

Effect of Safe Hydration Management Educationa Program on Nurses' Performance and Patients' Outcomes

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Abstract

Background: Fluid balance monitoring is a part of nurses' practices. Due to its great significance in monitoring and recognizing the clinical condition of patients which reported in the daily observation sheet of patients, fluid control is one of the most important steps. **Aim:** Evaluate the nurses' performance and patients' outcomes after nursing program about hydration status management. **Design:** Quasi experimental research design was utilized. **Setting:** This study was carried out at medical, neurological and urology departments at Minia University Hospitals **Subject:** All available patients who received intravenous administration and all nurses who are responsible for fluid and electrolyte administration represent the study subjects. **Tools:** Hydration management structured interview questionnaire; nursing practices observational checklist and patients' clinical outcome. **Results:** Their were highly statistical significant differences existed regarding nurses knowledge and safe practices regard administration of fluid and electrolyte administration $P = .001^*$. Also highest mean average among both complications were founded among hypervolemia and hyperkalemia complications and was ranked as number (1) & (2) constituted 3.63 ± 1.1639 & 8.45 ± 2.5866 respectively . **Conclusion:** Implementation of training program about safe practice of fluid and electrolyte administrations illustrate a positive effect for both nurses and patients. **Recommendations:** training program should be carried out for nurses related to safe practice of fluid and electrolyte.

Keywords: Nurses Performance, Patients' Outcomes & Hydration Status.

Introduction

Body fluids and electrolytes play a significant role in maintaining the body's homeostasis and stable internal environment. In continuous motion, body fluids transport nutrients, electrolytes, and oxygen to cells and bring waste products away from the cells. The body uses a number of adaptive reactions associated with these activities to maintain the composition and volume of body fluids and electrolytes within the narrow limits of normality in order to maintain homeostasis and promote health (Feher, 2017). When plasma electrolytes are balanced, the correct concentration of ions in the blood is balanced, particularly sodium, potassium and magnesium. Too many or too few of these electrolytes can cause cardiac arrhythmias. Nurses need to understand the fluid compartments in the body and how fluid moves between these compartments to perform a competent fluid balance assessment (Begg, 2017).

The accuracy of data collection of fluid balance during physical assessment as well as during monitoring and documentation is an integral part of the basic patient information which directs medical and nursing interventions (Diacon et al., 2014). Monitoring of fluid balance consists of assessing,

recording and calculating the intake and output of fluids. Intake is the amount that enters the body orally or by intravenous infusion. While the amount of fluid that leaves the body by urine, sweat, respiration and stools is called fluid output (Diacon, 2012) Fluid intake may vary from 1500 to 2500 ml / day and urine output should be at least 0.5 ml / kg body weight / hour, depending on the intake. If the output is less than 0.5 ml / kg body weight / hour, the doctor or the shift leader should be mentioned (Herbert et al., 2016).

Nurses should have adequate knowledge and practice in the giving of fluids and electrolytes. Assessment of nurses' knowledge as regard fluid and electrolyte balance is a must in order to identify their errors in administration and to plan further training classes to improve their knowledge. Not much study has been carried out to assess nurses' knowledge of fluid and electrolyte balance, although it is important (Vijayan, 2011).

In many hospitals, the intake and output (I / O) chart is used to record all intake and output fluids of a patient over a period of time, usually 24 hours. Although many types of I / O charts have been developed, many faults have been detected. (Ling et al., 2011)

So the chart included fluid balance chart, I&O amount, hospital number, date and any specific fluid requirements must be clearly identified in the chart. (Bausker, 2018).

Acute shifts in body weight following enforced fluid limits or exercise are a clear measure of the hydration status. The assessment should be carried out concurrently during the day using the same scales, which should be adjusted periodically (Shepherd, 2011)

Assessment of fluid status includes monitoring of vital signs; including blood pressure, heart rate, respiration rate, central venous pressure and body weight. Low blood pressure is associated with impaired hemodynamic processes and insufficient oxygenation, which can result in organ failure, which can have a direct effect on the outcome of the patient (Diacon, 2012).

Maintaining fluid balance is important to avoid complications such as dehydration and hydration, both of which may have serious clinical consequences. (Shengnan et al., 2018). Inaccurate monitoring of the fluid balance can lead to many complications, including hypervolemia, hypovolemia, hypernatremia, hyponatremia, hyperkalemia and hypokalemia. All these complications will exacerbate the condition of patients and increase the mortality rate (Johnson, 2016). Ten million patients worldwide are predestined to be harmed unnecessarily and each year suffers from disabling injuries or death as a result of unsafe medical practices and care. This occurs in all health systems, contributing to health costs and rising political pressure. Examples of patient damage include: hospital-acquired infections, medical facility falls, misdiagnosis, and wrong treatment or medication (Javadi et al., 2013, Lawati et al., 2018).

Patient safety is an important aspect of healthcare and is a big global issue at the moment. Which affects patients in all areas of the healthcare system worldwide, the WHO defines patient safety as 'preventing errors and adverse effects on healthcare-related patients' and 'doing no harm to patients' (Lawati et al., 2018). Services that are unsafe and of low quality result in decreased health outcomes and even harm, patient safety leads to prevention of harm, especially 'avoidable harm,' to patients during treatment and care, WHO calls patient safety as an endemic concern based on continuous learning, as there is a great need to report and learn from errors, accidents, near misses and adverse events. (Motamedzadeh et al., 2017; WHO, 2017).

Significance of the study

Through my observation in practical setting such as medical and neurological departments a lot of patients have severe complications from their hydration status impairments when left untreated or not provided for them a correctly and safety interventions in an appropriate and timely manner. The nurses' knowledge and practices regarding safe hydration management such as accurate assessment of fluid balance data as well as during monitoring and recorded keeping form. The baseline patient information is an essential part which guides medical and nursing interventions to achieve a physiological stability for their patients.. Hence limited research is carried in this area, the researcher attend to evaluate the effect of implementing structured educational program on nurses' knowledge & practices and patients' outcomes regarding safe hydration management.

Aim of the study

is to evaluate the effect of implementing safe hydration management educational program on nurses' performance and patients' outcomes.

Research hypotheses

1. Nurses' performance improved after implementing educational program about safe hydration.
2. Patients who are cared by nurses who attended educational program exhibit outcomes without fluid and electrolyte imbalance complications.

Operational definition

1. Nurses performance

Included level of knowledge and practices.

2. Hydration

The act or process of combining or treating with water

3. Patient outcomes

Show no clinical manifestations of fluid and electrolyte imbalance complications.

Subjects and methods

Study Design

Quasi-experimental research design (pre- & post-study) was utilized to fulfill the purpose of the study.

Setting

The fieldwork of the present study was performed in three departments which included patients who at risk for body fluid and electrolyte imbalance, these departments affiliated to Minia University Hospitals at Minia Governorate. The first department was general medical with a capacity equal to 42 beds, second department was urology its capacity equal to 36 beds and third department was neurological department with a capacity equal to 28 beds. Minia University hospitals located on the western bank of the Nile River and in the face the upper bridge on the

Nile south of Minia City. The area served was western of Minia city and Minia governorate. The hospital consisted of two buildings one for educational composed of classes for teaching and training of medical and nursing students while the second building is composed of 16 out patients' clinics and 8 in-patient departments in different medical and surgical specialties

Subjects

Two groups were constituted the study subjects

Group one: all patients who attended the medical, urological and neurological departments and receiving intravenous fluid administration or who are at risk for body fluid and electrolyte imbalance during the period of data collection and the number of patients was (n=60).

Group two: was include all available nurses who are working in medical (n.=20) ,neurological unit (n.=9) and urology departments(n.=11) was total (n.=40)

Study tools

Three tools were developed by the researcher to collect baseline data based on extensive review of literature adopted from , (Kanakalakshmi, 2014, Lawati et al., 2018, AbdElalem & Fouad 2018).

Tool one: A safe hydration management structured interview questionnaire

It includes three parts

Part one: concerned with demographic data for study group (patients and nurses) and consisted of (8) items as "age, gender, educational status , patient's department and previous attended educational sessions.

Part two: knowledge assessment of the nurses about hydration status through multiple choice questions covering the key information field of the education program, collected prior to the introduction of the intervention program and re-tested after three months;. Content of question remained the same for two testing sessions.

It composed of fifty-eight (58) questions which cover three (3) domains:-

1. Knowledge about fluid and electrolytes balance in the body (questions from1-23).
2. Knowledge about complication of fluid imbalance (questions from24-50) .These questions reflected six complications as hypovolemia(6 questions), hypervolemia(4 questions) ,hypernatremia (5 questions),hyponatremia(4 questions),hyperkalemia (4 questions) and hypokalemia (4questions).
3. Knowledge about nursing intervention for fluid imbalance (questions from51-58).

Scoring System

Every correct answer takes one grade, and the wrong answer takes zero with equal to 23 scores for first

domain, with equal to 27 scores for second domain then third domain sores with equal to 8 scores. While the total scores with equal to 58 scores. So (< 60%) from total (58 scores) in the three domains was considered as unsatisfactory knowledge and (≥ 60) from total (58 scores) from previous domains was considered as satisfactory knowledge.

Second tool: safety nursing practices regarding hydration management: observational checklist which used to evaluate of first study group subjects (staff nurses) regard safe hydration status through five checklists covered the major practice area regard safe hydration status, it was collected prior to the implementation of the intervention program and re-tested after three months .Content of checklists remained the same for two testing . **It was consisted of fifty (50) steps which cover the following five (5) practices:**

- Nurse role at patient's admission (items from1-8).
- Safety nursing practices related to I.V fluid administration (items from9-20).
- Safety nursing practices related to monitoring fluid intake (items from21-30).
- Safety nursing practices related to monitoring fluid output (items from31-39).
- Safety nursing practices related to assessment I.V fluid imbalance (items from40-50).

Scoring System

The score for each item ranged from (0 to 2), wrong and unsafe practice was taken a score of zero (0), correct and incompletely safe practice was taken a score of one (1), correct and complete safe practice was taken a score of two (2), so (< 60%) was considered poor safe practice, (≥ 60 -85%) was considered fair safe practice and more than (85%) was considered good safe practice.

Third tool: patients' clinical outcome related to safe administration of fluid and electrolyte chart

The chart evaluated by theresearchers for patient's regarding symptoms or complains that determine which type of fluid and electrolyte imbalance occur and it include also results of patient's blood chemistry analysis ,it was covered by six (6) complications as hypo-hypervolemia, hypo-hyperkalemia and hypo-hypernatremia . It was collected from patients who are cared by the trained nurses (study program).Patient's analysis findings during hospitalization were compared against normal values .

Study method

Tool development three tools were developed by the researchers

Tools validity

The study tools contents validity were done to identify the degree to which the study tools what face supposed to be measured through a panel from five

academic expert in the field of the study(medical and surgical specialty) at Minia and Assuit universities . All jury members (100%) agreed that current study too;s were valid and relevant with the aim of the study.

Tools reliability

Reliability was ascertained by using Alpha Cronbach's test. The results of the first tool(safe hydration knowledge) was (0.79), and the second tool (safe hydration practices) was (0.81) and the reliability of the third tool (patient outcome) was (0.83); the scale coefficient indicated that these measures were adequately reliable.

Pilot study

The pilot study to test feasibility and applicability of study tools, it was selected randomly on 10% among both the studied groups (patients & staff nurses). and was conducted in the medical, neurology and urology departments of the university hospital

The results of the pilot study have shown that the study tools were clear and understandable and this data was excluded from the current study .

Ethical Considerations

- A written official permission for conducting the study were obtained from the Ethics research Committee of the Faculty of Nursing, as well as from the Director of the Minia University Hospital at Governorate Minia.
- Oral consent from nurses and patients who agree to participate in the current study were taken after explaining the nature & objectives of the study by researcher to gain their cooperation.
- Patients' privacy were respected and collected data confidentiality was assured
- Patients' rights to withdrawal from the study at any time was assured without any penalty.

Four phases in the present study were conducted

Assessment phase

The researchers collect baseline data regard the studied groups from patients and staff nurses who met the study criteria were approached,

For nurses:

- Collection of the data through personal interviews, and nurses' agreement was taken after the explanation of the study objectives.
- Demographic data, safe hydration knowledge sheet (tool one) and practice questionnaire(tool two) were obtained as pretesting by researcher to assess needs, strength and weak points for nurses' knowledge and practices that need more emphasized in the study program.

For patients

- Collection of the data through personal interviews, and patients' agreement was taken after the explanation of the study objectives.
 - Demographic data was collected, safe hydration knowledge sheet (tool one) were obtained as pretesting by researcher to assess knowledge needs for patients who are cared by the trained nurses (study program). The time required to complete the questionnaire ranged from 10 to 15 minutes
1. Planning phase:
 - Goal priority and expected outcomes was formulated.
 - Methods and media were prepared.
 2. Implementation phase

For nurses

Educational study program were delivered in three sessions

- One session for teaching nurses a needed knowledge regard safe hydration include introduction, complications and nursing interventions regard fluid and electrolyte balance and imbalance.
- Two sessions for teaching safe nursing practices regard safe hydration, its title to I.V fluid administration & monitoring and fluid output monitoring & assessment measures I.V fluid imbalance .practical teaching sessions were conducted for 10 – 25 minutes.
- The three sessions was given for 6-8 nurses in every class who working in three study setting , held in a continuous education and training office at Minia university hospital which provided by teaching media as models, computer and data show machine , the session duration was taken within average 30 to 40 minutes .
- An educational booklet was translated into Arabic and was easily understood; it consisted of important issues and the main content of the educational program
- The duration for implementing the training of all participated nurses were 8 weeks from September 2017.
- The researcher was ensured that all topics is cleared that all nurses had satisfactory knowledge and competent level of practices at the end of every session and before post test (Immediately or after three months) .

For patients

- All patients who were coming to the study setting departments , and receiving intravenous fluid administration or who were

at risk for body fluid and electrolyte imbalance and who are cared by the trained nurses.

- All patients were received in one session individually a needed knowledge regard safe hydration was titled importance of fluid and electrolyte balance and complications regard fluid and electrolyte balance and imbalance.
- The session was conducted for 10 – 25 minutes.

Evaluation phase

For nurses :post-test was done for the assessment of knowledge and practices provided for nurses two times immediately at the end of each session and after three months by using tool one and tool two .Both post test lasted from September 2017 to February 2018 .

For patients: post-test for patients regard knowledge regard safe hydration (tool one) only immediately at the end of educational session while the tool three (patients' outcome) who cared by trained nurses who attend current study educational program ,it was collected for them daily /every shift until patient's discharge from their department.

Study duration

The study was lasted eight months from September 2017 to April 2018

Statistical analysis of data

An IBM compatible PC was used to store and analyze the data, as well as to generate important results in a graphical display. Calculations were made using a statistical software package called "SPSS" (version 22.0). Data were tabulated and statistically analyzed to evaluate the effect of the Educational Program on the hydration status assessment on patient outcomes and the performance of Nurses. Descriptive statistics (e.g., mean , standard deviation, frequency, and percentage) were used. Pearson's coefficient of correlation between critical parameters was added. When $p < 0.05$ was taken into account of important level value. The lower the P-value , the greater the outcome (*), less than 0.001 was deemed highly significant (* *). The P- value is the probability of error (Sedgwick, (2012).

Table (1): Percentage distribution of the nurses demographic data (n.=40).

demographic data	(N= 40)	%
Age		
• 20 to less 31years	4	10
• 31 to less 41years	18	45
• More than 41 years	18	45
Mean \pm SD = 2.35+0.662		
Sex		
• Male	22	55
• Female	18	45
Qualifications		
• Bachelor	10	25
• Technical nursing institute	7	17.5
• Secondary school nurse	23	57.5
Years of work experience		
• <5 years	17	42.5
• \geq 5years	23	57.5
Previous or current workshop attendance related to fluid balance		
• Yes	5	12.5
• No	35	87.5

Table (2): Percentage distribution of the studied group of patients as regards demographic and clinical setting data (n= 60).

Demographic data	(N = 60)	%
Age categories		
• 20 to less than 30yrs.	24	40
• 30 to 40 yrs	27	45
• ≥ 40 yrs	9	15
Mean ± SD	32.76 ± 5.027 years	
Gender		
• Male	24	40
• Female	36	60
Education Level		
• work	22	36.7
• Diploma secondary school	38	63.3
Patient's department		
• Medical	24	66.7
• Neurology	11	18.3
• Urology	25	45

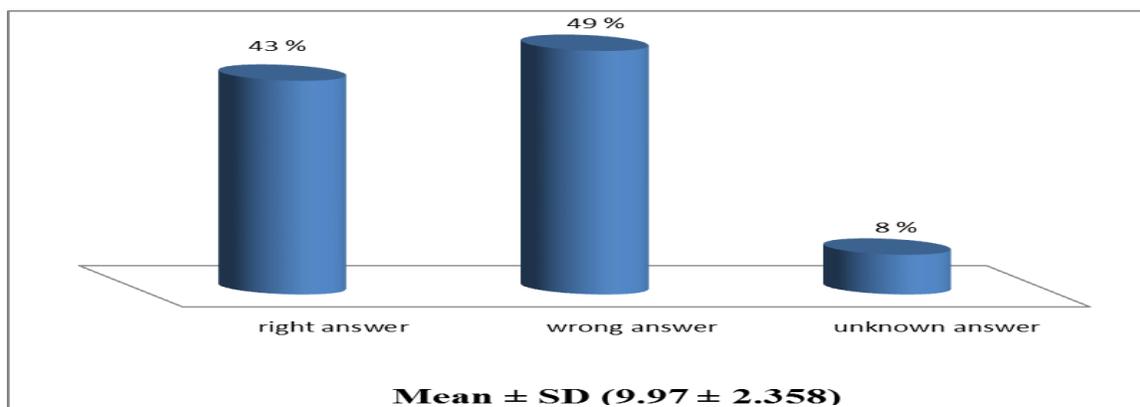


Figure (1): Percentage distribution of the nurses regarding knowledge of safe about fluid & electrolytes balance pre-educational program implementation (n= 40).

Table (3): Percentage distribution of nurses regarding knowledge about complications of fluid imbalance pre-program implementation (n= 40).

Specific complications of fluid imbalance	Right answer		Wrong answer		Unknown answer	
	(N)	%	(N)	%	(N)	%
Nurses' knowledge about dehydration:						
1. Definition of dehydration.	17	42.5	19	47.5	4	10
2. Causes of dehydration.	15	37.5	21	52.5	4	10
3. Precipitating factors of dehydration.	16	40	20	50	3	7.5
4. Effect of fluid loss on the body.	23	57.5	14	35	3	7.5
5. Clinical picture of dehydration.	13	32.5	25	62.5	2	5
6. Characters of urine during dehydration.	17	42.5	22	55	1	2.5
Nurses' knowledge about hypervolemia:						
7. Definition of hypervolemia.	14	35	22	55	4	10
8. Causes of hypervolemia.	14	35	21	52.5	5	12.5
9. Main signs of hypervolemia.	24	60	14	35	2	5
10. Complication of hypervolemia	16	40	19	47.5	5	12.5
Mean ± SD	10.70 ± 3.104					

Table (4): Total knowledge level of nurses regarding safe administration of fluid and electrolyte balance throughout the study period(pre, immediately, post three months of program implementation) (N=40).

Items	Pre program				Post program1 Immediately				Post program 2 After three months				X ²	P
	Satisfactory < 70		Un satisfactory >70		Satisfactory < 70		Un satisfactory >70		Satisfactory < 70		Un satisfactory >70			
	N	%	N	%	N	%	N	%	N	%	N	%		
Nurses knowledge	5	12.5	35	87.5	40	100	0	0	38	95	2	5	126.4	.001**
Mean \pm SD	7.40\pm2.35				17.80\pm1.42				16.27\pm1.53					

Table (5): Frequency distribution by percentage for participated group from patients' knowledge "importance of fluid and electrolytes balance and its imbalance complications" (N=60)

Variable	Post- program				Mean \pm SD
	Satisfactory < 70		Unsatisfactory \geq 70		
	N	%	N	%	
Patient's knowledge	51	85	9	15	1.77\pm0.422

Table (6): Percentages distribution as regard practice of safe fluid and electrolyte administration throughout the study period (pre, immediately, three months post program implementation) (n= 40).

Assessment of I.V fluid imbalance Items	Pre-program		Post-program				Test of significance	
			Immediately		After (3) months			
	Done accurate	Done accurate	Done accurate	Done accurate	F	P		
	No	%	No	%	No	%		
1. Check patient hemodynamic status periodically.	0	0	40	100	29	72.5	19.619	.001**
2. Observe patient's mouth and nose and behind the ears.	0	0	32	80	17	42.5		
3. Assess O2 saturation.	36	90	40	100	40	100		
4. Assess skin turgor for elasticity	0	0	32	80	25	62.5		
5. Assess capillary refill	6	15	40	100	36	90.0		
6. Check patient investigation lab tests	14	35	39	97.5	18	45		
7. Measure CVP with accurate manner periodically.	0	0	40	100	40	100		
8. Assess patient for any signs for fluid deficit.	24	60	36	90	38	95		
9. Check any signs for hypervolemia.	24	60	40	100	33	82.5		
10. Auscultate lung sounds.	0	0	28	40	13	32.5		
11. Observe presence of edema & determine its grades	0	0	23	57.5	26	65		

Table (7): Percentage distribution of nurses according to level of practices of fluid and electrolyte administration (pre, immediately, three months post program implementation) (n= 40).

Level	Pre - education		Post – education				X ²	P-value
			Immediately		After (3) months			
	No	%	No	%	No	%		
• Poor	32	80	0	0	0	0	152.370	.001**
• Fair	8	20	10	25	13	32.5		
• Good	0	0	30	75	27	67.5		

NS= not significant * $p = \leq 05$ (statistical significance) ** $p = \leq 01$ (highly statistical significance)

Table (8): Total mean score of clinical outcomes assessment of patients post nurses educational program implementation (patients n.= 60).

Items	Post educational Program	Complication Rank
	Mean ±SD	
• Hypervolemia	3.63±1.1639	2
• Hypovolemia	2.22±1.818	5
• Hyponatremia	2.63±1.1693	3
• Hyponatremia	1.25± 1.214	6
• Hyperkalemia	8.45±2.5866	1
• Hypokalemia	2.45±1.8961	4

Table (1): Shows that, less than half (45%) from participated group of nurses had aged 31 to more than 41 years old and the mean average of age was **2.35+0.662**; and (55%) from them were male. As regards to educational qualification level, the table represented that, highest percentage (57.5%) of same studied group was had nursing diploma degree and their experience more than five years; but (17.5%) among them were graduated from technical nursing institute. Lastly as related to previous or current attendance of study participants to fluid balance workshops, results found that most (87.5%) of them hadn't previously attended about it.

Table (2): Reveals that, the around one third (40%) of the studied group from patients aged were between 20 :>30 years old and their Mean average age ± SD was (32 .76 ± 5.027) years and the highest percentage among same group constituted (60%) was females, as regards their educational level, results found that two third (63.3) of them had graduated from diploma or secondary school. On the other hand, the highest percentage of study group of patients constituted (66.7%) were admitted in medical departments. Finally, as regards, previous teaching regarding regard body fluid balance, results founded that all group(100%) hasn't any teaching about it.

Figure (1): Illustrates that, the highest percentage of the first study group hav wrong answer while the lowest percentage of them have unknown answer regarding general knowledge about fluid & electrolytes balance constituted (49%, 8%)

respectively and their total mean average score ± SD (9.97 ± 2.358).

Table (3) as regards specific complications of fluid imbalance results revealed that, the highest percentage of the first study group constituted (57.5 %, 60 %) have right answer regarding effect of fluid loss on the body and main signs of hypervolemia respectively, while the highest percentage of the study group constituted (62.5%) had wrong answer regarding clinical picture of dehydration .The total mean average score for first study group's knowledge about specific complications of fluid imbalance pre-educational protocol was (10.70 SD ± 3.104).

Table (4): Shows that, there was highly statistical significant difference between participated groups from nurses 'knowledge regard safe hydration status management.

P =.001*

Table (5): Depicated that, highest percentage (85 %) among participated group of patients had satisfactory level of knowledge about importance of fluid and electrolytes balance and its imbalance complications while the rest of same group had unsatisfactory level of knowledge with mean average is **1.77+0.422**.

Table (6): The findings, stated that, assessment of I.V fluid imbalance practice performed by studied group from nurses ,there were highly statistically significant differences between pre & post educational program (one month, three months).

Table (7): Reveals that the majority of studied group from nurses have poor performance level pre-

educational program constituted (80 %) while they were had good performance level constituted (75% & 67.5) after one and three months respectively post educational program. lastly, There are highly statistically significant differences among same group in their practices levels between pre and post-educational program with p-value (0.000)

Table (8): As regards the total mean score of clinical outcomes assessment of patient's post nurses educational program implementation, results revealed that the highest mean score among complications of fluid and electrolyte imbalance were founded among hypovolemia and hyperkalemia complications and was ranked as number (1) & (2) constituted 3.63 ± 1.1639 & 8.45 ± 2.5866 respectively.

Discussion

Fluid Balance is defined as the balance between intake and output of fluid to permit metabolic processes to function correctly. In healthy persons, the amount of intake should be similar to the amount of output. The maintenance of homeostasis in fluids is a dynamic and balanced process (Morton et al., 2013). In order to preserve homeostasis and promote health, the body uses a variety of adaptive responses to keep the composition and volume of body fluids and electrolytes within the limits of normal (Brown et al., 2017).

The present study showed that less than half from participated group of nurses had age group 31yrs. to more than 41 years old and the mean average of age was (2.35+0.662) this findings not consistent with (Vijayan, 2011) who reported that the majority of study sample' age of nurses (70%) belonged to the age group 23-35years.

Also (Abdelalem & Fouad, 2018), found that more than half of the studied sample of nurses between the ages of 25 and 35 years (67.1%) and only (6.3%) of the sample was more than 35 years old.

The discussion will be illustrated in two parts ,first part related to knowledge and safe practices of nurses and second part related to patient's outcomes

The current study results found that, there were highly statistical significant difference between participated group from nurses' knowledge regarding hydration status management, this findings were related to the current study program consider as the first training program regarding patient's hydration management and there are lacking in study setting regard continuous updating knowledge or in-service development programs for their professional nurses.

These findings were agreed with (Scales et al., 2008) who stated that nurses' knowledge regarding fluid balance should be improved because nurses are the

primary persons responsible for the monitoring of the fluid balance. On the other hand, the findings of the present study were contradicted with (Diacon et al., 2014) who found that (90%) of the study sample answered correctly to multiple choice questions that are related to knowledge about fluid balance monitoring. These findings were similar to (Asfour, 2016) who found that two - third of participants had a right answer regarding knowledge about specific complication as hypovolemia/ hypervolemia, also (Vincent et al., 2015) concluded that 67% of the participant, said that more education on fluid balance and imbalance would be helpful because they had a lack of knowledge regarding fluid imbalance.

Current study results disagreed with (Abdelalem & Fouad, 2018) who were studied the effect of an instruction intervention about body fluid balance assessment on knowledge and practice among nurses; who mentioned that (20.3%) of the participants had correct answer regarding specific complication (hypovolemia) and (10.1%) of the study sample had correct answer regarding (hypervolemia) In addition, (Scales et al., 2008) they stated that nurses' knowledge regarding fluid balance should be improved because nurses are the primary persons responsible for monitoring of the fluid balance. On the other hand, these findings disagreed with (Abd El-Salam & Mahmoud, 2018) who stated that, the highest percentage of study sample had incorrect answer regarding nursing intervention related to specific fluid imbalance.

Also highest percentage among participated group of patients had satisfactory level of knowledge about importance of fluid and electrolytes balance and its imbalance complications. This may be related to researchers teaching by different media and using and providing in a simple written language (brochure) for them and their care provider.

The findings, stated that, assessment of I.V fluid imbalance practice performed by studied group from nurses, there were highly statistically significant differences between pre & post educational program (one month, three months). Measuring fluids intake and out put in critically ill patients is an important nursing procedure, so that the patient is not exposed to risks due to an imbalance of body fluids and electrolytes. So, this program has proven effective in improving nurses' knowledge and skills regarding this issue. Our results are the same as founded by (Abd El-Salam & Mahmoud, 2018) who concluded that, there were high statistically significant differences between pre and post program implementation in relation to total mean score of nurses' practices regarding to measuring fluid input for critically ill patients for all items of fluid input ($P < 0.001$). These results were also validated by (Eldsouky et al., 2016)

who concluded that the minority of the participants from nurses doing an admission measures as check vital signs. Also (Johnson, 2016) concluded that there was a discrepancy between fluids administered and fluids documented in the patient chart. On the other hand, these results were not consistent with the study conducted by (Vincent et al., 2015) who conducted a fluid balance monitoring audit in 117 patients and showed that less than half of the fluid balance charts had been completed due to incomplete documentation of fluid intake. In addition, (Malekzadeh, et al., 2013) conducted a study to evaluate nurses' knowledge and practice of fluid therapy. Researchers found that 37 per cent of nurses had safe fluid therapy practices, 42 per cent had moderately safe practices, and 21 per cent of nurses were considered unsafe.

The majority of studied group from nurses had poor performance level pre-educational program constituted (80 %) while they have good performance level constituted (75% & 67.5) after one and three months respectively. This results in the same line with (Kol et al., 2017) who concluded that continuous in-service nursing training is considered to be a very important issue that allows the qualified nurse to be trained by a nursing science that enhances nursing practice.

As regards the total mean average scores of fluid imbalance complications or (patient's outcomes) among studied group results revealed that the highest mean average among both complications were occurred with rank number (1) & (2) were founded among hypervolemia and hyperkalemia complications, this related there are still percentage numbers from participated group of nurses still were had a fair level in their practices regarding hydration management and need a more training and continuous education. These results were validated by (Asfour, 2016) who stated that (66.67%) of study sample had correct answer regarding Nurses' action for patients who had hypovolemia/ hypervolemia. Moreover these results were also validated by (Kanakalakshmi, 2014) who conducted a retrospective longitudinal study to determine awareness of intravenous fluid administration among adult patients in the health care settings. His study results indicate that 30 percent have adequate knowledge of intravenous fluid administration and 40 percent have moderate knowledge and 28.5 percent have strong knowledge of intravenous fluid administration. Accordingly, the researcher concluded that the level of knowledge will improve according to the level of practice.

Conclusion

It can be concluded that implementation of training program about safe practice of fluid and electrolyte

administrations illustrate a positive effect for both nurses and patients.

Recommendations

- A training program should be carried out for nurses related to safe practice of fluid and electrolyte administration.
- Replication of the study should be implemented using a large probability sample.

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