal physiologic losses and includes such conditions as vomiting and diarrhea[7, 8].

II. Material And Methods

This quasi experimental study was carried out on patients of ICUs at the Alexandria Main University hospitals from September 2018 to May 2019. A total 60 adult patients (both male and females) aged ≥ 18 years were included in this study.

Study Design: A quasi experimental research design

Study Location: This study was carried out in three ICUs at the Alexandria Main University Hospital, namely:unit I included 14 beds, unit II 6 beds and unit III 15 beds.

Study Duration: September 2018 to May 2019

Sample size: 60 critically ill patients.

Sample size calculation: The minimum sample size was based on power analysis (Epi-Info program that was used to estimate sample size using population size over 6 months (240 patients), expected frequency 50%, acceptable error 5%; confidential coefficience 95%, sample size was **60** patients).

Subjects & selection method: A convenience sample of 60 newly admitted critically ill adult patients to the previously-mentioned settings were included in the current study.

The patients were assigned into two chronological equal groups:

Group A: the control group consisted of 30 patients who received the **routine** fluids management in the mention setting

Group B: the intervention group consisted of 30 patients who received the **NICE** fluids management guidelines.

Inclusion criteria:

All newly admitted adult critically ill patients.

Exclusion criteria:

1. Patients with severe chronic kidney (stage 4 or 5) disease because of the need for hemodialysis or peritoneal dialysis due to extensive fluids retention.
2. Patients diagnosed with end stage liver failure because of the extensive fluids retention.
3. Patients diagnosed with heart failure because of the extensive fluids retention.
4. Patients with diabetic ketoacidosis because of managing diabetic ketoacidosis in the ICUs during the first 24-48 hours. They need close monitoring, correction of fluids loss with intravenous fluids, correction of hyperglycemia with insulin, correction of electrolyte disturbances, particularly potassium loss, and correction of acid-base balance.

Procedure methodology:

An approval from the ethical committee, Faculty of Nursing was obtained; an official permission was obtained from the Faculty of Nursing Alexandria University to the administrative authorities of the Alexandria Main University Hospital to conduct the study; an official approval was obtained from the hospital administrative authorities to collect the necessary data from the selected settings after explanation of the aim of the study. Informed written consent was obtained from each patient after explaining the aim of the study and the right to refuse participation in the study was assured. The anonymity and the privacy of the patients, as well as the confidentiality of the collected data were assured.

Two tools were developed by the researcher after reviewing the related literature, except part I of the tool two was adopted from Chirrs E Bennett 2010. The study tools were tested for content validity by 5 experts in the field of the study. A pilot study was carried out on 6 patients (10% of the sample) in order to test the applicability of the tools. Reliability of the two tools were measured using Cronbach Alpha reliability, the reliability coefficient values were (r =0.932) and (r 0.827) which are acceptable. The necessary modifications were done accordingly. The patients were assigned into two equal groups. All newly admitted critically ill patients were assessed by the researcher for meeting the inclusion criteria on the first day of admission. They assigned into control and intervention groups. Patient's characteristics and clinical data were assessed for each patient in the both groups. The data was recorded using part I tool one. Factors associated with fluids imbalance were assessed for each patient in the both groups to identify expected causes of fluids deficit or excess. The data was recorded using part II tool one. Critically ill patients' therapeutic modalities were assessed for each patient in the both groups to determine its effects on fluids status. The data was recorded using tool one part III. Critically ill IV fluids need and prescription were assessed for

each patient in the control group. Routine daily fluids management in the previously mention unit was assessed for the three consecutive days. The data was recorded using part IV tool one. The intervention group received NICE fluids management guidelines for three consecutive days from admission day. Critically ill IV fluids need and prescription were assessed for each patient in the intervention group. Daily fluids management plan was done for the three consecutive days using the five Rs fluids management guidelines. The data were recorded using part IV tool one. The fluids balance evaluation was assessed for each patient in the both groups. The data was recorded using tool two. Cumulative fluids balance was assessed for each patient in the both groups using cumulative fluids bar chart, the data was recorded using part I tool two. Fluids imbalance manifestations were assessed for each patient in the both groups, the data was recorded using part II tool two

Statistical analysis:

The raw data were coded and transformed into coding sheets. The results were checked. Then, the data were entered into SPSS system files (SPSS package version 20) using personal computer. Output drafts were checked against the revised coded data for typing and spelling mistakes. The following statistical measures were used Chi square test, Fisher Exact for Chi square test, and paired sample t-test

Comparison between the both groups was done to determine the effect of implementing fluids management guidelines on the accumulative fluids balance among critically ill patients. The level $P < 0.05$ was considered as the cutoff value or significance.

III. Result

Table no 1 presents the distribution of the both studied groups in relation to the patient's data. It was observed that 63.3% of the control group aged from 40 to <59 years old and 50% of them were male, compared to 50% of the intervention group aged from 19 to <39 years old and 53.3% of them were female. From the same table it was observed that 43.3% of the control group and 60% of the intervention group were suffering from the neurological diseases. Moreover, 66 .7% of the control group had history of cardiovascular diseases, while, 46.7 % of the intervention group had history of the neurological diseases. There was no statistical significance difference between the control and intervention groups in relation to age (X2=2.591, p=0.274); sex (X2=0.067, p=0.794); current diagnosis (X2=2.805 =p=0.730) and medical or surgical history (X2=6.761, p=0.239).

Table no 1: Comparison between the control and intervention groups in relation to the patient data.

Patients data	Control group		Intervention group		X2	p
	NO	%	NO	%		
Age						
18-39	9	30.0	15	50.0	2.591	0.274
40-59	19	63.3	14	46.7		
60	2	6.7	1	3.3		
Male	15	50.0	14	46.7	0.067	0.796
Female	15	50.0	16	53.3		
Current patient diagnosis						
Cardiovascular disease	9	30.0	7	23.3	2.805	0.730
Respiratory disease	12	40.0	13	43.3		
Renal disease	1	3.3	3	10.0		
Neurological disease	13	43.3	18	60.0		
Endocrine disease	3	10.0	3	10.0		
GIT disease	1	3.3	0	0.0		
Medical co-morbidities or surgical history						
Cardiovascular	20	66.7	12	40.0	6.761	0.239
Respiratory disease	13	43.3	9	30.0		
Neurological disease	8	26.7	14	46.7		
GIT disease	1	3.3	0	0.0		
Endocrine disease	1	3.3	1	3.3		
Renal disease	13	43.3	5	16.7		

Table no 2 demonstrates comparison between the both studied groups in relation to the fluids volume of the used in the fluids management. Regarding the volume of the fluids resuscitation, it was noticed that the mean of fluids resuscitation volume used in the control group was 711.8 ± 583.9 while, in the intervention group was found to be 466.7±281.1. There was a statistical significance difference between the both groups in relation to the fluids volume used in the resuscitation (X2=2.072, p=0.043).

Concerning the fluids volume used in the routine maintenance, it was observed that the mean of the routine fluids maintenance volume in the control group was found to be 4164.2± 1153.9, while, the mean of the routine fluids maintenance volume in the intervention group was found to be 2806.4± 532.2. There was a

statistical significance difference between the both studied groups in relation to the fluids volume management used in the routine maintenance (X2=5.853, p=0.000).

Regarding the fluids volume used in the fluids replacement for the both groups, it was found that the mean of the fluids used in the control group was 537.3± 529.9, while, it was 558.1±309.7 in the intervention group. There was no statistical significance difference between the both studied groups in relation to the mean volume of the fluids replacement. (X2=0.186, p=0.853).

Table no 2: Comparison between control and intervention group in relation to the volume of fluids management used:

Volume of fluids management	Control group	intervention group	X^2	P
Volume of fluids resuscitation	711.8 ± 583.9	466.7±281.1	2.072	0.043*
Volume of routine fluids maintenance	4164.2± 1153.9	2806.4± 532.2	5.853	0.000*
Volume of fluids replacement	537.3± 529.9	558.1±309.7	0.186	0.853
Volume of fluids redistribution	0.0 ± 0.0	0.0 ± 0.0	0	0

Table no 3 displays comparison between the control and intervention groups in relation to the cumulative fluids balance throughout the three consecutive observation days. It was observed that the mean of the cumulative balance in the control group on the first day was 877.4 ± 1671.1, and it was 298.0 ± 425.4 in the intervention group. On the other hand, the mean of cumulative balance was increased in the both groups in the second and third days (it was 1784±832573, and 3024.3 ± 3437.3 in the control group; while, it was 390±07363, and 801.7 ± 1972.1 in the intervention group in the second and third day respectively).

There was no statistical significance difference between the both groups in relation to the cumulative balance in the first day. While, there was a statistical significance difference between the both studied groups in relation to the cumulative fluids balance in the second day (X^2=9.006, p<0.001) and third day (X^2=3.072, p= 0.003)

Table no 3: Comparison between control and intervention group in relation Cumulative fluids balance:

Observation Days	Cumulative fluids balance		X^2	p
	Control group	Intervention group		
First day	877.4 ± 1671.1	298.0 ± 425.4	1.840	0.071
Second day	1784±832573	390±07363	9.006*	<0.001*
Third day	3024.3 ± 3437.3	801.7 ± 1972.1	3.072	0.003*

Table no 4 shows comparison between the studied groups in relation to the negative and positive cumulative fluids balance. It was observed that 23.3% of the control group had negative fluids balance, while, it was 10% in the intervention group. There was no statistical significance difference between the both groups in relation to the negative cumulative fluids balance (X2=1.92, p<0.166). On the other hand, it was observed that 76.7% of the control group had positive fluids balance, while, it was 90% in the intervention group.

The cut point off the positive cumulative fluid was indicated by 1000ml. findings of the current study revealed that 95.7 % of the control group had positive balance more than 1000ml, while, 92.6% of the intervention group had positive cumulative balance which was less than 1000ml. There was a statistical significance difference between the both studied groups in relation to the positive cumulative fluids balance (X2=38.74, p<0.001).

Table no 4 Comparison between control and intervention group in relation to positive and negative cumulative fluids balance

Cumulative fluids balance		Control group		Intervention group		X^2	p
		No.	%	No.	%		
Negative fluids balance		7	23.3	3	10.0	1.92	0.166
Positive fluids balance		23	76.7	27	90.0		
Positive fluids balance	≤1000ml	1	4.3	25	92.6	38.748	<0.001*
	>1000ml	22	95.7	2	7.4		

IV. Discussion

Fluids imbalance among critically ill patients are yet a common clinical relevance in the ICUs. This issue has received a little attention both at the national and international levels. It was documented that there is gap in the nursing practice for maintaining fluids balance in the ICUs in Egypt [9]. Therefore, it is mandatory to

include fluids management guidelines to guide critical care nurses in their practice. The current study was conducted to identify the effect of implementing fluids management guidelines on the cumulative fluids balance among adult critically ill patients.

The current study results revealed that neither the control nor the intervention group had a zero cumulative fluids balance. This can be justified by the fluids homeostasis which is frequently disrupted in the critically ill patients. Moreover, many factors can affect the fluids balance among the studied patients during the observation days as using of mechanical ventilating; diuretics; presence of hypoalbumenia; hyperglycemia; fever; and increases insensible respiratory loss. Fluids needs to be prescribed such as other medications according to the patient characteristics, disease processes, and treatments[10]. The finding in the presence study is congruent with Colbert & Szerlip (2019) who reported that the determination of the amount of the fluids that should be administered to the critically ill patients to improve hemodynamics without causing fluids overload has clinical challenges and only about 50% of hemodynamically unstable patients will respond to a fluids bolus[11].

The findings of the current study indicated that the positive cumulative fluids balance occurs in the majority of the studied patients rather than the negative cumulative balance throughout the three consecutive observation days. The fluids balance of the body is maintained with remarkable accuracy within narrow limits plus or minus variations that rarely don't exceed one to two liters [12]. Andrea etal (2015) supported the current study finding revealed that the excess positive fluids balances are frequently seen in the critically ill patients associated with worse outcomes. They interpreted this results to the progressive increase of fluids balance during the shock period, and they indicated that the patients became more positive after the recovery from shock which increase the ICU length[13].

One liter of fluids in this study was used as a cutoff point to determine the amount of the positive cumulative fluids. It was observed that the patients who are subjected to the NICE fluids management guidelines exhibited the positive cumulative fluids balance less than one-liter than those who aren't subjected over the three consecutive observation days. Therefore, the hypothesis of this study is accepted.

Patients who are subjected to the NICE fluids management had lower cumulative balance than those patients who are subjected to the routine fluids management. This may be related to that the control group managed by massive volume of isotonic fluids during the fluids management according to the routine care of the ICU fluids management. To get spot on, increase positive cumulative balance more than one liter in control group can be justified by that most of the control group experienced iatrogenic electrolyte imbalance mainly hypernatremia throughout the three observation days which increased risk of fluids accumulation. This attributed the aggressive and copious I.V fluids especially normal saline 0.9% used for hemodynamic stability which cause iatrogenic fluids volume excess in case of fluids resuscitation throughout the observation days. Normal Saline is more likely to cause metabolic acidosis, interstitial lung edema and renal blood flow disturbances. It may be equivalent to the other crystalloids when is safely administered less than 2 liters to the ICUs patients [14]

The current study finding is congruent with Blumberg (2018) who indicated that the normal saline is the only solution recommended for administration during their hospitals stay. Normal saline infusions can contribute to undesirable metabolic changes including hyperchloremic metabolic acidosis, hyperkalemia and impaired renal function. For volume resuscitation of critically ill patients there seems no rationale to use the normal saline as a first choice[14].

On the other hand, the intervention group in the current study managed by the predetermined amount of the fluids according to the NICE guidelines. Early step by step guided fluids management and early use of vasopressure followed by continuous monitoring persistence need of fluids until hemodynamic stability achieved. Patients who are subjected to the NICE fluids management had guided by fluids resuscitation indicators throughout the observation days. The current study findings is in agreement with NICE (2013) who reported that patients who cannot meet their daily needs of fluids through oral or enteral routes had fluids overload as the most common complications due to the excessive fluids are administered[15]. Moreover Morisawa (2019) found that the patients who subjected to fluids management strategy had less positive cumulative fluids balance compared to patients who aren't subjected after one week of the ICU stay, and had associated with lower mortality rate. Moreover, it was documented that the aggressive volume administration without cautious of monitoring should be avoided in the ICU. Hence, critical care nurses should advocate for reporting any significant abnormalities in the patients' records and maintain accurate fluids balance charting. [8].

V. Conclusion

From the results of the current study, it can be concluded that patients who are subjected to the NICE fluids management guidelines exhibit less volume used in fluids resuscitation and routine maintenance than patients who were subjected to the routine fluids management in the previous mention units. Regarding fluids status reassessment, patients who are subjected to the NICE fluids management guidelines experienced less

fluids imbalance manifestations such as presence of edema; abnormal breath sounds, had low hematocrit, and had high CVP, MAP, and respiratory rate than patients who were subjected to the routine fluids management in the previous mention units.

Concerning the cumulative balance, it was noticed that patients who are subjected to the NICE fluids management guidelines experienced less fluids accumulation than patients who were subjected to the routine fluids management in the previous mention units. Using one liter as cut off point of fluids accumulation, patients who were subjected to the NICE fluids management guidelines exhibit less positive balance than patients who were subjected to the routine fluids management.

The current study findings recommend to educate the fluids management algorisms and guidelines in caring for critically ill patients; encourage continuing education for the critical care nurses and develop workshops and seminars for them related to fluid management; use of cumulative fluids balance chart in monitoring fluids balance for critical ill patients; encourage administrative authorities to use cumulative fluids balance bar chart in monitoring fluids balance for critical ill patients ; replications of the current study on larger sample size for generalization.

References

[1]. Frazee, E., Fluid Management for Critically Ill Patients: A Review of the Current State of Fluid Therapy in the Intensive Care Unit. Karger, 2016. **2**(4): p. 64-70.
[2]. Padhi, S., Intravenous fluid therapy for adults in hospital: summary of NICE guidance. National Clinical Guideline Centre, 2013. **347**(7073).
[3]. Harper, D., Infusion therapy much more than a simple task. Lippincott Williams & Wilkins, 2014: p. 66-67.
[4]. Baombe, J. New NICE guidance on intravenous fluid therapy for adults in hospital: how is this relevant to EM. 2014 [cited 2018 22/10]; Available from: http://www.stemlynsblog.org/new-nice-guidance-intravenous-fluid-therapy-adults-hospital-relevant-em/.
[5]. NICE, NICEPathway Intravenous fluid therapy in adults in hospital. National Clinical Guideline Centre, 2019: p. 1-20.
[6]. Cathala, X., Selecting IV fluids to manage fluid loss in critically ill patients. Nursing Times, 2018. **114**(12): p. 41-44.
[7]. Castera, M. Fluid Management. 2019 [cited 2019 10/10]; 10-14]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK532305/.
[8]. Callum, K., NICE guidance on giving intravenous fluids. Nursing Times, 2014. **110** (6): p. 12-13.
[9]. Ghany, M., Developing Nursing Standards for Maintaining Fluid and Electrolyte Balance for Critically Ill Patients in Intensive Care Units. Journal of Intensive and Critical Care, 2019. **5** (1:4): p. 1-7.
[10]. JeanLouis, Fluid management in the critically ill. Kidney International, 2019. **1**(5): p. 1-9.
[11]. Colbert, G. and H. Szerlip, Euvolemia is acritical target in the management of acute kidney injury. Wiley Periodicals, 2019. **34**(11): p. 31-34.
[12]. Marriott, H., The maintenance of fluid balance, 1995, The Royal College of Surgeons. p. 339-359.
[13]. Regina, A., What happens to the fluid balance during and after recovering from septic shock? Rev Bras Ter Intensiva Journal 2015. **27**(1): p. 11-17.
[14]. Blumberg, N., et al., 0.9% NaCl (Normal Saline)—Perhaps not so normal after all? Transfus Apher Science, 2018 **57**(1): p. 127-131.
[15]. NICE, Intravenous fluid therapy in adults in hospital, in National Clinical Guideline Centre2013, The National Institute for Health and Care Excellence. p. 1-194.

Shimmaa Mohamed. "The Effect of Implementing Fluids Management Guidelines on the Cumulative Fluids Balance among Critically Ill Patients" *IOSR Journal of Nursing and Health Science (IOSR-JNHS)*, 9(2), 2020, pp. 60-65.