Knowledge and Practice regarding Fluid and Electrolytes Administration among Nurses Working in a Teaching Hospital, Chitwan

Chanak Trikhatri[1], Gayatri Rana[2], Siddheshwar S. Angadi [3]

[1] Master of Nursing (Adult) College of Nursing, Chitwan Medical College, Bharatpur, Nepal
[2]Master of Public Health (Reproductive Health), Associate Professor & HoD, Department of Community Health Nursing, School of Nursing, Chitwan Medical College, Bharatpur, Nepal
[3]MSc. in Nursing, Associate Professor, School of Nursing, Chitwan Medical College, Bharatpur, Nepal
Corresponding Author: Ms. Gayatri Rana,

Abstract: *Fluid and Electrolytes administration is one of the most common procedures performed most frequently done in critical care units and in inpatient wards. The objective was to find out knowledge and practice regarding fluid and electrolytes administration among nurses.*

Descriptive, cross sectional research design was adopted and a total 110 nurses were selected by simple random sampling (lottery method) technique in critical and general ward of the Chitwan Medical College Teaching Hospital from 14 November to 11 December, 2016. Self-administered structured questionnaire & observational checklist was used to collect data. Descriptive (mean, standard deviation & range), inferential statistics (Chi-square) and Spearman correlation were used to analyze data.

Only 10% nurses received in service education on fluid and electrolytes administration. Nurses (85.5%) got positive reinforcement by supervisor, 96.4% nurses collaborated with their co-workers, 72.7% nurses answered there is protocol regarding fluid and electrolyte administration available in ward, 39.1% nurses had adequate level of knowledge which was statistically significant with professional qualification (p=0.007). Safe level of practice was among 33.6% of nurses which was statistically significant with working unit (p=0.001). There was weak positive correlation between knowledge score and practice score.

One third of the nurses had adequate level of knowledge and one third of the nurses had safe practice on fluid and electrolytes administration, thus continue nursing education to update knowledge of nurses', assignment of patient to nurse according standard guideline and supply of all necessary equipments are required.

Key words: *Fluid and electrolyte administration, Knowledge, Practice*

I. Introduction

Fluid and electrolytes balance is crucial for physiology of human body and its normal functioning and metabolism. About 60% (60-67%) of the total body weight is made up of water.[1] Electrolytes are such as sodium, potassium, chlorine, calcium, magnesium and phosphorus. The body's homeostatic control mechanisms ensure that a balance between fluid gain and fluid loss is maintained. The hormones Anti diuretic hormone (vasopressin) and aldosterone play a major role.[2] The body electrolytes- sodium, potassium, chloride, and bicarbonate- help regulate nerve and muscle function and maintain acid-base balance and water balance.[3] The levels of electrolytes in body can become too low or too high. This can happen when the amount of water in body changes.[4]

There are different factors (Illness, trauma, surgery, age, gender, environmental temperature and medication, etc.), which affect the fluid and electrolytes balance and the mechanism of the body. Vital organ for the fluid and electrolytes balance are kidney and cardiovascular system.[5] Patient who are confused, cannot communicate, postoperative patient, patient in coma are at high risk of imbalance fluid and electrolytes. Patient having diarrhea, vomiting, nasogastric suction, burn or trauma can cause fluid and electrolytes deprivation. Some medication such as diuretic, corticosteroids can lead to the disharmony of the fluid and electrolytes.[6]

Basically there are two types of fluid imbalances i.e. isotonic and osmolar. Hence there are four categories of fluid imbalances may occur in body (a) an isotonic loss of water and electrolytes, (b) an isotonic gain of water and electrolytes, (c) a hyperosmolar loss of only water, and (d) a hypo-osmolar gain of only water. These are referred to, respectively, as fluid volume deficit, fluid volume excess, dehydration (hyperosmolar imbalance), and over hydration (hypo-osmolar imbalance).[7]

Excessive fluid generates oedema and is associated with organ dysfunction and even death. Strict and

---

authoritarian monitoring of fluid balance of overall intake and output is vital to tailor fluid administration. Evident losses via urine, drains, stoma or nasogastric aspirates and oral feeding, nasogastric feeding, or parenteral through intravenous (IV) infusion should be documented and insensible losses through respiratory tract and skin must be estimated to correlate with the normal physiological requirement of the patient. The compulsion to interpret all the evidence and observation according to the patient diagnosis as edematous patient may have a positive fluid balance but can be decrease intravascular fluid, which lead to the inadequate oxygenation and tissue perfusion.[8]

Nurses working in health care setting and community frequently encounter in situation where patient has a need to receive fluid and electrolytes additionally. People's life and environment around them regarding health and wellness become very competitive hence people need best quality of care and treatment from health care. To overcome with dehydration, adequate balance of the circulatory fluid volume, prevent inadequate tissue perfusion, even to administer the medication and anesthesia the administration of the IV fluid is high in practice. The registered nurse who practices intravenous therapy must possess a thorough and up-to-date working knowledge and sound practice of the fluid and electrolytes administered. This is very crucial to maintain safe nursing practice as well as for the excellent quality patient care. Nowadays different types of fluid and electrolytes are available in the market hence it is very important for the nurses to be entirely familiar with each product.[9]

II. Material and Methods

Descriptive, cross sectional research design was conducted to find out knowledge and practice regarding fluid and Electrolytes administration among nurses in Chitwan Medical College Teaching Hospital, Bharatpur Metropolitan-10, Chitwan. Probability, Simple random sampling technique -lottery method was used to select 110 nurses from 11 wards {critical care units (CCU, MICUi, MICUii, SICU, NICU and PICU) and general wards (Nephro ward, Neurosurgery ward, surgery ward, Postoperative ward, and Emergency)} who have acquired one of the professional qualification (Proficiency Certificate Level nursing/Bachelor in Nursing/Bachelor of Science in Nursing) and are having experience in clinical field working in selected wards of the Chitwan Medical College Teaching Hospital at least for 3 months.

Then Cochran formula was used to calculate sample size.

$n_0 = Z_\alpha^2 pq/ d^2$ (Cochran, 1977)

Where,

Z_α is the tabulated value of z-score at $_\alpha$ level of significance, at 95%, its value is 1.96

p is prevalence of knowledge of previous study i.e. 0.15 (Kanakalakshmi, 2014).

q = 1- p hence **q** =1- 0.15 = 0.85

d is the degree precision set at ±4% or 0.04

$n_0 = 306.1275$

Adjusting the above sample size for a finite population

$$n = \frac{n_0}{1+\dfrac{n_0 - 1}{N}} \text{ (Daniel, 2006)}$$

Where, N is population size for the study. In this study population size is CCU, MICUi, MICUii, SICU, NICU and PICU) and general ward (Nephro ward, Neurosurgery ward, surgery ward, Postoperative ward, and Emergency) working in Chitwan Medical College Teaching Hospital. So, N=149

From the calculation sample size was 100. To reduce the non-response error, 10% sample was added on it.

Hence, the required sample size for this study was 110.

Nurses who have experience less than 3 months and who have resigned 1 month ago were excluded by confirming with ward in charge. Data was collected from 14 November to 11 December, 2016.

Kuder Richardson formula 20 (KR-20) reliability test was calculated in knowledge and practice instrument. KR-20 value for knowledge instrument was 0.719 and for practice instrument was 0.728. Structured knowledge questionnaire & observational checklist were developed to collect data. Ethical approval from Institutional Review Committee, Chitwan Medical College Bharatpur, Chitwan was taken for the study. Written consent was obtained from each respondent prior to knowledge questionnaire. In a day, approximately 8-10 respondents filled questionnaire and it took about 25-30 minutes for each respondent. Observation was done after knowledge questionnaire. Answer sheet and checklist was coded in R1 to R110 of 110 nurses. It took several hours in some case several shifts to observe the procedure of the fluid and electrolytes administration in same nurses. For observation, researcher had gone to the duty according to the shift and participates in normal work. Confidentiality was assured and maintained. Data was entered into Epidata version 3.1, and exported to statistical package for social science (SPSS) version 20 and analyzed and interpreted in terms of descriptive (mean, standard deviation & range), inferential statistics (Chi-square) and Spearman correlation.

III. Results

Out of 110 nurses, 57% were in age group 21-25 years, 85.5% answered effective method to supply fluid and electrolytes is intravenous (IV), (56.4%) drop calculation is 40 gtt/min, (20.9%) complication may arise in a patient receiving continuous IV fluid developed dyspnea, cyanosis is air embolism, (52.7%) action if IV tubing and spike fall into medication cart is obtain new IV tubing, (19.1%) action if patient develop the reddened, warm, painful is document the condition, (37.3%) important action prior to administration of fluid and electrolytes is evaluate the lab. reports.

The findings of the study are presented in following tables. Mean score of knowledge of nurses regarding fluid and electrolytes administration (Table 1), Nurses' level of knowledge regarding fluid and electrolytes administration (Table 2), Association between nurses' level of knowledge regarding fluid and electrolytes with characteristics of nurses (Table 3), Association between nurses' level of knowledge regarding fluid and electrolytes with health care environment related characteristics (Table 4), Mean score of practice of nurses regarding fluid and electrolytes administration (Table 5), Nurses' level of practice regarding fluid and electrolytes administration (Table 6), Association between nurses' level of practice regarding fluid and electrolytes with characteristics of nurses (Table 7), Association between nurses' level of practice regarding fluid and electrolytes with health care environment related characteristics (Table 8), and Correlation between knowledge score and practice score of fluid and electrolytes administration (Table 9).

Table 1: Mean Score of Knowledge of Nurses regarding Fluid and Electrolytes Administration

n=110

Subscale of Knowledge	Maximum Possible Score	Mean±SD	Mean Percentage	Range
Knowledge				
Knowledge regarding concepts of composition of human body	9	4.74 ± 1.51	52.7	1-8
Concept of fluid	10	3.94 ± 1.83	39.4	0-9
Concept of electrolytes	15	6.62 ± 2.31	44.1	1-11
Concept of fluid and electrolytes administration	6	2.72 ± 1.04	45.3	0-5
Total	**40**	$\mathbf{18.01 \pm 4.42}$	**45.0**	**9-30**

Table 2: Nurses' Level of Knowledge regarding Fluid and Electrolytes Administration

Level of Knowledge	Frequency	Percentage
Adequate (20-30 score)	43	39.1
Moderately adequate (16-19 score)	30	27.3
Inadequate (9-15 score)	37	33.6
Total	**110**	**100.0**

According to the statistical Tertile partition

Table 3: Association between Nurses' Level of Knowledge regarding Fluid and Electrolytes with Characteristics of Nurses

n=110

Variables	Level of Knowledge			χ^2	p-value
	Inadequate n (%)	Moderately Adequate n (%)	Adequate n (%)		
Age group (years)					
≤21	24 (37.5)	19 (29.7)	21 (32.8)	2.550	0.279
>21	13 (28.3)	11 (23.9)	22 (47.8)		
Professional qualification					
PCL nursing	34 (37.8)	27 (30.0)	29 (32.2)	9.848	**0.007**
BN and BSc. N	3 (15.0)	3 (15.0)	14 (70.0)		
Professional experience (months)					
≤15	28 (35.4)	22 (27.8)	29 (36.7)	0.713	0.700
>15	9 (29.0)	8 (25.8)	14 (45.2)		
Working unit					
Critical units	19 (28.8)	17 (25.8)	30 (45.5)	3.001	0.223
General wards	18 (40.9)	13 (29.5)	13 (29.5)		
Experience in present unit (months)					
≤10	27 (35.5)	22 (29.0)	27 (35.5)	1.313	0.519
>10	10 (29.4)	8 (23.5)	16 (47.1)		
Designation					
Staff nurse	34 (36.2)	27 (28.7)	33 (35.1)	4.273	0.118*
Senior staff nurse	3 (18.8)	3 (18.8)	10 (62.5)		
Received in-service education on fluid and electrolytes					

administration					
Yes	3 (27.3)	4 (36.4)	4 (36.4)	1.434	0.222*
No	34 (34.3)	26 (26.3)	39 (39.4)		
Perceived level of performance by nurses					
Advance beginner	8 (29.6)	11 (40.7)	8 (29.6)		
Competent	10 (26.3)	9 (23.7)	19 (50.0)	6.529	0.367*
Proficient	14 (43.8)	6 (18.8)	12 (37.5)		
Expert	5 (38.5)	4 (30.8)	4 (30.8)		
Self-directed learning					
Sometimes	30 (34.5)	22 (24.3)	35 (40.2)	0.828	0.661
Frequently	7 (30.4)	8 (34.8)	8 (34.8)		

Significance level at 0.05   *Likelihood ratio*

Table 4: Association between Nurses' Level of Knowledge regarding Fluid and Electrolytes with Health Care Environment related Characteristics

n=110

Variables	Level of Knowledge			χ^2	p-value
	Inadequate n (%)	Moderately Adequate n (%)	Adequate n (%)		
Availability of needful resources					
Adequate	25 (38.5)	18 (27.7)	22 (33.8)	2.228	0.328
Inadequate	12 (26.7)	12 (26.7)	21 (46.7)		
Positive reinforcement by supervisor					
Yes	29 (30.9)	27 (28.7)	38 (40.4)	2.192	0.334*
No	8 (50.0)	3 (18.8)	5 (31.3)		
Collaboration with co-workers					
Yes	35 (33.0)	29 (27.4)	42 (39.6)	1.324	0.129*
No	2 (50.0)	1 (25.0)	1 (25.0)		
Availability of protocol of fluid and electrolytes administration					
Yes	23 (28.8)	24 (30.0)	33 (41.3)	3.232	0.199
No	14 (46.7)	6 (20.0)	10 (33.3)		
Nurse patient ratio					
Appropriate	18 (41.9)	13 (30.2)	12 (27.9)	3.905	0.142
Inappropriate	19 (28.4)	17 (25.4)	31 (46.3)		

Significance level at 0.05   *Likelihood ratio*

Table 5: Mean Score of Practice of Nurses regarding Fluid and Electrolytes Administration

n=110

Subscale of Practice	Maximum Possible Score	Mean±SD	Mean Percentage	Range
Pre administration	8	4.21± 0.68	52.6	2.5-5.7
During administration	16	11.26± 1.80	70.4	8-16
Post administration	9	6.03± 0.96	67	4-8
Total	**33**	**21.50±2.27**	**65.2**	**16.74-27**

Table 6: Nurses' Level of Practice regarding Fluid and Electrolytes Administration

Level of Practice	Frequency	Percentage
Safe practice ($\geq$ 22 score)	37	33.6
Moderately safe practice ($\geq$11 to <22 score)	73	66.4
Unsafe practice (<11 score)	0	0.0
Total	**110**	**100.0**

Table 7: Association between Nurses' Level of Practice regarding Fluid and Electrolytes with Characteristics of Nurses

n=110

Variables	Practice Level		χ^2	p-value
	Moderately Safe Practice n(%)	Safe Practice n(%)		
Age group (years)				
$\leq$21	41 (64.1)	23 (35.9)	0.363	0.547
>21	32 (69.6)	14 (30.4)		
Academic qualification				
PCL Nursing	57 (63.3)	33 (36.7)	2.036	0.154
BN and BSc. N	16 (80.0)	4 (20.0)		
Professional experience (months)				
$\leq$15	49 (62.0)	30 (38.0)	2.364	0.124

	Moderately Practice n(%)	Safe Practice n(%)	χ²	p-value
>15	24 (77.4)	7 (22.6)		
Working unit				
Critical care unit	35 (53.0)	31(47.0)	13.141	**<0.001**
General ward	38 (86.4)	6 (13.6)		
Experience in present unit (months)				
≤10	50 (65.8)	26 (34.2)	0.036	0.849
>10	23 (67.6)	11 (32.4)		
Designation				
Staff nurse	61 (64.9)	33 (35.1)	0.626	0.429
Senior staff nurse	12 (75.0)	4 (25.0)		
Received in-service education on fluid and electrolytes administration				
Yes	8 (72.7)	3 (27.3)	0.018	0.893**
No	65 (65.7)	34 (34.3)		
Perceived level of performance by nurses				
Advance beginner	17 (63.0)	10 (37.0)		
Competent	28 (73.7)	10 (26.3)	1.817	0.611*
Proficient	19 (59.4)	13 (40.6)		
Expert	9 (69.2)	4 (30.8)		
Self-directed learning				
Sometimes	58 (66.7)	29 (33.3)	0.017	0.896
Frequently	15 (65.2)	8 (34.8)		

Significance level at 0.05   **Likelihood*   ***Yate's Corrections*

Table 8: Association between Nurses' Level of Practice regarding Fluid and Electrolytes with Health Care Environment related Characteristics

n=110

Variables	Practice Level		χ²	p-value
	Moderately Practice n(%)	Safe Practice n(%)		
Availability of needful resources				
Adequate	43 (66.2)	22 (33.8)	0.003	0.955
Inadequate	30 (66.7)	15 (33.3)		
Positive reinforcement by supervisor				
Yes	64 (68.1)	30 (31.9)	0.858	0.354
No	9 (56.2)	7 (43.8)		
Collaboration with co-workers				
Yes	71 (67.0)	35 (33.0)		0.601*
No	2 (50.0)	2 (50.0)		
Availability of protocol of fluid and electrolytes administration				
Yes	54 (67.5)	26 (32.5)	0.170	0.680
No	19 (63.3)	11 (36.7)		
Nurse patient ratio				
Appropriate	28 (65.1)	15 (34.9)	0.049	0.824
Inappropriate	45 (67.2)	22 (32.8)		

Significance level at 0.05   **Fisher exact test*

Table 9: Correlations between Knowledge Score and Practice Score of Fluid and Electrolytes Administration

Variables	Spearman Correlation (ρ)	p- value
Knowledge and Practice score	0.132	0.170

Significance level at 0.05

IV. Discussion

Regarding characteristics of nurse, the findings of the present study indicated that among 110 nurses (51.8%) of the nurses belongs to age group of 21-25 years. This result was more than the findings of the study done by Mohammed and Taha (2014) revealed that 26.6% of nurses were between age group of 20 -25 years.[10] Due to high turnover rate of nurses, hospital has to recruit newly graduates with less professional experience hence most of the nurses belong to age group of 21 - 25.

In concern of availability of protocol of fluid and electrolytes administration (41.3%) nurses knew that protocol regarding fluid and electrolytes is available in ward had adequate knowledge. However, it seems that nurses didn't follow the protocol as knowledge and practice score are not good enough. The study done by Mohammed, Elshamy and Mohammed (2015) who revealed that the total mean knowledge and performance score of nurses was increased immediately after implementation of the protocol with statistically significant difference and after one month slightly decreased.[11] Hence the findings both study point out the need of nurses to adhere the protocol regarding fluid and electrolytes administration.

Findings of this study showed that more than one third (39.1%) nurses from the selected wards had an adequate knowledge score regarding fluid and electrolytes administration while 27.3% of nurses possess the moderately adequate knowledge and 33.6% of nurses had inadequate knowledge; which was less than the study done by Mohammed and Taha (2014) which indicated 47.50% of nurses had satisfactory knowledge.[10] Findings of another study done by Mogileeswari, and Ruth (2016) who revealed 15.0% of nurses had adequate knowledge, which opposed present study.[12]

In context of mean score, the findings of the present study revealed mean score of knowledge (45%). Similarly study done by Mogileeswari, and Ruth (2016) who unveiled mean score of knowledge (44.4%).[12] However present study is inconsistent with the study done by Taha, and Mohammed (2014) who revealed higher mean score of knowledge (71.1%) than the present study.[10]

There was highly statistical significant between level of knowledge and level of education (χ^2=9.848, p=0.007), knowledge levels of nurses in this study were influenced by academic qualification of the nurses as 70% nurses who have bachelor level education possess the adequate knowledge. This finding was correspond with study done by Mohammed and Taha (2014) who reported that bachelor degree nurses scores were significantly better than diploma nurses possibly because of the basic knowledge received during academic years, which is different than that received by diploma nurses.[10] In addition, statistical significance association was demonstrated by the study done by Mogileeswari, and Ruth (2016) between level of knowledge of nurses regarding fluid and electrolytes administration for patient with burns with education,[12] which is why finding perceptibly compatible the present study.

In relation to practice, 33.6% of nurses had safe practice followed by (66.4%) nurses had moderately safe practice and none of the nurses had unsafe practice regarding fluid and electrolytes administration. The finding of study was inconsistent with Mogileeswari, and Ruth (2016) revealed the 37% of nurses had safe practice followed by (42%) nurses had moderately safe practice and (21%) nurses had unsafe practice.[12]

In recent study, mean score of practice was 65.2% which was coherent with the study done by Mogileeswari, and Ruth (2016) who unveiled mean score of knowledge (64.2%).[12] However present study was inconsistent with the study done by Mohammed and Taha (2014) showed higher mean score of practice (74.69%) than the present study.[10]

Findings of the present study unveiled that level of practice of nurses were significantly associated with present working area and didn't show any statistical significant association with age, education, experience, other characteristics of nurses and health care environment related characteristics. In contrast, Mogileeswari, and Ruth (2016) there is a significant association between level of practice of nurses regarding fluid and electrolytes administration for patient with burns with year of experience and designation.[12] This finding is inconsistent with the study done by Kanakalakshmi, (2014) which reveals that the association between practice and age, religion, year of experience and designation is significant along with working area.[13]

This study revealed that most of nurses (99.1%) keep the record according to protocol which was inconsistent to the study done by Arslan, and Karadag (2008) which finds that record keeping behavior of nurses regarding intravenous fluid treatment is not at the desired level.[14] Nurses' strong adherence to the practice of record keeping behavior according to the protocol is due the fact that nurses are very much aware of ethical and legal issue that they might have to suffer if they did not adhere to the protocol.

Though present study didn't show significant association between level of knowledge and practice with in–service education however (90.0%) nurses didn't receive in–service education regarding fluid and electrolytes administration. It is seen that periodic check or review of knowledge and practice regarding fluid and electrolytes administration among nurses is necessary. On the basis of the periodical evaluation nurse managers and organization can determine education program, in lacking part of the fluid and electrolytes administration procedure (preparation, administration or monitoring) the nurse should receive education or training courses. This study adheres with the study conducted by the Jensen (2009) who stated that increased competence, confidence and higher level of comfort and knowledge regarding intravenous therapy content was perceived by students who participated in the workshop than those who did not participated in the course or had no elective intravenous therapy education.[15] This study was evidently supported by another study Ameri et al. (2016) who unfold improved mean scores of knowledge and practice 17.56 (1.59) from 11.93 (1.91) and 40.15 (3.02) from 38.84 (2.96) respectively after parenteral nutrition (PN) training program.[16] Therefore, the findings of this study are a good basis to formulate the educational activities, as there is need of educational program regarding fluid and electrolytes administration. Improving knowledge and monitoring nurse's practices could significantly reduce the complication that may develop from the fluid and electrolytes administration.

Up to date information and in service training can improve the nurses practice and knowledge the statement is supported by the study done by the Bedier, EL-Ata, and Shehab (2016) which illustrate that implementation of the educational program total mean practice score were improved 87.09 (14.55) after 3 months and 77.71 (11.54) after 6 months later from pre-program 18 (3.30) regarding caring of patients undergoing nasogastric tube feeding.[17] In addition to being valuable for further research, the results of this study

can become the basis for improving the concept of nursing care quality and patient safety.

Findings of the present study reported that there is a weak positive correlation (ρ= 0.132, p=0.170) between nurses' knowledge and practice though it is not statistically significant. The reason behind the findings study is due to the fact about fluid and electrolytes practice, which can be performed without understanding the basic knowledge, by repeated action and observing the same procedure over and over again. The finding of the study was contradicted with Mogileeswari and Ruth (2016) who stated that a highly statistical significant correlation (ρ= 0.47) between nurses' knowledge and practice score.[12] The correlation between nurse's knowledge and practice score in the study however, point out truth that the effective establishment of fluid and electrolytes administration is often hindered by lack of basic knowledge regarding fluid and electrolytes is essential for nursing practice. The present study is also supported by the study done by Mohammed and Taha (2014) depicted the statistical significant correlation between knowledge and practice score.[10]

V. Conclusion

Knowledge related to fluid and electrolytes administration was adequate and moderately adequate among the nurses however it did not reciprocate into appropriate practice in the setting of delivering direct patient care. The influencing factor for level of practice of nurse fluid and electrolytes administration was working unit however the level of knowledge of nurses related to fluid and electrolytes administration was affected by level of education. This study suggests that length of nurse's professional experience has no influence on the level of knowledge and practice achieved by these nurses. In addition, level of knowledge and practice of nurses was not correlated as the nurses who have inadequate knowledge might not necessarily safe practice or might have safe practice. Hence, by determining the level of knowledge we cannot draw the conclusion about the level of practice level.

Hence to clinch adequate knowledge and safe practice continuation of higher education must give more priority by the nurses. Nurses who directly involve in patient care must be rotated in different ward routinely to improve knowledge and practice. By acquiring higher education and exchanging the ward adequate knowledge and safe practice may or may not be ensured hence in service education must provide routinely to the nurses who are directly involve in patient care.

References

[1]. Wikipedia the free encyclopedia. Body fluid. 2019. Available from: https://en.wikipedia.org/wiki/Body_fluid
[2]. Lumen. Water balance. NA. Available from: https://courses.lumenlearning.com/boundless-ap/chapter/water-balance/
[3]. Merck Sharp, Dohme Corp. Overview of electrolytes. 2019. Available from: https://www.msdmanuals.com/home/hormonal-and-metabolic-disorders/electrolyte-balance/overview-of-electrolytes
[4]. U.S. National library of medicine. Fluid and electrolyte balance. 2019. Available from: https://medlineplus.gov/fluidandelectrolytebalance.html
[5]. Berman A, Snyder S. Kozier & ERB's fundamental nursing concepts, process, and practice. New Jersey: Pearson Education, Inc. 2012. 1450-1481 p.
[6]. Dudrick SJ. History of parenteral nutrition. Journal of the American College of Nutrition [Internet]. 2009 Jun;28(3):243-251. Available from: https://www.ncbi.nlm.nih.gov/pubmed/20150597
[7]. Waugh A, Grant A. Ross & Wilson anatomy and physiology in health and illness. Glasgow, UK: Churchill Livingstone. 2010
[8]. Floss, K, Borthwick, M. Clark C. Intravenous fluid therapy-background and principles. Pharmaceutical Journal [Internet]. 2008 Sep. Available from: https://www.pharmaceutical-journal.com/learning/learning-article/intravenous-fluid-therapy-background-and-principles/10032372.article?firstPass=false
[9]. Grocott MP, Mythen MG, Gan TJ. Perioperative fluid management and clinical outcomes in adults. Anesthesia & Analgesia [Internet]. 2005 Apr;100(4):1093-1106. Available from: https://www.ncbi.nlm.nih.gov/pubmed/15781528 DOI: 10.1213/01.ANE.0000148691.33690.AC.
[10]. Blackburn GL, Wollner S, Bistrian BR. Nutrition support in the intensive care unit: an evolving science. Archives of Surgery [Internet]. 2010 Jun;145(6):533-538. Available from: https://www.ncbi.nlm.nih.gov/pubmed/20566972 DOI: 10.1001/archsurg.2010.97.
[11]. Mohammed EK, Taha AS. Critical care nurses' knowledge and practice regarding administration of total parenteral nutrition at critical care areas in Egypt. Journal of biology, agriculture and healthcare [Internet]. 2014;4(13):10-22. Available from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.849.527&rep=rep1&type=pdf
[12]. Mohammed MA, Elshamy KF, Mohammed HAB. Effect of implementing intravenous infusion therapy protocol on nurses' knowledge and performance at specialized medical hospital. Journal of American Science [Internet]. 2015;11(11):144-153. Available from: http://www.jofamericanscience.org/journals/am-sci/am111115/015_29567am111115_144_153.pdf DOI: 10.7537/marsjas11111.15.
[13]. Mogileeswari P, Ruth GM. Knowledge and practice regarding fluid and Electrolytes replacement therapy for patient with burns. International Journal of Multidisciplinary Research and Development [Internet]. 2016;3(4):217-220. Available from: www.allsubjectjournal.com › download › 3-4-97-381
[14]. Kanakalakshmi R. Knowledge and practice regarding fluid and Electrolytes replacement therapy for patient with burns among working nurses. Narayana Nursing Journal [Internet]. 2014;3(4):34-36. Available from: https://www.bibliomed.org/?mno=220203
[15]. Arslan S, Karadag A. The determination of record-keeping behavior of nurses regarding intravenous fluid treatment: The case of turkey. Journal of Infusion Nursing [Internet]. 2008;31(5):287-294. available from: https://www.ncbi.nlm.nih.gov/pubmed/18806639 DOI: 10.1097/01.NAN.0000336183.85280.b7.
[16]. Jensen R. Teaching students about intravenous therapy: Increased competence and confidence. Journal of the Association for Vascular Access [Internet]. 2009; 14(1):21-26. Available from: https://www.ivteam.com/intravenous-literature/intravenous-iv-therapy-comptencies/

[17]. Ameri ZD, Vafaee A, Sadeghi T, Mirlashari Z, Ghoddooshi-Nejad D, Kalhor, F. Effect of a comprehensive total parenteral nutrition training program on knowledge and practice of nurses in NICU. Global Journal of Health Science [Internet]. 2016 Oct 1;8(10):56478. Available from: https://www.ncbi.nlm.nih.gov/pubmed/27302458 DOI: 10.5539/gjhs.v8n10p135.

[18]. Bedier NA, EL-Ata ABA, Shehab MS. Effect of educational program on nurses' practice related to care of patients undergoing nasogastric tube feeding. International Journal of Caring Sciences [Internet]. 2016;9(2):432. Available from http://www.internationaljournalofcaringsciences.org/docs/7_Shaehab_originial_9_2.pdf