Factors Affecting Hydration Status among Critically Ill Patients

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Abstract

Background: Hydration is a complex physiological condition that includes total body water, its distribution, and the concentration of the major electrolytes. Hydration status is linked with health, wellness, and performance, it can be evaluated by water intake and urine output. **Aim of study:** (1): Assess critically ill patient's hydration status (2): Assess the factors affecting hydration status among critically ill patient. **Research design:** A descriptive exploratory research design was utilized. **Subjects:** A convenient samples of 100 patients were included in the current study. **Setting:** This study was carried out at the Intensive Care Units of Elzaitoun specialized Hospitals. **Tools of data collection:** (1): Patient's hydration status physical assessment tool, (2): Factors affecting hydration status of critically ill patient's assessment tool. **Results:** revealed that half (51%) of the studied patients suffering from fluid volume deficit (dehydration), and one third (33%) of the patients had fluid volume excess (overhydration) and less than one fifth (16%) of the studied patients were euhydrated. There is a significant relation between patient's hydration status and age, history of ischemic heart disease, vital signs, conscious level, cumulative fluid balance, diuretics, betablockers, anticonverting enzyme (ACEI) medications at p. value < 0.001. **Conclusion:** It can be concluded that there were many factors affecting patients' hydration status such as: antibiotic, antacid, calcium channel blockers, beta blockers, diuretic medications, level of consciousness, respiratory infection, smoking, overweight, vomiting, fever, and impaired skin integrity **Recommendation:** Future studies are recommended to evaluate patients' hydration status and factors affecting hydration among critically ill patients and regular follow up for all patients with hydration alterations to evaluate their health conditions and to detect complications early.

Keywords: Critically ill patient, Hydration Status, Factors.

Introduction:

Hydration is the process of providing an adequate amount of fluid to body tissue. It is achieved when an individual has sufficient fluids to drink in order to replace their normal day to day fluid loss and any unexpected losses. This enables the body to maintain healthy hydration levels to support physical and mental health and wellbeing **(Academic Health Science Network, 2016).**

Water is the single largest component of the body, representing about 50% - 70% of total body mass, and is present in variable amounts in all cells, tissues, and organs. Body water content is determined by the balance between the rates at which water is added to the body and the rate of water losses **(Lukaski, 2017).**

Maintaining appropriate water and electrolyte content in various fluid compartments is crucial for the proper functioning of the human body. Many complex systems, including the kidneys, work together to maintain and restore this balance **(Merrill & Chambliss, 2020).**

Dehydration refers to a total body water deficit often induced by a combination of restricted fluid intake and exposure to adverse environments. It is associated with poor health outcomes, chronic diseases, increased mortality among intensive care patients, decreased physical and cognitive performance, and it can lead to negative health effects **(Bashyam, et al., 2020).**

In critically ill patients, fluid overload is related to increased mortality and also lead to several complications like pulmonary edema, cardiac failure, delayed wound healing, tissue breakdown, and impaired bowel function. Therefore, the evaluation of volume status is crucial in the early management of critically ill patients **(Claure-Del Granado & Mehta, 2016).**

There are many factors affecting altered hydration status in critically ill patients such as comorbidities disease (cardiovascular disease, renal disease, cerebrovascular stroke, diabetes mellitus, deterioration in the level of consciousness, excessive gastrointestinal fluid loss, impaired skin integrity such as pressure ulcer, burn, trauma and sepsis). Critical patients are at risk for increased sensible and insensible loss via many mechanisms as infection, and fever **(Samoni, et al., 2016).**

Hydration assessment in the intensive care setting is complex and requires indepth knowledge of fluid balance dynamics. Deviation from normal values is associated with increased morbidity and mortality. Fluid balance monitoring is an essential component of intensive care management. Maintaining fluid balance plays an important role in the management of critically ill patients. Inaccurate monitoring of fluid balance especially in critically ill patients can deteriorate patient's conditions **(Asfour, 2016).**

Critically ill patients are at great risk for fluid and electrolyte imbalances, so the nurse needs to understand the physiology of fluid balance to anticipate, identify, and respond to possible imbalances in each. The nurse also must use effective teaching and communication skills to help prevent and treat various fluid disturbances **(Papadakis, et al., 2017).**

Nurses must employ several strategies to optimize fluid and electrolyte balance in individuals entrusted to their care. Such strategies include assessment of fluid and electrolyte status, prevention strategies, and fluid and electrolyte replacement. These strategies focus on managing fluid volume excess and fluid volume deficit because fluid balance is determined by daily gains and losses. Most daily intake of water is oral, with a small percentage coming from food and metabolic processes. The majority of body fluid losses comes from the formation of urine **(Kear, 2017).**

Significance of the Study:

Fluid balance plays an important role in the management of a critically ill patient. The effective management of critically ill patients requires accurate assessment of their fluid balance status. This assessment includes appropriate monitoring of fluid intake and output, as well as the accurate calculation and correct recording of this data. Inaccurate monitoring and recording of the fluid balance can have far-reaching consequences and lead to life threating conditions. Disorders of the fluid balance account for a range of serious problems experienced across the lifespan. It is associated with high rates of morbidity and mortality. Early diagnosis and assessment of hydration status disorders are very important for critical ill patients in order to protect patient from any complications. So, this study aims to identify the factors

affecting hydration status in critically ill patients.

Aim of the Study:

This study aimed to:

(1) Assess critically ill patient's hydration status

(2) Assess factors affecting hydration status among critically ill patients.

Research questions

1- What is the current hydration status of the critically ill patient?
2- What are the factors affecting hydration status among critically ill patients?

Subjects and Methods:

1-Technical Design:

The technical design includes research design, setting, subjects and tools for data collection.

Research design:

A descriptive exploratory research design was utilized to achieve the aim of the present study.

Setting:

The study was carried out in four different intensive care units at El Zeitoun Specialized Hospital, Egypt, Cairo. These units are Medical Intensive Care Unit 1 in the 1st floor which consists of seven beds, Medical Intensive Care Unit 2 in the 3rd floor which consists of four beds, Cardiac Care Unit in the 2nd floor which consists of six beds, and Open-Heart Intensive Care Unit in the 1st floor which consists of six beds.

Subjects:

A convenient sample of one hundred patients was recruited in this study. They were 59 males, and 41 females.

Study tools:

I. Patient's hydration status physical assessment tool:

This tool was used to assess the hydration status of patients; it was developed by the investigator based on review of relevant recent literatures **(Da Rosa Hise & Gonzalez, 2018; Bak, et al., 2017; and Baron, et al., 2015).** It included three parts as follows:

Part (1): was concerned about demographic characteristics of patients under the study, it consists of six questions regarding age, gender, marital status, educational level, occupation, and date of ICU admission.

Part (2): included the patient's clinical data, it composed of five questions about present, past history, and family history.

Part (3): This part is divided into five sections as follow; assessment of vital signs, assessment of oxygenation and ventilation status, physical examination of body systems (cardiovascular system, respiratory system, integumentary system, gastrointestinal system, and urinary system), general signs of altered hydration status, fluid balance chart and laboratory investigations.

❖ **Scoring System:**

Regarding scoring system of the patient hydration physical assessment tool, this tool consisted of 108 statements, which were grouped into 3 parts. The responses were either by ″yes″ or ″no″, the correct answer was given ″one grade″ while the incorrect one was given ″zero″. The score of each statement was calculated, then the scores for every part were summed up giving a total score for every part, then the total score for all physical assessment tool were calculated.

- **Dehydration** if scores < 42.
- **Euhydration** if scores 42-< 68.
- **Overhydration** if scores 68- ≤ 108.

II: Factors affecting hydration status of critically ill patient assessment tool:

This tool was developed by the investigator in English language based on review of relevant related literatures **(Mullen, et al., 2018; Asfour, 2016; and Basso et al, 2013).** It was used to assess factors affecting hydration status of critically ill patients.

❖ **Scoring system:**

Regarding scoring system of factors affecting hydration status of critically ill patient assessment tool, this tool consisted of 66 statements, which were grouped into 4 parts. The responses were either ″yes″ or ″no″, the "yes answer" was given one grade, while the "no answer" was given ″zero″. The scores of each statement were summed up, then giving a total score for every part. The total score for all the factors assessment tool were calculated.

2. Operational design: -

The operational design includes preparatory phase, content validity, reliability, pilot study, ethical consideration and field work.

A- Preparatory Phase:

This phase includes the reviewing of related literatures and theoretical knowledge of various aspects of the study to develop the tools for data collection.

B- Validity of the study tool:

Validity was tested through jury of (7) experts from Medical Surgical Nursing Department, Ain Shams University. The experts reviewed the tools for clarity, relevance, comprehensiveness, simplicity and applicability. Minor modifications were done.

Reliability of the study tools: Testing reliability of the proposed tools was done statistically by alpha Cronbach test.

The reliability of the patient hydration status physical assessment tool Cronbach's alpha was 0.806 and for the factors affecting hydration status of critically ill patient's assessment tool was 0.791.

C- Pilot Study:

A Pilot study was carried out on 10 % (10) of patients under study to test the clarity, applicability, feasibility and relevance of the tools used.

D-Field work:

The collection of data of the current study lasted over a period of six months; starting in September 2019 and ended in February 2020, through the following phases:

The preparation phase:

It was concerned with construction and preparation of different data collection tools. The investigator prepared formal requests to the medical and nursing directors of El Zeitoun Specialized Hospital. The purpose and nature of the study were explained to gain their acceptance and support. This stage required about six months duration and ended by carrying out the pilot study.

The data collection phase:

The investigator obtained oral consents from patients who are accepted to share in this study.

The investigator visited the selected settings on three days (from Saturday to Monday) during the morning and the afternoon shifts (9.00 am to 5.00 pm).

The involved 100 patients were informed individually about the purpose and nature of the study.

The data were collected from the pre-determined numbers of critically ill patients in the intensive care units. The average number of patients who were assessed by the investigator was two to three patients per day.

Each patient was assessed for 40- 60 minutes to fill in the patient hydration status physical assessment tool and the factors affecting hydration status of critically ill patient assessment tool

E- Ethical considerations:

The research approval obtained from the ethical research committee at faculty of nursing, Ain Shams University before starting the study. Oral consent for patients' agreements to be included in the study were obtained after explanation of the nature and purpose of the study. Each patient was free to either participate or not in the current study and had the right to withdraw from the study at any time without any rational. The investigator was assured maintaining anonymity and confidentiality of the subjects' data. Patients were informed that obtained data was collected for the research purpose. Confidentiality and anonymity of each subject were assured through coding of all data.

3- Administrative design

An official permission to conduct the study was obtained from Faculty of Nursing and the medical and nursing directors of Intensive Care Units at El Zeitoun Specialized hospital.

4- Statistical design

The collected data was revised, coded, and tabulated using Statistical Package for Social Science (SPSS 20). Data was presented and suitable analysis was done according to the type of data obtained for each parameter.

Descriptive statistics

1. Mean, standard deviation (± SD) and range were used for parametric numerical data, while median and interquartile range (IQR) was used to present non-parametric numerical data

2. Frequency and percentage were used to describe non-numerical data.

Analytical statistics

1. Chi-Square test was used to examine the relationship between two qualitative variables.
2. Fisher's exact test: was used to examine the relationship between two qualitative variables when the expected count is less than 5 in more than 20% of cells.

- The observed differences and association were considered as follows:
- P-value < 0.05 was considered significant.
- P-value < 0.001 was considered as highly significant.
- P-value > 0.05 was considered non-significant.

Results:

Table (1): As regard to age, table 1 shows that half of the studied patients (51.0%) were more than or equal sixty (60) years. Regarding gender, table 1 shows that 59.0 % of the studied patients were males, and 69.0% of them were married. Concerning with educational level, 40.0% of patients were highly educated, and 56.0% of them were not working.

Table (2): Regarding patient's current diagnosis table 2 shows that 33% of patients under study had gastrointestinal disease on their admission such as hematemesis (13%) and melena 10%. Approximately, one quarter of patients 26%, 25%, 22% had neurological disease, cardiovascular disease, and respiratory disease respectively on admission. As regard to duration of the current disease, the table revealed that more than three quarters of patients (77.0%) their diseases were less than six months.

Table (3): showed that, more than half of the studied patients (51.0%) had fluid volume deficit (dehydration), while one third of the patients (33.0%) were had fluid volume excess (overhydration), and (16.0%) of the studied patients were euhydration (normal hydration).

Table (4): Regarding factors affecting patient's hydration status, table 4 showed that, the most common factors affecting hydration status of patients was antibiotic, antacid, calcium channel blockers, beta blockers medications, deterioration in level of consciousness, respiratory infection, smoking, overweight, diuretic medications, vomiting, fever, and impaired skin integrity (89.0%, 61.0%, 55.0%, 52%, 51.0% 43.0%, 41.0%, 38%, 37%, 35%, 34.0%, 34%) respectively. While the least common factors were diabetic foot infections that represent 3.0% of patients, and weight loss, thirst, alcoholic intake, underweight patients, and medications allergy represent 2.0% for each.

Table (5): demonstrates that there is a significant relation between patient's hydration status and current cardiovascular system status in all four days during admission (p value < 0.001), also there is a significant relation between patient's hydration status and current respiratory system status in all four days (p value < 0.001).

Table 6 demonstrates that there is statistically significant relation between patient's hydration status and current gastrointestinal system status in all four days (p value < 0.001).

Table (7): demonstrate that there is a significant relation between patient's hydration status and current urinary system status in all four days of admission (p value < 0.001).

Table (8): demonstrates that there is statistically significant difference between patient's hydration status and current integumentary system status in all four days (p value = < 0.001).

Table (1): Number and Percentage distribution of the studied patients according to their demographic characteristics (n=100).

Patients Demographic Data			
Age		**N**	**%**
18 - < 30		8	8.0%
30 - < 50		10	10.0%
50- < 60		31	31.0%
≥ 60		51	51.0%
Mean ± SD		60.6 ± 14.7	
Gender	Male	59	59.0%
	Female	41	41.0%
Marital Status	Single	8	8.0%
	Married	69	69.0%
	Divorced	3	3.0%
	Widow	20	20.0%
Educational level	Can't read and write	37	37.0%
	Secondary school	23	23.0%
	Higher education	40	40.0%
Occupation	Working	44	44.0%
	Not Working	56	56.0%

Table (2): Frequency and percentage distribution of the studied patients as regarding to current diagnosis (n=100).

Medical Diagnosis		N	%
Neurological Disease	Stroke	19	19.0%
	Others (head injury and brain tumors)	7	7.0%
	Total	**26**	**26.0%**
Cardiovascular disease	Heart failure	8	8.0%
	Coronary artery disease	12	12.0%
	Others (arrythmia)	5	5.0%
	Total	**25**	**25.0%**
Respiratory disease	Pulmonary edema	9	9.0%
	Coronary obstructive pulmonary disease (COPD)	3	3.0%
	Others (asthma)	10	10.0%
	Total	**22**	**22.0%**
Gastrointestinal disease (GIT)	Hematemesis	13	13.0%
	Melena	10	10.0%
	Others (gastritis)	10	10.0%
	Total	**33**	**33.0%**
Renal Disease	Renal impairment	9	9.0%
	Urinary tract infection (UTI)	5	5.0%
	Others (kidney stones)	3	3.0%
	Total	**17**	**17.0%**
Endocrinal Disease	Diabetic ketoacidosis (DKA)	8	8.0%
	Thyroid problems	2	2.0%
	Others (adrenal insufficiency)	2	2.0%
	Total	**12**	**12.0%**
Musculoskeletal disorders	Fracture	9	9.0%
	Others (osteoporosis)	4	4.0%
	Total	**13**	**13.0%**
Duration of disease	< 6 months	77	77.0%
	6 - 12 months	7	7.0%
	> 1 year.	16	16.0%

Table (3): Frequency and percentage distribution of patients regarding the current hydration status (n=100).

Hydration status	N	%
Overhydration	33	33.0%
Euhydration	16	16.0%
Dehydration	51	51.0%

Table (4): Frequency and percentage distribution of patients regarding factors affecting hydration status related to patients (n=100).

Patients related factors			N	%
Health problems	Heart disease		25	25.0%
	Cerebrovascular disease		23	23.0%
	Endocrinal disease		11	11.0%
	Lung disease		19	19.0%
	Renal insufficiency		13	13.0%
	Patient on dialysis		6	6.0%
	Malnutrition		3	3.0%
	Weight loss		2	2.0%
	Obesity		20	20.0%
	Fever		34	34.0%
	Hyperglycemia		21	21.0%
	Constipation		7	7.0%
	Diarrhea		13	13.0%
	Vomiting		35	35.0%
	Hematemesis		12	12.0%
	Melena		11	11.0%
	Impaired skin integrity		34	34.0%
	Impaired swallowing		18	18.0%
	Thirst		2	2.0%
	Long term NPO		19	19.0%
	Deterioration in level of consciousness		51	51.0%
	Respiratory infection		43	43.0%
Sepsis and Infection	Urinary tract infection		11	11.0%
	Others (diabetic foot infection)		3	3.0%
Current medication	Diuretics		37	37.0%
	Laxative		7	7.0%
	Beta blockers		52	52.0%
	Calcium channel blockers		55	55.0%
	Antacid		61	61.0%
	Corticosteroids		7	7.0%
	Proton pump inhibitors		10	10.0%
	Anticonverting enzyme inhibitors (ACEI)		29	29.0%
	Digoxin		10	10.0%
	Antibiotic		89	89.0%
	Chemotherapy		1	1.0%
	Antidepressant		17	17.0%
	Medication's allergy		2	2.0%
Life style	Smoking		41	41.0%
	Alcoholic		2	2.0%
	Caffeine intake		13	13.0%
	Body math index (BMI)	Under weight	2	2.0%
		Normal	40	40.0%
		Overweight	38	38.0%
		Obese	20	20.0%

Table (5): Relations between patient's hydration status and status of cardiovascular and respiratory systems (n=100).

Physical examination			Overhydration		Euhydration		Dehydration		Chi square test		
			N	%	N	%	N	%	X^2	p value	sig.
Day1	Cardio vascular system	Normal	1	3.0%	16	100.0%	2	3.9%	X^2 =81.21	< 0.001	S
		Abnormal	32	97.0%	0	0.0%	49	96.1%			
	Respiratory system	Normal	0	0.0%	9	56.3%	20	39.2%	X^2 =21.83	< 0.001	S
		Abnormal	33	100.0%	7	43.8%	31	60.8%			
Day 2	Cardio vascular system	Normal	3	9.1%	16	100.0%	0	0.0%	X^2 =82.28	< 0.001	S
		Abnormal	30	90.9%	0	0.0%	51	100.0%			
	Respiratory system	Normal	0	0.0%	10	62.5%	22	43.1%	X^2 =25.28	< 0.001	S
		Abnormal	33	100.0%	6	37.5%	29	56.9%			
Day 3	Cardio vascular system	Normal	5	15.2%	16	100.0%	4	7.8%	X^2 =57.71	< 0.001	S
		Abnormal	28	84.8%	0	0.0%	47	92.2%			
	Respiratory system	Normal	0	0.0%	13	81.3%	30	58.8%	X^2 =39.66	< 0.001	S
		Abnormal	33	100.0%	3	18.8%	21	41.2%			
Day 4	Cardio vascular system	Normal	10	30.3%	16	100.0%	6	11.8%	X^2 =43.64	< 0.001	S
		Abnormal	23	69.7%	0	0.0%	45	88.2%			
	Respiratory system	Normal	0	0.0%	14	87.5%	32	62.7%	X^2 =44.96	< 0.001	S
		Abnormal	33	100.0%	2	12.5%	19	37.3%			

Table (6): Relation between patient's hydration status and status of gastrointestinal system (n=100).

Physical examination			Overhydration		Euhydration		Dehydration		Chi square test		
			N	%	N	%	N	%	X^2	p value	Sig.
Day 1	Gastrointestinal system	Normal	25	75.8%	15	93.8%	7	13.7%	X^2 =47.66	< 0.001	S
		Abnormal	8	24.2%	1	6.3%	44	86.3%			
Day 2	Gastrointestinal system	Normal	25	75.8%	14	87.5%	7	13.7%	X^2 =44.24	< 0.001	S
		Abnormal	8	24.2%	2	12.5%	44	86.3%			
Day 3	Gastrointestinal system	Normal	26	78.8%	16	100.0%	19	37.3%	X^2 =26.71	< 0.001	S
		Abnormal	7	21.2%	0	0.0%	32	62.7%			
Day 4	Gastrointestinal system	Normal	26	78.8%	16	100.0%	23	45.1%	X^2 =20.25	<0.001	S
		Abnormal	7	21.2%	0	0.0%	28	54.9%			

Table (7): Relation between patient's hydration status and status of urinary system (n=100).

Physical examination			Overhydration		Euhydration		Dehydration		Chi square test		
			N	%	N	%	N	%	X^2	p value	sig.
Day 1	Urinary system	Normal	17	51.5%	15	93.8%	2	3.9%	X^2 =50.53	< 0.001	S
		Abnormal	16	48.5%	1	6.3%	49	96.1%			
Day 2	Urinary system	Normal	11	33.3%	16	100.0%	2	3.9%	X^2 =55.05	< 0.001	S
		Abnormal	22	66.7%	0	0.0%	49	96.1%			
Day 3	Urinary system	Normal	6	18.2%	16	100.0%	4	7.8%	X^2 =55.33	< 0.001	S
		Abnormal	27	81.8%	0	0.0%	47	92.2%			
Day 4	Urinary system	Normal	7	21.2%	16	100.0%	5	9.8%	X^2 =50.27	<0.001	S
		Abnormal	26	78.8%	0	0.0%	46	90.2%			

Table (8): Relation between patient's hydration status and status of integumentary system (n=100).

Physical examination			Overhydration		Euhydration		Dehydration		Chi square test		
			N	%	N	%	N	%	X^2	P value	Sig.
Day 1	Integumentary system	Normal	0	0.0%	16	100.0%	0	0.0%	X^2 =100	< 0.001	S
		Abnormal	33	100.0%	0	0.0%	51	100.0%			
Day 2	Integumentary system	Normal	0	0.0%	16	100.0%	0	0.0%	X^2 =100	< 0.001	S
		Abnormal	33	100.0%	0	0.0%	51	100.0%			
Day 3	Integumentary system	Normal	1	3.0%	16	100.0%	0	0.0%	X^2 =93.13	< 0.001	S
		Abnormal	32	97.0%	0	0.0%	51	100.0%			
Day 4	Integumentary system	Normal	1	3.0%	16	100.0%	6	11.8%	X^2 =64.63	< 0.001	S
		Abnormal	32	97.0%	0	0.0%	45	88.2%			

Discussion:

Water balance within the body plays an important role in the maintenance of plasma osmolality and effective circulating volume **(Wingfield, 2020).** Accurate regulation of body fluid balance is crucial to the maintenance of intravascular volume to support hemodynamic stability and heat loss **(Meade et al., 2020).** Fluid and electrolyte management is part of everyday routine clinical practice in critical patients. **(Rizza & Ricci, 2019).**

Regarding the demographic characteristics of the studied patients, the findings of the current study revealed that the mean of age of patients under study was 60.6 ± 14.7 years and more than half of the studied patients were male. This could be due to that old age peoples are at high risk for altered hydration status. This result is similar to **Balcı et al., (2013)** who found that the mean of age of patients was 59.28 ±16.79 years old and more than half of the studied patients were male in a study entitled "General characteristics of patients with electrolyte imbalance admitted to emergency department".

These results also supported by **Zoccali, et al., (2017)** who mentioned that the mean of age of the studied patients was 60.96 ± 15.7 years old and approximately two thirds of the studied patients were males. Regarding patient's current diagnosis, the present study revealed that about one third of the studied patients were had gastrointestinal disease on their admission to intensive care unit and approximately one quarter of them were had neurological disease, cardiovascular disease and respiratory disease respectively. This might be due to that these diseases are considered chronic disease that affect people in this age and result in physiological changes of the body.

This result is in agreement with **Denneman et al., (2020)** who found that the most common causes for ICU admission was cardiovascular disease in a study entitled "Fluid balance and phase angle as assessed by bioelectrical impedance analysis in critically ill patients: a multicenter prospective cohort study". In addition to **Hettige, (2017)** who found that more than two thirds of patients had the cardiovascular and neurological conditions.

Concerning with the assessment of the current hydration status of patients under study, the findings of the current study indicated that around half of the studied patients had fluid volume deficit (dehydration), while one third of patients were had fluid volume excess (overhydration), and less than fifth of the studied patients were euhydration (euhydration). This might be due to that most of patients under study had different comorbidities and chronic disease that affect hydration status and lead to alterations in fluid balance among critically ill patients in intensive care unit.

This study is consistent with **Elsayed, (2017)** who found that more than two thirds of the studied patients had fluid

volume deficit while only one third had fluid volume excess in a study entitled "Factors associated with altered hydration status among critically ill adult patients". These findings are contraindicated with **Jones et al., (2015)** who found that nearly one quarter of patients were dehydrated, and more than one third were normally hydrated and two fifths were overhydrated upon ICU admission.

Regarding factors affecting hydration status of patients, the present study revealed that the most common factors affecting hydration status of the studied patients were antibiotic, antiacid, calcium channel blockers, beta blockers medications, deterioration in level of consciousness, respiratory infection, smoking, overweight, diuretics medications, vomiting, fever, and impaired skin integrity.

This result was supported by **Musaa, (2014)** who found that diarrhea, vomiting, fever, and diuretic medications are most common risk factors for dehydration.

The result is disagreed with **Jones et al., (2015)** who reported that the most common characteristics of altered hydration status of studied patients were asthma, chronic obstructive pulmonary disease, and chronic liver disease in a study entitled "Bioelectrical impedance vector analysis in critically ill patients: a prospective, clinician blinded investigation".

This study revealed that there is a significant relation between patient's hydration status and status of cardiovascular, respiratory, gastrointestinal, urinary and integumentary systems. This might be due to that the alteration in the function of any body system due to any conditions as disease may affect the hydration status of the body. This result goes in the same line with **Claure-Del Granado & Mehta, (2016)** who found that there is a relation between fluid overload in critically ill patients and acute respiratory distress syndrome, and acute lung injury in a study entitled "Fluid overload in the ICU: evaluation and management".

The result is also supported by **Hoen, et al., (2021)** who found that there is a relation between the hydration status of elderly patients determined by bioelectrical impedance analysis and disorders of cardiovascular and urinary systems. This result is also agreed with **Carrera-Jiménez, et al., (2018)** who found that the hydration status is influenced by severity of Gastrointestinal problems and there is a positive relation between hydration status and gastrointestinal system.

Conclusion:

Based on the findings of this study it can be concluded that about half of the patients suffering from fluid volume deficit, and more than one third suffering from overhydration. Dehydration (fluid volume deficit) is more common than overhydration (fluid volume excess) among critically ill patients. This may be due to that half of patients were more than 60 years old who are usually prone to dehydration due to aging proves and decrease. Also, it can be concluded that there were many factors affecting patients' hydration status such as: previous history (comorbidities), respiratory infection, deterioration in level of consciousness, vomiting, fever, impaired skin integrity, overweight, smoking and use of antibiotic, antiacid, calcium channel blockers, beta blockers, and diuretics medications.

Recommendations related to patients:

1. Regular follow up for all patients with hydration alterations to evaluate their health conditions and to detect complications early.
2. Strict monitoring of fluids intake and output should be done.
3. Training programs for the critical care nurses regarding importance of hydration

and the risk factors affecting hydration status of critically ill patient.

5. Availability of written guidelines, booklets, policies regarding fluid balance monitoring.
6. Manage the shortage in nursing staff number to decrease risk of fluid balance monitoring error.
7. Establishment of continuing educational programs including evidence-based guidelines to improve nurses' knowledge and practice regarding fluid balance monitoring.

Recommendations for further research:

1. Replication of the study on a larger probability sample selected from different geographical area in Egypt is recommended to obtain more generalized data.

2. Further researches should be conducted to raise awareness of patients about hydration status and factors affecting hydration status.

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