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Intensive Care Unit Nurse's Knowledge and Practices Related to Intravenous Fluid and Electrolyte Administration

Thesis Submitted

By

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Supervisor

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بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ

﴿أَوَلَمْ يَرَ الَّذِينَ كَفَرُوا أَنَّ السَّمَاوَاتِ وَالْأَرْضَ كَانَتَا رَتْقًا فَفَتَقْنَاهُمَا ۗ

وَجَعَلْنَا مِنَ الْمَاءِ كُلَّ شَيْءٍ حَيٍّ ۗ أَفَلَا يُؤْمِنُونَ﴾

صدق الله العظيم

سورة الأنبياء / آية 30

Supervisor Certification

I certify that this thesis, which is entitled " **Intensive Care Unit Nurse's Knowledge and Practices Related to Intravenous Fluid and Electrolyte Administration** ", was prepared under my supervision at the College of Nursing- The University of Babylon in partial fulfillment of the requirements for the master's degree in Nursing Science.

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Dedication

*“The future belongs to those who believe in the beauty of
their dreams “*

Eleanor Roosevelt

*I dedicate this work to my loved **parents** who has always
taught me to trust in Allah, believe in hard work, and teach
me that so much could be done with little.*

*To my dear special **sister** who always supported me to make
the dream become a reality.*

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Abstract

Background: The most effective course of treatment entails careful management of fluid balance, including careful evaluation of hydration, a patient-specific fluid treatment plan, frequent fluid and electrolyte balance checks with appropriate treatment plan modifications in response to critically sick patients' rapidly changing clinical status. Nurses have the knowledge and clinical abilities to maintain patients' electrolyte balance and hydration status as best as possible. They can continuously assess their patients' health and quickly identify any abnormalities that call for immediate intervention, such as fluid and electrolyte imbalances.

Objective: To assess intensive care unit nurses' knowledge and practice related to fluid and electrolyte administration.

Methodology: Descriptive – observational study design is chosen to carry out this study to achieve the objectives which structures to analyze the knowledge and practices of nurses who work in the intensive care unit regarding intravenous fluid and electrolyte administration phenomena, from the period between 9 November 2022 to 5 June 2023. Non-probability purposive sample of (174) nurses were selected out of (269) nurses working in Al-Hilla teaching hospitals.

Results: The findings indicated that the majority of the study sample 88(50.6%) were male. The results recorded that most of their age 91(52.3%) were between (20-25) years age group, the higher percentage 90 (51.7%) were married, the majority of the study sample 110 (63.2%) had a bachelor's degrees, and 120 (69.0%) lived in urban resident. Intensive care unit nurse's knowledge recorded (71.15%) unsatisfactory level, related to training sessions concerning fluid and electrolyte administration the results recorded that most of the study sample 131(75.3%) didn't involve in any training courses, while their practices recorded (46.52%) unsatisfied related to the studied phenomena.

Conclusion: Overall knowledge level of the nurses related to fluid and electrolytes administration was recorded unsatisfied level while their practices were recorded as fair in level.

Recommendation: Continuous in-service education programs can be established to improve nurse's knowledge to assessment, monitoring fluid and electrolyte replacement therapy.

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List of Acronyms and Statistical symbols

Title	Meaning
%	Percentage
ACS	Acute coronary syndrome
AKI	Acute kidney injury
APH	Antepartum hemorrhage
ARDS	Acute respiratory distress syndrome
AVP	Arginine vasopressin
BP	Blood pressure
CNS	central nervous system.
ECF	Extracellular fluid
ECV	Extracellular volume
EN	Enteral feeding
F	Frequency
FVD	Fluid volume deficit
FVE	Fluid volume excess
GFR	glomerular filtration rate.
I & O	Intake and Output
ICF	Intracellular fluid
ICUs	Intensive care units
IV	Intravenous fluid
IVP	Intravenous pyelogram
LAP	leucine aminopeptidase
LVN	Licensed Vocational Nurse
MS	Mean Score
NAP	Nursing Assistive Personnel
R-A-A	Renin-angiotensin-aldosterone
SD	Standard Deviation
TBW	Tension band wiring

List of Appendices

List	Title
A	Approval
B1, B2, B3	Administrative arrangements
C1, C2	Questionnaire form
D1, D2	Checklist
E1, E2	Validity
F	Ethical consideration

Chapter One

Introduction

Chapter One

1.1. Introduction:

The care of critically ill patients is crucially dependent on critical care nurses. They are qualified to offer ongoing observation and cutting-edge treatment for many urgent diseases. Nurses have the knowledge and clinical abilities necessary to maintain patients' electrolyte balance and hydration status in the best possible way. They can continuously assess their patients' health and quickly identify any abnormalities that call for immediate intervention, such as fluid and electrolyte imbalances (Timby and Smith 2013).

To deliver high-quality patient care, nurses should engage in critical thinking, advanced problem-solving techniques, and practice based on evidence-based research (Bell 2015, Mosadeghrad 2012). In healthcare facilities, health quality is always importance. In the field of nursing, it is referred to as the procedure for achieving the maximum level of excellence in the provision of patient care (Finkelman and Kenner 2016). Nursing standards are the accepted or anticipated levels of performance and practice for nurses (Hussein 2011). It is an effective tool for assisting nurses in their work and ensuring high-quality care. Nursing standards offer a platform for assessing the quality of provided care. (Bell L 2015).

An integral aspect of the daily treatment of patients in the critical care unit is the monitoring of fluid and electrolyte imbalance (Culleiton, & Simko, 2011). Physiological crises that endanger at least one physiological system and a patient's life are what prompt patients to be admitted to critical care units. Critical patients are most susceptible to fluid and specific electrolyte abnormalities, survival rates can be significantly improved by using appropriate hydration therapy and treating electrolyte imbalances (Eckman & Lobus, 2010).

The most effective course of fluid balance management, including careful evaluation of hydration, fluid treatment plan, frequent fluid and electrolyte balance assessment, and appropriate treatment plan modifications in response to critically sick patients' when rapidly changing in clinical status may occurs. (Harbir and Madhu, 2009). To promote proper safe hydration and effective nursing care, nurses should always report any significant anomalies discovered in a patient's fluid record (Desborough, 2010).

Severe burns, trauma, infections, brain injury, and heart failure are critical situations that affect fluid and electrolyte homeostasis. The renin-angiotensin-aldosterone system and vasopressin, as well as tubular damage from ischemia or nephrotoxic kidney injury, including renal insult brought on by a number of medicines used in critical care. When diagnosing and treating fluid and electrolyte imbalances, it's also important to consider inefficient fluid and electrolyte administration. (Lee 2010).

In critically ill patients, fluids are frequently utilized to boost renal protection against contrast, globin, and uric acid, to provide caloric intake, and as a supplemental method of medication dilution (Rivers ,*et al.* 2001) (Nemec *et al.* 2008). Isotonic fluids can occasionally save lives during the initial hours of shock syndromes by stabilizing arterial pressure and perfusion. Furthermore, a significant amount of intravenous fluids might be necessary to achieve physiological hemodynamic objectives. To prevent hypoglycemia, dehydration, and electrolyte shortage, infusions of one to three liters of dextrose in water with extra electrolytes, primarily sodium, chloride, and potassium, are given to some fasting patients. It is crucial to preserve the kidneys in critically ill patients, and hyperhydration is routinely utilized to increase urine production and prevent renal tubular cell damage from toxic chemical retention at high concentrations. Finally, a lot of medications need to be delivered properly with a lot of fluids

that have electrolytes. Significant amounts of fluids and electrolytes are given to critically sick patients, especially chloride-rich solutions, are usually associated with decreased urine output and renal electrolyte excretion failure. This combination is substantially more prominent in the early stages of a severe illness or when acute kidney injury (AKI) is present. (Maciel ,*et al.* 2013). (Maciel , *et al.* 2012).

Poor fluid and electrolyte management in critically ill patients leads to hydro electrolytic overload, which results in physiological disturbances and worse outcomes (Wiedemann , *et al.* 2006).

1.2. Importance of the study:

Sepsis, cardiovascular failure, and multiorgan failure are the three main causes of death in the intensive care unit (ICU). More than 1.7 million Americans are affected with sepsis, which accounts for 270,000 deaths annually and is the main cause of hospital deaths. It also accounts for the majority of hospital readmissions within 30 days, which are costly (\$2 billion yearly). Up to 51% of patients with sepsis experience severe renal failure, and up to 20% experience acute respiratory failure necessitating mechanical ventilation. Each year, sepsis affects more than 75,000 kids, and 6800 of them pass away. Mortality rate for patients admitted to adult ICUs typically ranges from 10% to 29%, depending on age, comorbidities, and the severity of the illness. Patients who have been hospitalized in the ICU have a greater mortality rate during the ensuing ten years. (CDC, 2019). (Dombrovskiy , *et al.* 2007).

The problem of fluid and electrolyte imbalance is critical, particularly in ICU patients who usually do not require long-term hospitalization but need good care, with compliance to a therapeutic regimen for maintenance of adequate fluid and electrolyte balance for life. Otherwise, they may suffer from serious

problems that may be fatal. The nurse has an important role in helping these patients to comply with their treatment regimen. The goal of this study is to identify the variables that influence the role of the nurse in ensuring that patients in the intensive care unit have an acceptable fluid and electrolyte balance. These factors may include a lack of knowledge or inadequate practice (Saleh, 2016).

Ensuring that patients are sufficiently hydrated is an important part of nursing care. Intake of fluids, as well as the ability to pump fluids (blood) to the kidneys and away from tissue spaces, are all equally important. Nurses can determine if a patient is dehydrated severely if they have low blood pressure, high heart rate, cold hands and feet, and low urine output. In the hospital setting, dehydration can be treated (Watwood, C. L. 2011).

The nurse is a vital member in the health care team who assess and identifies changes in fluid and electrolytes balance. Understanding the basic principles of fluid and electrolyte imbalance in the body is essential in assessing the patient, planning interventions, and evaluates the effects of care. Knowledge of which electrolytes can be affected by various disorders and an ability to quickly identify the signs and symptoms of electrolyte imbalance can ensure prompt treatment, thereby circumventing more serious complications (Hassan, *et al.* 2021).

Patients admitted to the critical care unit experience a myriad of fluid and electrolyte disorders. Fluid and electrolyte management is one of the cornerstones of patient care. In today's world of health care, the registered nurse who practices intravenous therapy must possess a thorough and up-to-date working knowledge of the intravenous fluids that are administered. This is not only necessary for safe nursing practice, but it is essential for excellent quality of patient care. Due to the many types of intravenous fluids manufactured and

administered today it is extremely vital that the nurse be entirely familiar with each one before it is administered (Vijayan, 2011).

Fluid and electrolyte abnormalities in critically ill patients can lead to fatal consequences. More caution to electrolyte disturbances should be exercised in intensive care because it is often impossible to adequately assess symptoms and signs of critically ill patients. To provide optimal management, clinicians should be knowledgeable about fluid and electrolyte homeostasis and the underlying pathophysiology of the respective disorders. In addition, intensivists should pay attention to the administered fluid and medications potentially associated with fluid and electrolyte disturbances as indicated by (Lee 2010) in his research.

1.3. Research problem:

The statement of the study: Is the intensive care unit nurses have knowledge and practices related to intravenous fluid and electrolytes administration?

Accurate fluid balance activity monitoring is a critical component of patients' baseline data that directs nursing and medical actions to attain physiological stability. Patients' illnesses can get worse if fluid balance is not accurately monitored, especially in critically ill patients. The understanding of fluid and electrolyte imbalance among nurses in critical care settings was examined in this study, as well as how they applied it. A vital part of the medical team who assesses and detects changes in the fluid and electrolyte balance is the nurse. To diagnose the patient, organize interventions, and analyze the results of care, it is crucial to comprehend the fundamentals of fluid and electrolyte imbalance in the body. Knowing which electrolytes can be affected by different conditions and being able to spot electrolyte imbalance

symptoms and indicators early can help assure rapid treatment and prevent more catastrophic problems. (Ignatavicius and Workman, 2010).

Fluid balance monitoring falls under the purview of nursing practice. As a result, when caring for critically ill patients, ICU nurses have a responsibility and obligation to accurately record and calculate fluid balance. When a patient is extremely ill, managing their fluid balance is just as crucial as doing any other patient care task. (Hassan, and Mohamed, 2021). For a better understanding of homeostasis and metabolic diseases, it is crucial to learn about electrolytes. (Balçı *et al.*, 2013). Body fluids contain vital electrolyte components. Numerous physiological mechanisms depend on it. (Arneson, 2014). Sometimes an imbalance in electrolytes may cause mortality or it may lead to hyperchloremic acidosis, renal vasoconstriction, reduced glomerular filtration rate, and edema. Disorders caused due to electrolyte imbalance are mostly seen in patients who are hospitalized and also most commonly seen in the elder population. Electrolytes help us to know the pathophysiology of diseases and help us to find the primary diseases (Liamis *et al.*, 2013). Aim of study is to explore the variables that influence the intensive care unit nurse's knowledge and practices to maintain acceptable fluid and electrolytes balance.

1.3.1: Significance of the study:

Analysis of nurses' knowledge and practice related fluid and electrolyte imbalance in critically ill patients was a goal of this research, which is significant because it demonstrates the importance of that topic.. Finding of this research might be beneficial in many ways: it will serve as a foundation or a data base for health professionals in this respect. It might aid in safe guarding

such group of patients from these fatal complications. It could also help in planning and implementing care for those patients.

1.3.2: Objectives of the study:

- To assess intensive care unit nurses' knowledge and practice related to fluid and electrolyte administration.
- To identify the study sample's demographical and employment characteristics.
- To find out the relationship between the nurse's knowledge and practices with some variables related to demographical and employment such as (age, gender, and years of experience)

1.3.3. Research question:

1. Can nurses solve patient problem depending on their knowledge related to fluid and electrolytes imbalance?
2. Did nurses have competence to assess patient problem when administer fluid and electrolytes?
3. Is there relation between nurse's knowledge related to fluid and electrolyte administration and their employment characteristics?
4. Is there relation between nurses practice related to fluid and electrolyte administration and their employment characteristics?

1.4. Definitions of terms:

1.4.1. Knowledge

1.4.1.a. Theoretical

Understanding or awareness of a specific reality that may be shared with others (Chinn and Kramer, 2011).

1.4.1.b. Operational

Awareness or understanding of intensive care unit nurses related to intravenous fluid and electrolytes administration.

1.4.2. Practices

1.4.2.a. Theoretical

Recruiting knowledge in special health aspects, based on knowledge skill to detect health problems and maintain management (Dahnke, 2015).

1.4.2.b. Operational

It is the skill or expertness of intensive care nurses related to intravenous fluid and electrolytes administration procedures.

1.4.3. Fluid

1.4.3.a. Theoretical

Liquid that cannot withstand a tangential, or shearing, force at rest and that continuously changes shape in the presence of such stress (Britannica, 2021).

1.4.3.b. Operational

Intravenous fluids or medications are infused alongside blood or blood products straight into a vein, which commonly used in the intensive care unit as therapeutic method for critical ill patient treatment is a quick-acting, effective way to provide fluids or medications in an emergency or to people who are unable to take medications orally.

1.4.4. Electrolyte**1.4.4.a. Theoretical**

Substance dissolves in fluid which produce positively or negatively charged ions in solutions or melts, it conducts an electric current. This is known as an electrolyte. Cations are positively charged ions, and anions are negatively charged ions. (Rarey, *et al.* 2019)

1.4.4.b. Operational

Substances produce ions that cells need to control the electric charge and the movement of water molecules across the cell membrane, such as sodium, potassium, or chloride. They are primarily minerals with electric charges that are dispersed in blood, cellular fluid, or extracellular fluid and support the body's neuron, muscle, acid-base, and water balances.

1.4.5. Administration**1.4.5.a. Theoretical**

Delivery of fluids to patient through an enteral or parenteral route which used as therapeutic method. (Chow,2021)

1.4.5.b. Operational

Maintain critical ill patient's fluid and electrolyte by intravenous excess.

Chapter Two

Review of Literatures

Chapter Two

Review of Literatures

2.1. Historical review:

The fundamentals governing fluid and electrolyte management in patients date to the 19th century. James Gamble, in his famous monograph on extracellular fluid, opens with a quote from Claude Bernard (1832), “The living organism does not really exist in the milieu exterior (the atmosphere if it breathes, salt or freshwater if that is its element) but in the liquid milieu interieur formed by circulating organic liquid, which surrounds and bathes all tissue elements the stability of the milieu interieur is the primary condition for freedom and independence of existence; the mechanism which allows this is that which ensures in the milieu interieur the maintenance of all conditions necessary to the life of the elements.” (Gamble, 1948) edition by (Friedman 2010)

Saline solutions were initially given out during the London cholera pandemic in 1832, which is when intravenous (IV) fluid resuscitation began (Cosnett, 1989). In 1885, Sidney Ringer created a physiologic salt solution, which Alexis Hartman later adjusted, continuing the advancement of fluid treatment. These first solutions (now known as balanced or buffered solutions) contained chloride at lower amounts and many additional electrolytes, in contrast to 0.9 percent "normal" saline (Hammond *et al.*, 2015)

As potential resuscitation fluids, albumin, and artificial colloids were introduced. Theoretically, they have an advantage over crystalloids due to the oncotic pressure principle, which allows for a stronger volume expansion impact. However, there is debate concerning their clinical advantage over crystalloid solutions (Featherstone and Ball, 2018)

Resuscitation, replacement, and maintenance are the three primary categories used to classify the use of IV fluids in critically ill patients. In contrast to maintenance fluids, which are typically given as continuous infusions and are intended to meet a patient's daily needs, resuscitation fluids are particularly crucial during the first phase of treatment to reestablish hemodynamic stability (Hammond *et al.*, 2015). (Evans *et al.*, 2021).

Replacement fluids are given a unique status and are made to make up for particular losses (e.g. electrolytes). Critically ill patients in the intensive care unit (ICU) frequently need a lot of fluid in the initial stages to stabilize. However, both too little and too much liquids could be harmful (Balakumar *et al.*, 2017; Bundgaard-Nielsen *et al.*, 2009). As a result of this insight, fluids are now regarded as medications, with positive and negative effects based on the content and dosage used. As a result, numerous studies have sought to address the topic of whether particular fluid compositions and dosages benefit patients in particular circumstances (Malbrain *et al.*, 2018).

Svante Arrhenius developed the theory in 1884 and received the 1903 Nobel Prize in Chemistry for it. This theory describes how solid crystalline salts separate into paired charged particles when they are dissolved. 2019 (Masa *et al.*) According to Arrhenius, when salt dissolves in water, it separates into charged particles that Michael Faraday (1791–1867) had named "ions" many years previously. Ions were thought to be formed during electrolysis, according to Faraday. Arrhenius proposed that salt solutions had ions even in the absence of an electric current. As a result, he claimed that ionic processes accounted for chemical reactions in solutions. (William H. Harris, 1927) edition by (Friedman 2010) Franz Hofmeister and Sigmund Lewith published their ion hypothesis soon after Arrhenius (Hofmeister, 1888). (Kunz *et al.*, 2004) (Gregory *et al.* 2022) discovered that various ion types had various effects on

things like the solubility of proteins. In numerous other systems, an order of these various ions according to the strength of their effects also constantly emerges. The Hofmeister series has since come to be recognized as this. It has been suggested that the charge density of these ions is significant and may actually have explanations originating from the work of Charles-Augustin de Coulomb more than 200 years ago, despite the fact that the origins of these effects are not entirely clear and have been debated throughout the past century (Gregory *et al.*, 2021)

National Confidential of the UK inquiry into perioperative deaths' 1999 report highlighted the link between fluid imbalance and serious post-operative mortality and morbidity, with an estimated 20% of patients under study had either inadequate documentation of fluid balance or unrecognized/untreated fluid imbalance. It was claimed that some doctors and nurses are unaware of the critical importance of effective hydration management. In order to propagate excellent practice and enhance awareness, recommendations included training for medical and nursing staff in fluid management. They also suggested that fluid management be given the same standing as a medication prescription. (Callum, Gray, *et al.* 1999) edition by (Friedman 2010).

Monitoring a patient's fluid balance to prevent dehydration or overhydration is a relatively straightforward chore, however fluid balance tracking is infamous for being incomplete or erroneously completed. (Reid 2004) evaluated the completion of fluid balance charts on various wards and discovered that staff shortages, a lack of training, and a lack of time were the main causes of improper completion of the charts. (Bennet,2010)

Hans (2005) conducted research and discovered that more regularly using intravenous infusion management devices and routinely evaluating administration rates could help to prevent administration errors involving

continuous IV infusions. Intravenous medication therapy is being used by more patients on a regular basis, however it comes with a high risk of negative side effects.

The nursing and midwifery council (2007) asserts that maintaining records is a crucial component of nursing care rather than something that should be "fitted in" when the situation permits. The nurse caring for the patient must ensure that observations and fluid balance are recorded, and any abnormal findings must be documented and reported to the nurse in charge. promptly (Scales and Pilsworth, 2008). In the literature, there is presently discussion over the application of fluid balance charts that display cumulative input and output (Bennet, 2010).

The cornerstone of intravenous fluid therapy has been intravenous sodium chloride (NaCl) solution ever since Thomas Latta discovered that intravenous saline infusions saved cholera sufferers from almost certain death. In hospital practice, fluid and electrolytes are the most often administered medications. (Latta 1832) edition by (Friedman 2010).

Stoneham and Hill (1997) discovered that 0.9 % saline was the most often given fluid in four-week research on postoperative fluid therapy. They emphasized the prescriptions' wide variation and the fact that patients typically received 3000 mL of water and 242 mmol of sodium daily. Only 37% of patients received potassium supplements, and 42% of patients had insufficient fluid balance charts. The tendency to overprescribe saline is not a new phenomenon and dates back to the time when a fluid replacement was accomplished by rectal infusions, as evidenced by Evans' 1911 statement that "One cannot fail to be impressed with the danger of which salt solution is frequently prescribed, particularly in the postoperative period." (GH Evans 1911) adapted by (Friedman 2010).

The following statement was made by Rhoads in 1957: "A long succession of attempts to construct shortcuts have obfuscated the topic of water and electrolyte balance. It is not an easy issue, but one that needs thorough research and consideration. (Rhoads and Veech 1957) adapted by (Awad 2008) repeated same comments three decades later: "The use of fluid and electrolyte therapy has become such a common element of medicine that it is rarely questioned." (Veech 1986). Fluid imbalance has been linked to serious postoperative morbidity and mortality, according to the UK National Confidential Enquiry into Perioperative Deaths' 1999 report (Callum, Gray, *et al.* 1999) adapted by (Awad 2008). The study also found that 20% of the patients had inadequate fluid balance documentation or fluid imbalance that had not been identified or treated. It was said that certain medical professionals, including nurses, are not aware of the crucial significance of good hydration management. The suggestions included training in fluid management for medical and nursing staff to increase knowledge and encourage best practices as well as the notion that fluid management should be accorded the same status as the prescription of medications. (Callum, Gray *et al.* 1999) adapted by (Awad 2008).

2.2. Theoretical framework

Theoretical framework is the most essential guidance of a nursing research. A theoretical framework is based on experimental evidence based on scientific research and articles which has been thoroughly controlled and approved to avoid bias. The general purpose of theoretical framework is to make the research meaningful and easily interpreted.

In this study selection Florence Nightingale theory as framework for intensive care unit nurse's knowledge and practice regarding intravenous fluid and electrolytes.

Florence Nightingale is known for her pioneering work as a nurse during the Crimean War and for her significant contributions to the development of modern nursing. Her environmental theory, also known as the theory of nursing, focuses on the impact of the environment on a patient's health and well-being. The theory emphasizes the importance of a clean, well-ventilated, and aesthetically pleasing environment to promote healing and prevent disease (Kozier 2008).

Nightingale's theory also emphasized the importance of the nurse's role in patient care. She believed that nurses had a crucial role in the prevention of disease and in the promotion of health. According to her, the nurse's responsibility was to facilitate the patient's natural healing processes by providing a clean, comfortable, and supportive environment. Nightingale also emphasized the importance of ongoing education and training for nurses to develop the knowledge and skills necessary to provide high-quality patient care (Bastable 2021).

Today, providing structured healthcare delivery systems with effective, efficient, high-quality treatment has never been more critical or important for nurses. Nurses are able to provide care that satisfies those standards as well as to explain and record what they accomplish through engaging in theory-based nursing practice and critical thinking abilities. Professional nurses gather, organize, and classify patient data using nursing and behavioral science ideas. They also comprehend, examine, and interpret the health circumstances of their patients. Planning, administering, and assessing nursing care are all parts of the nursing process that are guided by theoretical concepts and theories, which also describe and explain desired reactions to and outcomes of care. (Papathanasiou, *et al.* 2014).

Critical care nursing is a specialized field that requires nurses to have extensive knowledge and skills in patient care. Intravenous (IV) fluid administration is a vital aspect of critical care nursing, and it is essential for nurses to have a thorough understanding of the theory and practice of IV fluid administration. Florence Nightingale, the founder of modern nursing, developed a theoretical framework for nursing that is still relevant today. Her theory can be applied to the assessment, knowledge, and practice of critical care nurses regarding IV fluid administration (Mahmood 2007). Additionally, they can examine how the availability of resources such as infusion pumps, intravenous fluids, and electrolyte solutions affect nurses' ability to deliver optimal care (Plowright, 2021).

2.3. Conceptual framework:

The Resuscitation, Optimization, Stabilization, and Evacuation (R.O.S.E.) conceptual model succinctly captures a dynamic approach to fluid therapy, maximizing benefits and limiting risks. Fluid therapy should be administered with caution in all critically ill patients, including those with burns or trauma, taking into account the significance of their unique goals. This will sustain peripheral oxygen delivery while preventing the negative effects of fluid overload. (Malbrain, et al 2020).

2.3.1. Resuscitation phase (R)

When a patient has poor end-organ perfusion and life-threatening hypovolemia, resuscitation aims to restore intravascular volume. Patients that are critically unwell and in need of this care include those who have severe gastrointestinal or fluid loss, sepsis, active bleeding, shock, or thermal injury. Based on objective indicators of hemodynamic instability, such as hypotension,

tachycardia, decreased urine output, or high lactate concentration, resuscitation should be started. To restore intravascular volume, an immediate large-volume intravenous fluid bolus must be started. Rapid intravascular volume expansion promotes cardiac output, circulation, and end organ perfusion by boosting venous return to the heart. Clinical signs of a successful resuscitation depend on the underlying cause, although they frequently include a mean arterial pressure of 65 mm Hg or higher, urine output of 0.5 mL/kg/h or higher, and, in cases of sepsis or septic shock, normalization of lactate levels. Comorbidities of the patient can also affect hemodynamic monitoring. For instance, to accurately determine if preload has been maximized, patients with heart failure may require invasive monitoring using a right heart catheter. Since resuscitation is a life-saving procedure, it is crucial for nurses to recognize and launch suitable procedures without delay (Gross *et al.* 2017).

2.3.2. Optimization phase (O)

When the patient is no longer visibly experiencing absolute or relative hypovolemia but is still hemodynamically unstable, the optimization phase begins. By now, some type of monitoring should be in place. Fluids should be supplied in accordance with each patient's needs and routinely evaluated, such as by employing fluid challenge procedures (Cecconi *et al* 2015 and Vincent, Weil 2006)

The following four crucial factors (TROL) must be considered when conducting fluid challenges: a balanced crystalloid fluid like PlasmaLyte, for example, as the fluid type; rate (10 minutes, e100-200 mL); Objective and Limitations (such as normal heart rate or arterial pressure) (e.g., high central venous pressure level)

In order to avoid and minimize organ damage, this phase aims to maximize and maintain appropriate tissue perfusion and oxygenation. Throughout the optimization phase, the patient must be closely watched; frequently, a combination of monitoring techniques (e.g., arterial catheter, echocardiogram, central venous pressure, arteriovenous blood gas) is needed to get the fullest picture of the patient's hemodynamic status. Although a resuscitation based on microcirculatory goals is anticipated to produce a similar improvement in the microcirculation, there may not be enough coherence between the two. However, in addition to lactate, a delayed capillary refill time, and a mottling score should be considered as indications of hypoperfusion. (Bennett *et al.* 2018)

2.3.3. Stabilization phase (S)

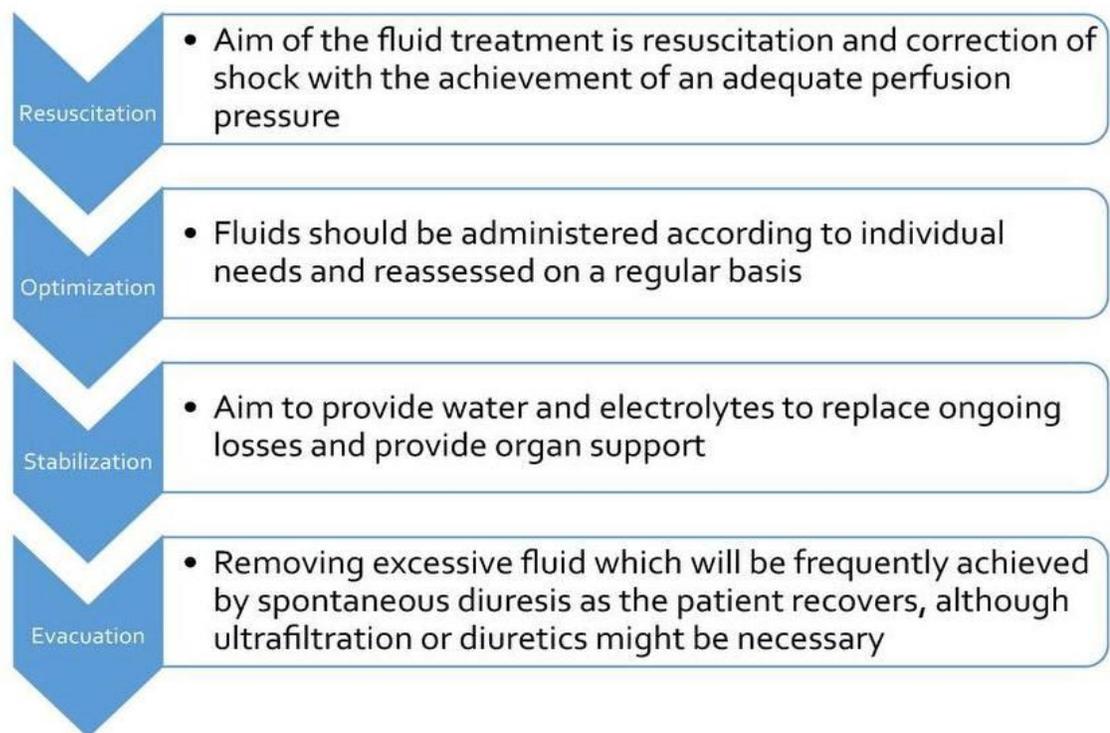
The stabilization phase starts once the patient is stabilized and lasts for days. The goal of fluid management during this stage is to make sure there is enough water and electrolytes to replenish ongoing losses and sustain the organs. A fluid balance of zero or slightly negative should be the goal. In this respect, it could be interesting to draw attention to the fact that these colloids were given liberally at the stabilization phase of the big trials that suggested a negative effect, i.e., in a phase that may not have needed these medicines' ingredients. (Perner *et al.* 2012) (Myburgh *et al.* 2012).

2.3.4. Evacuation phase (E)

Evacuation, also known as de-escalation, is the last stage, and it aims to remove extra fluid. As the patient recovers, this will typically be accomplished by spontaneous diuresis, however ultrafiltration or diuretics may be required. It's noteworthy that research from recently suggests that diuretics may encourage the

recruitment of microcirculation, hence reducing diffusion lengths and enhancing oxygen extraction (Uz *et al.* 2018).

An ongoing, dynamic process known as critical illness makes it possible for the administration of fluids to have unanticipated effects due to the development of new diseases or the acute decompensation of pre-existing ailments. Without adjusting for these modifications, intravenous fluid administration may have negative effects that raise morbidity and death. As a result, it's critical to regularly check on patients and keep a close eye on their condition in order to reduce or stop their fluid intake when it's clinically necessary. To determine when adjustments to fluid therapy are necessary, nurses should integrate clinical and laboratory assessments, including physical examination, vital signs, urine output, electrolytes, renal function, and acid-base status. (Barlow *et al.* 2020)



(Fig 2.1) The role of fluids within the R.O.S.E. concept adapter from (Malbrain,2020)

2.4. Nursing process:

This model integrated with nursing processes it is a problem-solving approach that leads the nurses to provide care based on a significant background in order to cover holistic patient needs, for this purpose the following practices presented integration between ROSE conceptual frameworks for fluid therapy and the nursing process

Type	Etiology	Nursing	Process
Resuscitation (Minutes)	Severe shock Septic shock, major trauma, hemorrhagic shock, ruptured abdominal aortic aneurysm, severe acute pancreatitis, severe burns (> 25% TBSA)	<i>Assessment</i>	-Measure and record urinary output and specific gravity - Monitor blood pressure and heart rate
		<i>Nursing Dx</i>	Risk for deficient fluid volume related to vasodilation
		<i>Planning</i>	-Patient will display hemodynamic stability. -Patient will verbalize understanding of the disease process. -Patient will achieve timely wound healing

		<i>Intervention</i>	<p>-Administer IV fluids, such as isotonic crystalloids (D W) normal saline (NS), lactated ringers [LR], and colloids (albumin, fresh frozen plasma), as indicated.</p>
		<i>Evaluation</i>	<p>-Patient displayed hemodynamic stability.</p> <p>-Patient verbalized understanding of the disease process.</p> <p>-Patient achieved timely wound healing.</p>
<i>Optimization</i> (Hours)	severe gastro-intestinal losses (vomiting, gastroenteritis)	<i>Assessment</i>	<p>-skin turgor</p> <p>-mucous membrane</p> <p>-thirst</p> <p>- monitor hourly intake and output</p>
		<i>Nursing Dx</i>	<p>-Risk for deficient fluid volume related to excessive gastric</p>

			losses due to nausea and vomiting.
		<i>Planning</i>	- After 12 hours of nursing intervention, no hypovolemic shock and no signs of dehydration will be noted
		<i>Intervention</i>	- Administer oral fluids with caution. Do a 24-hour schedule fluid intake if fluids are restricted. - Monitor infusion rate of parenteral fluids closely; may use infusion pump, as necessary -Assess patient daily
		<i>Evaluation</i>	-After 12 hours of nursing intervention, no hypovolemic shock was noted, and the mucosa of the patient was moist,

			indicating no signs of dehydration
<i>Stabilization</i> (<u>Days</u>)	Postoperative patient, abdominal vacuum-assisted closure, replacement of losses in less-severe pancreatitis	<i>Assessment</i>	- Monitor BP and measure CVP if available. - Measure I&O including vomiting, gastric aspirate, and diarrhea. Calculate 24-hr fluid balance
		<i>Nursing Dx</i>	-Risk for deficient fluid volume related to alteration of the clotting process, hemorrhage
		<i>Planning</i>	-Relief of pain and discomfort caused by pancreatitis, improvement of nutritional status, improving respiratory function, and improvement of fluid and electrolyte status

		<i>Intervention</i>	<ul style="list-style-type: none"> - Administer fluid replacement as indicated (saline solutions, albumin, blood, blood products, dextran). - Replace electrolytes (sodium, potassium, chloride, calcium as indicated).
		<i>Evaluation</i>	<ul style="list-style-type: none"> -Blood tests to look for elevated levels of pancreatic enzymes, along with white blood cells, kidney function, and liver enzymes. Abdominal ultrasound to look for gallstones and pancreas inflammation.
<i>Evacuation</i>	Patient on full enteral feed in the recovery phase of critical illness,	<i>Assessment</i>	<ul style="list-style-type: none"> Measure -I&O accurately. -Weigh daily. - urine output closely

(Days to weeks)	polyureic phase after recovering from acute tubular necrosis		-Calculate insensible fluid losses.
		<i>Nursing Dx</i>	-Risk for deficient fluid volume related to excessive loss of fluid
		<i>Planning</i>	-The patient will have adequate urine output, acceptable laboratory test results, steady weight, normal range of vital signs, and absence of edema.
		<i>Intervention</i>	Administer intravenous fluids as indicated. Clients with Acute kidney injury represent challenging fluid management problems. Hypovolemia potentiates and

			<p>exacerbates all forms of Acute kidney injury. Vigorous fluid administration in this setting aims to reverse renal ischemia and dilute nephrotoxins to either avert the onset of acute tubular necrosis or prevent recurrent injury that might compromise renal recovery (Effat <i>et al.</i>, 2021)</p>
		<p><i>Evaluation</i></p>	<p>-Evaluation should determine the presence and type of Acute kidney injury and seek a cause. Blood tests generally include complete blood count (CBC), BUN, creatinine, and electrolytes (including calcium</p>

			and phosphate). Urine tests include sodium, urea, protein, and creatinine concentration; and microscopic analysis of sediment
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That table is interpreted by the researcher.

In order to achieve or maintain optimal function, nursing practice entails promoting health as well as assessing, caring for, and treating medical disorders. This is done through supportive, preventative, therapeutic, palliative, and rehabilitative methods. Fluid, electrolyte, and acid-base imbalances can put a patient at high risk due to acute and chronic illnesses, trauma, and some therapeutic approaches. Such abnormalities can gravely jeopardize the patient's health and even put their lives in danger. (Lee 2010)

2.5. Distribution and physiology of body fluids:

Understanding the distribution of bodily water as well as the variables impacting the internal and external balance of fluid and electrolytes is necessary for the clinical management of fluid and electrolyte issues. This section discusses the broad physiological concepts behind these problems (Martini, 2005).

Understanding the factors that affect the fluid physiology of the human body that can influence how it is distributed is essential for the safe and efficient use of intravenous fluids. In a typical adult, water makes up 60% of men's lean body weight and 50% of women's total lean body weight (Harrison *et al.* 1936) adapter from (Barlow, *et al* 2020).

The intracellular space, interstitial space, and intravascular space all contain all of the body's water. The body contains two thirds intracellular water and one third extracellular water. Estimates were used for the percentages of total body water and the fluid distribution among these compartments. Age, sex, weight, and serious sickness are a few factors that can have an impact on these variables (Holliday 1999) adapter by (Kerr, C. L. 2022). (Fig. 2).

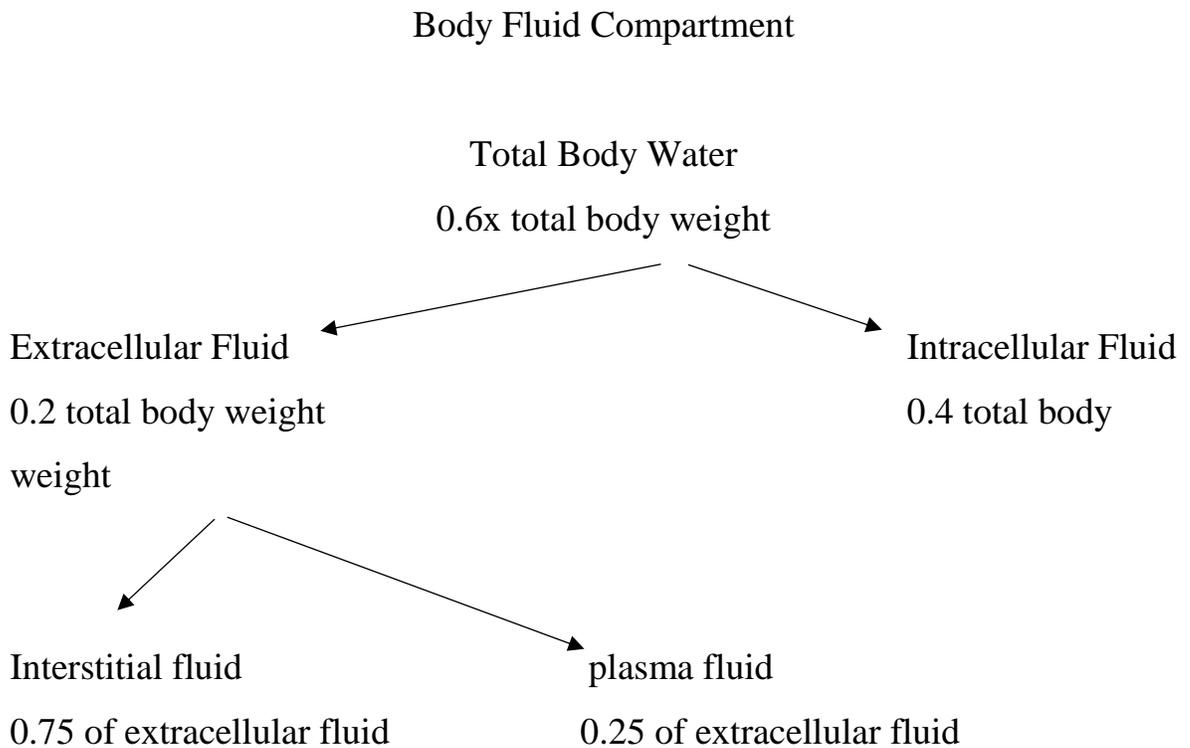


Fig 2.2. Body fluid compartment. Adapter by (Friedman A. 2010).

Water can freely move through the osmosis process thanks to the semipermeable membrane that divides these compartments. In order to maintain equilibrium, water is distributed through osmosis from low solute concentration

areas to high-solute-concentration areas. Osmosis is fueled by a fluid's tonicity, or the concentration of dissolved solutes in a solution (Holliday *et al.* 2008)

The osmolarity of a solution is defined as the total solute concentration represented as the number of solutes per liter of fluid. The nearly equal osmolarity of isotonic intravenous fluids and human plasma allows for the simple flow of fluid between the interstitial and intravascular compartments. Water is more likely to move from the intravascular compartment into the intracellular and interstitial compartments in hypotonic intravenous fluids because of the lower solute content in these solutions. Hypotonic fluids do not stay in the intravascular compartment to boost circulation. Extravasating hypotonic fluids, on the other hand, hydrate cells and tissues and can cause an excessive amount of aggregation in the interstitial spaces. The supraphysiological solute concentration of hypertonic IV fluids draw fluids from the intracellular and interstitial compartments into the intravascular space in order to maintain equilibrium. (Chesney 2008)

The secret to choosing the right fluid is to understand how osmosis and tonicity are related. If a disease or iatrogenic actions change the location and make-up of the extracellular environment, medical intervention is necessary. As with the administration of any medication, fluid and electrolyte therapy demands meticulous handling. (Friedman 2010)

2.6. Mechanism

Fluid therapy has typically been administered to patients once a clinician has determined whether they are hypovolemic, euvoletic, or hypervolemic. How does pathophysiology work? of the patient's illness, and secondly, are there electrolyte abnormalities? The majority of clinicians concentrate on hypovolemia. This disorder is particularly prevalent in pediatrics and has

historically had the highest fatality rate due to gastroenteritis. These clinical indicators give a fluid loss estimate. The degree of dehydration associated with hyponatremia is frequently less severe than it appears from clinical features. The degree of dehydration in hypernatremia is frequently higher than the clinical features imply. The extracellular space accounts for the vast bulk of patients' fluid loss. This is significant because "rapid and generous replacement of extracellular fluid with 0.9 percent saline or Ringer's solution" is the treatment for dehydration or depletion of plasma volume or extracellular volume. (isotonic liquid), according to (Friedman 2010).

Repletion can be carried out in as little as 30 to 60 minutes or as long as 8 to 12 hours, depending on how severe the depletion is. Extracellular fluid volume is often replenished as part of rapid restoration; however, in some cases, the clinical situation necessitates lengthier therapy (severe hyponatremia or severe hypernatremia). The intracellular fluid loss will occur in patients who have experienced extended fluid loss (chronic diarrhea). The extracellular (particularly interstitial) space gets depleted as a result of intracellular fluid leaking into it. Intracellular water will be replenished with adequate extracellular fluid replacement. Plasma quickly releases isotonic saline solution into the interstitial space, typically within a few minutes. One must be careful with the rate of change of osmolality in hypernatremic dehydration because the migration of water from the interstitial space to the intracellular space, which occurs with hypernatremic dehydration, can also occur in minutes (Chesney 2008).

Hyponatremic dehydration is the opposite of the former. Water will move from the intracellular to the extracellular environment as a result of the change in osmolality brought on by the infusion of isotonic saline solution. This change explains why quite a bit of sodium is required in the treatment of hyponatremia in order to properly restore the extracellular sodium concentration (osmolality).

To fully replenish intracellular fluid, more potassium may be required. Rapid, generous extracellular fluid volume restoration is the proper response to volume depletion for a number of reasons. Two hormones, aldosterone and vasopressin, are key players in the "physiologic" response to volume loss: (antidiuretic hormone). Renin-angiotensin-aldosterone (R-A-A) is a hormone that is released in response to the extracellular volume being depleted. The R-A-A response to volume depletion will be quickly shut down, limiting aldosterone secretion and minimizing potassium loss in urine (Chambliss *et al* 2020). Volume (plasma and extracellular) decrease causes the release of vasopressin. As a result, the volume of urine will reduce, and the kidneys will absorb water rapidly. Isotonic fluid should be administered when there is extracellular volume depletion because of this non-osmotic vasopressin release. Vasopressin release will stop if extracellular volume is replaced quickly. Finally, extracellular volume loss results in a reorganization of blood flow, with reduced flow to some tissues including the gut and muscle. This explains some of the challenges associated with replanting volume depletion with oral fluid administration. Hirschhorn noted that it is easier to administer fluids orally when reabsorption from the gut is adjusted with volume repletion (achieved by quick, generous, extracellular fluid repletion) (Hirschorn 1980) from (Merrill *et al* 2020).

Since Holliday and Segar's groundbreaking article more than 50 years ago, maintenance fluids have been part of everyday speech. They described a prescription for a euvolemic patient with normal renal function that calls for the intravenous injection of water and electrolytes to make up for the predicted losses of water and electrolytes over the next 24 hours. (Holliday and Segar 1957) adapted from (Holliday *et al* 2007).

While the clinician's immediate focus is on fluid and electrolyte restoration, the fluid treatment also considers continual losses and the administration They

are maintenance fluids. A patient who has experienced prior losses (vomiting, diarrhea, excessive urine losses), where the process has not ceased, and who is receiving fluids for ongoing losses, is just acknowledging that fluid loss will continue even if the preceding losses are restored. If these losses are severe, they are often repaired by measuring the volume of the loss over a period of time (such as hours); if necessary, the electrolytes in the loss are determined, particularly sodium, potassium chloride, or bicarbonate, and given back to the patient. Each compartment has a distinctly different electrolyte composition from the other. The main electrolytes (ions) found in human fluid compartments are listed in (Table 2.1). Understanding the differences between intracellular fluid, which contains potassium as a primary cation and phosphate as the primary anion, and extracellular fluid, which contains sodium as a primary cation and has chloride and bicarbonate as its primary anions, is crucial for understanding transcellular transport as well as for understanding how to treat fluid and electrolyte disorders. (Holliday and Segar 1957) adapted by (Burks 2023).

Table2.2: Electrolytes and ion composition in body fluids (ECF extracellular fluid, ICF intracellular fluid).

Ion	ECF	Interstitial	ICF
Sodium	135-145 mEq/l	145 mEq/l	10-20 mEq/l
Potassium	3.5-5.5 mEq/l	3.5-5.5 mEq/l	130-150 mEq/l
Chloride	95-105 mEq/l	100-115 mEq/l	< 3 mEq/l
Bicarbonate	22-30 mEq/l	25-35 mEq/l	< 10 mEq/l
Phosphate	2 mEq/l	2 mEq/l	110-120 mEq/l
Other	Albumin (plasma space)	No albumin	No albumin

Adapter by Friedman (2010).

Table 2.3: The severity of dehydration, Reproduced, BP. blood pressure, Ant. Anterior, Mo. Months.

Characteristic			
Infant	Mild, 1-5%	Moderate, 6-9%	Severe, >10% (≥15%=shock)
Older Children	Mild, 1-3%	Moderate, 3-6%	Severe, >6% (≥9%=shock)
Pulse	Full, normal	Rapid	Rapid, weak
Systolic BP	Normal	Normal, low	Very low
Urine output	Decreased	Decreased (<1 ml/kg per hour)	Oliguria
Buccal mucosa	Slightly dry	Dry	Parched
Ant. Fontanel	Normal	Sunken	Markedly sunken
Eyes	Normal	Sunken	Markedly sunken
Skin turgor capillary refill	Normal	Decreased	Markedly decreased
Skin	Normal	cool	Cool, mottling, acrocyanosis
Infants < 12 mo of age			

Adapter by Friedman A. (2010).

2.7. Goals of Fluid Therapy

There is no one method that works for fluid management. Critically ill patients require personalized fluid kinds, quantities, infusion rates, and durations catered to their volume status and fluid therapy objective based on the underlying illness. Because of the rapid, erratic changes in clinical status and alternate fluid sources that further complicate these aspects, this individualization is especially crucial for critically sick patients. Consideration should also be given to fluid losses that are hard to measure or that are simple to overlook. Sensible fluid losses are quantifiable and include those caused by gastric suctioning, wound drainage, urine, stool, and wound healing. It is difficult to measure and rather common during critical illness to experience irreversible fluid losses as a result of persistent fevers, sweating, laborious breathing, or mechanical ventilation (Barlow *et al.* 2020)

2.7.1. Assessment of fluid and electrolytes:

To ensure that you make the patient-centered clinical judgments necessary for providing safe nursing care, thoroughly assess each patient and critically analyze your findings during the assessment process. You can safely discuss a patient's expressed requirements, values, and preferences while helping them maintain or restore fluid, electrolyte, and acid-base balances by using a methodical approach to evaluation. However, you must obtain this information through a patient-centered assessment from a patient who is alert enough to discuss care. Pay attention to how the patient feels about the sickness and any fluid, electrolyte, or acid-base changes that occurred. For a patient who is hospitalized for clinical dehydration due to diarrhea, for instance, find out if the patient has ever had dehydration before and gauge how they perceive the signs, symptoms, and potential causes. To gauge the person's comprehension of how to

avoid the imbalances in the future, inquire further about how they have handled diarrhea at home. Consider possible obstacles to rehydration, such as doubts about IV therapy or a lack of favorite fluids at the chosen temperature. To create the foundation for an active partnership in developing, implementing, and assessing patient-centered care, find out what the patient's biggest concerns are regarding fluid status. (Suresh *et al.* 2017).

2.7.2. Physical Assessment.

The information gathered in the patient history is extended and validated by the data obtained through a targeted physical examination. Focus your evaluation on the factors that are relevant to each patient's circumstances. Consider body weight changes, clinical markers of vascular and interstitial volume, thirst, behavioral changes, and state of consciousness when assessing individuals who are at risk for fluid imbalances. Specific cardiac, respiratory, neuromuscular, and GI markers are further specialized examinations for patients at high risk of electrolyte and acid base abnormalities. By organizing your tests into these categories, you may more efficiently assess and decide which tests to prioritize. (Suresh *et al.* 2017).

2.7.3. Daily Body weight.

Daily weights are a crucial fluid condition indication. 1 L of fluid is retained or lost for every kilogram (2.2 lbs) of weight increased or decreased overnight. These fluid gains or losses do not signify shifting across physiological compartments; rather, they reflect changes in the amount of total body fluid, typically ECF. Weigh daily people with heart failure, as well as those who have ECV excess or are at high risk for it. Patients who have clinical dehydration or

who are at risk for an ECV deficit should also use daily weights. After a patient voids, weigh them using the same scale at the same time every day. Calibrate the scale frequently or every day. If using a bed scale, use the same number of sheets on the scale for each weighing. The patient must wear the same clothes or clothes that weigh the same. To determine fluid gains or losses, compare the weight at the end of each day to the weight from the day before. To spot trends, look at the weights over a number of days. The interpretation of daily weights directs nursing care and medical therapy. Teach heart failure patients to weigh themselves each day, keep track of them, and inform their doctor if their weight increases unexpectedly by a certain amount (obtain parameters from their health care providers). It's critical to spot trends in daily weights taken at home. The week before to admission, patients with decompensated heart failure frequently exhibit steady weight gains each day. (Felver, 2013).

2.7.4. Fluid Intake and Output Measurement.

An essential component of fluid balance assessment is measuring and documenting all liquid intake and output (I&O) throughout the course of a 24-hour period. A patient's 24-hour intake and 24-hour output should be compared. In the event that the person has a normal fluid balance, the two measurements should be roughly comparable. Consider the specific patient when interpreting scenarios where I&O are significantly different. For instance, if intake is significantly higher than outflow, there are two potential explanations: either the patient is consuming excessive amounts of fluid or they are regaining their normal fluid status by replacing fluid they had previously lost from the body. The patient may be losing necessary fluid from the body and developing an ECV deficit and/or hypernatremia if intake is much less than output, or the patient may be returning to normal fluid status by excreting too much fluid that was

previously obtained. I&O measurement is a nursing assessment in the majority of healthcare settings. Some organizations need a doctor's prescription for I&O. In order to decide whether they can set up an I&O measurement for a patient with compromised fluid status, nurses should review the agency policies. (Felver, 2013)

Any liquid that a person consumes, whether it be through food (such as gelatin, ice cream, or soup) or beverage (such as water, coffee, or juice), is considered to be part of their fluid intake. Blood components and IV fluids (continuous infusions and intermittent IV piggybacks) are additional sources of nutrition. When ingesting tablets or liquid drugs, water counts as an intake. Water is used to cleanse the tube before and/or after drugs are administered to a patient receiving tube feedings. These liquids add up to significant intake over the course of a day and are always noted on the I&O record. Explain to relatives why they should not consume anything from the patient's meal trays or water pitcher, and ask patients who are awake and oriented to assist with metering their oral intake. (Felver, 2013)

Urine, diarrhea, vomiting, stomach suction, and drainage from post-surgical incisions or other tubes are all examples of fluid outflow. After each voiding, take a patient's urine production into account. Patients who are conscious, oriented, and able to move around should be told to save their urine in a calibrated insert that fastens to the toilet bowl's rim. Explain to patients and their families why I&O measures are taken. Additionally, show them how to measure, empty, and properly report any container with void fluid by themselves or by calling the nurse or nursing assistant personnel (NAP). For patients to complete these measures, they must have strong vision and motor coordination. In order to maintain correct I&O readings, patient and family involvement is a crucial component of patient-centered treatment. When a patient has an indwelling

urinary catheter, drainage tube, or suction, record output as necessary for the patient's condition (for example, at the conclusion of each nursing shift or every hour). (Felver, 2013).

Parts of I&O measurement and recording can be delegated by nurses to NAP with proficiency in measuring. Visual estimations of fluid quantities are less accurate than actual measurements. In many hospitals, NAP only records oral consumption; it does not record IV or feeding intake, which fall under the purview of nursing. Similar to NAP, tube drainage is frequently missed when recording output of urine, vomit, and diarrhea. Together with the NAP, the responsible registered nurse (RN) or licensed practical nurse (LPN/LVN) enters measurements in the appropriate spot in the electronic health record (EHR), frequently on a flow sheet with other data. The 24-hour totals are typically calculated by the EHR program. Record I&O on paper forms connected to the bedside chart or room door if an EHR is not being used. The 24-hour totals are determined by you or the NAP (see agency policy). The continual assessment of a patient's hydration state is made easier by accurate I&O. (Tzamaloukas 2008)

2.7.5. Vital Signs

Vital sign changes may signal or even come before fluid, electrolyte, and acid-base imbalances. For instance, dehydration or an increase in body fluid loss may be the cause of a raised body temperature. An early indication of hypovolemia is tachycardia. In FVD, pulse volume will be lower; in FVE, it will be higher. Electrolyte abnormalities can lead to irregular pulse rhythms. A compensatory mechanism in metabolic acidosis or alkalosis may be indicated by changes in respiratory rate and depth, which can lead to respiratory acid-base imbalances. Blood pressure (BP), a sensitive indicator of blood volume changes,

may drastically decrease or rise in response to FVD, hypovolemia, and FVE. With FVD and hypovolemia, postural or orthostatic hypotension can also happen. Measure the client's blood pressure and heart rate while they are laying down to check for orthostatic hypotension. The blood pressure cuff should be left on the client's arm for 3 to 5 minutes while they are in that position. Ask the client to stand up, then check their blood pressure and pulse once more. Orthostatic or postural hypotension is indicated by a drop of 10 to 15 mmHg in systolic blood pressure, a comparable drop in diastolic blood pressure, and an elevated pulse rate (of 10 or more beats per minute). (Berman and Snyder 2018)

2.7.6. Monitoring Fluid Therapy

Fluid therapy is a proven life-saving technique, but overzealous delivery without sufficient monitoring and evaluation can counteract its positive benefits. In critically ill patients, an increase in mortality has been directly linked to the development of fluid overload. Fluid excess can also occur in heart failure, pulmonary edema, which impairs gas exchange, gastrointestinal dysfunction, and peripheral edema, which results in pressure ulcers, infections, and sluggish wound healing. (Claire-Del Granado and Mehta 2016)

In order to avoid these consequences, nurses' role in monitoring and evaluating hydration status cannot be overstated. Nurses should examine patients for peripheral edema, pulmonary crackles, shortness of breath, jugular venous distention, and additional heart sounds as indicators of hypervolemia (Claire-Del Granado and Mehta 2016).

Due to the risks associated with intravenous fluid therapy and the fact that only approximately half of patients benefit from it, predictors of fluid responsiveness can be used to help determine whether a certain patient is likely to respond. Static indicators of fluid responsiveness include right ventricular end-

diastolic volume, left ventricular end-diastolic volume, central venous pressure, and pulmonary artery occlusion pressure are no longer commonly recommended for directing or evaluating response to intravenous fluid therapy. Dynamic measures like stroke volume variation, pulse pressure variation, and inferior vena cava collapsibility are better at predicting fluid responsiveness. (Alvarado Sánchez *et al.* 2018).

The degree and rate of the intended rise are patient-specific. An increase in blood pressure or cardiac output is usually used to assess the effectiveness of intravenous fluid therapy. A patient may be responding correctly to intravenous fluid therapy if their urine production increases to more than 0.5 mL/kg/h or if their lactate level drops. Perhaps more suitable measurements of response to intravenous fluids include dynamic measures of fluid responsiveness, such as stroke volume variation measurement, echocardiography to evaluate cardiac output, and others. It's crucial to be aware of other factors that can cause fluid overloads, such as the intermittent administration of intravenous medications and the continuous infusion of total parenteral nutrition products, sedatives, analgesics, and vasopressors, which can make up a sizable portion of the fluid administered. A higher mortality rate is linked to fluid overload levels of more than 10%, which are computed by dividing admission body weight in kilograms by admission fluid intake in liters, then multiplying by 100. (Frazee *et al.* 2015), (Benes and Kirov *et al.* 2015)

Monitoring for under-resuscitation and under-replacement is another vital duty of the critical care nurse. Nurses keep an eye out for signs of hypotension such as tachycardia in hypotension (which may be a compensatory response), decreased urine output, prolonged capillary refill time, and lower-than-expected blood pressure (either systolic or mean arterial pressure). (Benes and Kirov *et al.* 2015)

On the other hand, patients with diabetes insipidus, hyperglycemic crises, or iatrogenic diuretic use may produce an excessive amount of urine, which results in hypovolemia. AKI, electrolyte imbalances, and acid-base issues are some additional fluid treatment adverse effects that need to be checked for.

Laboratory values such as sodium, creatinine, and lactate should be evaluated at least once daily in patients with unstable situations since they are related to volume status and the harmful consequences of fluid therapy. Other electrolytes, such as potassium, chloride, and magnesium, should also be checked before to fluid therapy and at irregular intervals in order to establish a secure electrolyte balance and guarantee that the appropriate fluid is selected (Frazee *et al.* 2015).

Patients may have different fluid needs when they first arrive, and they may also be going through acute illness processes that are dynamically affecting their fluid status and requirements. The bedside critical care nurse must therefore constantly reevaluate patients and their hydration management. (Benes and Kirov *et al* 2015).

2.8. Internal fluid balance and body water compartments

Body water makes up 60% of the average healthy subject's body weight and 73 % of their lean mass. Being largely anhydrous, fat and bone, heavier people have lower body water percentages. (Moore 1959) adapted by (Bhave 2011).

Extracellular fluid (ECF) and intracellular fluid are the two compartments that make up the body's water in a functional way (ICF). The cell membrane separates the intracellular fluid from the extracellular fluid, and it is the sodium potassium ATPase pump that keeps the two compartments' fluid levels balanced. The primary external cation is sodium, whereas the primary intracellular cation

is potassium. The latter cation counteracts the negative charges on proteins and other intracellular molecules. (Aronson *et al* 2016).

A part of ECF that is also found in the cerebral column, pleural cavity, lymphatic system, joints, glandular secretions, and eyes is transcellular fluid. Transcellular fluid is not significantly gained or lost every day. ICF is found inside cells and accounts for about 40% of an adult's body weight (Metheny, 2012).

ICF and ECF are separated by capillary walls and cell membranes, however ECF needs to be balanced with ICF. Compared to ICF, ECF is more easily eliminated from the body (McLafferty, Johnstone, Hendry, & Farley, 2014).

The intravascular, interstitial, and transcellular fluid gaps further split the ECF compartment: The actual circulating volume is plasma, which is found in the intravascular space (the fluid inside blood arteries). Plasma makes up around 3 L of the typical 6 L blood volume in humans. Erythrocytes, leukocytes, and thrombocytes make up the final 3 L. The fluid that surrounds the cell is located in the interstitial space, which in an adult has 11–12 L of fluid. Interstitial fluid is lymph. The transcellular space, the tiniest component of the ECF compartment, has a volume of about 1 L. Cerebrospinal, pericardial, synovial, intraocular, pleural, perspiration, and digestive secretions are a few examples of transcellular fluids. In addition to carrying electrolytes, the ECF also carries hormones and enzymes. In an effort to keep the two primary compartments or spaces balanced, body fluid typically travels back and forth between them. The body losing fluid might throw off this balance. Even when bodily fluid is not lost, the ICF or ECF may not be able to use it. Third-space fluid shift, also known as third spacing, is the term used to describe the loss of ECF into a space that does not contribute to the ICF and the ECF reaching equilibrium. (Papadakis & McPhee, 2016).

A decrease in urine output despite appropriate fluid intake is the first sign of a third-space fluid shift. The kidneys receive less blood as a result of fluid shifting out of the intravascular region, and they try to make up for it by producing less urine. Third spacing can also manifest as edema, increased body weight, decreased blood pressure, decreased central venous pressure, increased heart rate, lowered blood pressure, and abnormalities in fluid intake and output (I&O). Over a few days to a few weeks, this fluid will be reabsorbed back into the extracellular space. To avoid additional difficulties, the acute volume loss must be recovered. Intestinal blockage, pancreatitis, traumatic injuries that produce crushing, bleeding (due to trauma or a dissected aortic aneurysm), peritonitis, and significant venous obstruction are a few causes of third-space fluid losses. (Sterns, 2014a).

All of the body's cells are both inside and surrounded by fluid. Electrolytes like salt and potassium are present in body fluids, along with some acidity. All bodily systems are kept healthy and functioning by fluid, electrolyte, and acid-base balances. Due to their effects on cell activity, bodily fluid properties have an impact on how well some bodily systems work. These properties include the volume, osmolality, composition, electrolyte concentration, and acidity level of the fluid (pH). There are control systems for each of these traits that maintain their equilibrium for normal operation. Learn how the body typically maintains fluid, electrolyte, and acid-base balance in this chapter. Additionally, you study how various fluid, electrolyte, and acid-base imbalances influence patients as well as how to properly assist them in maintaining or restoring balance. (Hinkle, J. L., & Cheever, K. H. 2018).

The cell membrane does not prevent water from passing through it, but larger molecules like proteins, whose negative charges help retain potassium inside the cell, are not allowed to do so (Gibbs-Donnan equilibrium). It is

impossible to alter the ECF's tonicity without also altering the ICF because changes in water entering or leaving the cell depend on the osmotic gradient between the ECF and the ICF. This is how uniform osmotic pressure is maintained. When salt is added to the ECF or water is removed from it, the tonicity is raised. Then, as water passes from the ICF to the ECF, cells become dehydrated, their thirst is heightened, and arginine vasopressin is secreted (AVP). On the other hand, if salt is taken out of or water is added to the ECF, tonicity is reduced, water travels from the ECF to the ICF, increasing cellular hydration, suppressing AVP, and decreasing thirst. The cell membrane does not prevent water from passing through it, but larger molecules like proteins, whose negative charges help retain potassium inside the cell, are not allowed to do so (Gibbs-Donnan equilibrium). It is impossible to alter the tonicity of the ECF without altering the ICF, which is how uniform osmotic pressure is maintained. Changes of water into or out of the cell depend on the osmotic gradient between the ECF and the ICF. When salt is added to the ECF or water is removed from it, the tonicity is raised. Water then dehydrates cells, stimulates thirst, and secretes arginine vasopressin as it flows from the ICF to the ECF (AVP). On the other hand, if salt is taken out of or water is added to the ECF, tonicity is lowered, water travels from the ECF to the ICF, and this enhances cellular hydration, stifles AVP, and reduces thirst (Koeppen 2023).

Although there are ways to assess the volume of the ECF, total body water, and plasma, there is no direct way to assess the volume of the ICF. So, the ECF volume must be subtracted from the total body water in order to compute it. A drug that attaches to plasma proteins and doesn't circulate quickly can have its early volume of distribution evaluated to determine how much plasma is present. There have been experiments using albumin labeled with ^{125}I or ^{131}I , Evan's blue (T 1824), and vital red. The ECF volume is calculated using a material that

disperses itself throughout the ECF but does not penetrate the cells. It ought to quickly re-establish equilibrium to prevent the need for a sizable correction due to metabolic decay and urine loss. Thiocyanate, inulin, sucrose, bromide, and radiolabeled sulphate have all been used, but the optimum ingredient has not yet been discovered. Utilizing compounds like urea, thiourea, antipyrine, deuterium, and tritium that diffuse uniformly throughout the body water, one can calculate the amount of total body water in the body. (Koeppen 2023).

The ICF has been compared to the disperse phase of an emulsion, while the ECF has been compared to the continuous phase of an emulsion, highlighting the ECF's role as a transport medium that permeates all tissues while the ICF provides the anatomical basis for differentiation of cellular chemical function (Edelman and Liebman 1959; Robinson and McCance 1952) adapted by (Bhave 2011).

The ECF, according to Claude Bernard, offers the body's tissue cells an almost constant internal environment (*milieu interior*) in which they can securely graze. Only through such a configuration can the body safely digest animal tissue or produce acidic urine without causing harm to its own cells. (Black 1960) adapted by (Bhave 2011).

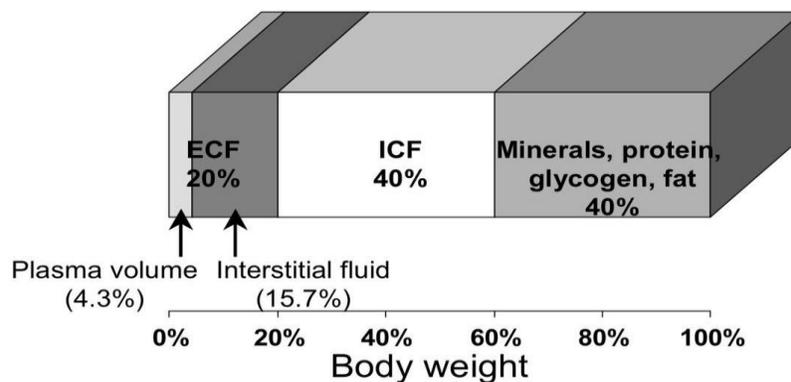


Fig 2.3: Represented as a percentage of body weight are the body's water reserves. Extracellular fluid (ECF) and intracellular fluid (ICF) (Lobo, Dileep N 2003)

The ECF is further divided by the capillary membrane into its intravascular and interstitial compartments (Fig.2.3), with the equilibrium between these compartments being controlled by the relative concentration of proteins and the resulting oncotic pressure on the two sides of the membrane as well as the capillary hydrostatic pressure. Inflammation also affects membrane pore size. Starling's equation, now known as the Law of the Capillary, demonstrates that the extravascular water flux is inversely linked to the capillary oncotic pressure as long as other elements in the equation remain constant. The body's sodium content influences how well intravascular and ECF quantities are preserved. A proper sodium intake or excretion protects the consistency of both amounts. This thesis will show that the kidney's capacity to excrete an excess of sodium may be constrained, maybe as a result of the fact that mammalian evolution has not been particularly exposed to this circumstance. The kidney has a huge capacity for salt storage (Shrivastava *et al* 2023).

2.9. Intravenous (IV) fluid

Patients of all ages frequently have fluid and electrolyte disorders. There are numerous causes that have been linked to the emergence of these imbalances. Populations at each end of the lifespan are at a higher risk of morbidity and mortality due to dehydration, overhydration, salt and water deficiencies, and these factors (El-Sharkawy 2014).

One of the simplest ICU procedures is IV fluid administration, which is essential for attaining and maintaining fluid and electrolyte balance in seriously unwell patients. The main objective of IVF is to reach a sufficient level of cardiac output and circulating blood volume to guarantee appropriate tissue oxygenation and prevent the failure of numerous organs. Additionally, it helps prevent cerebral edema caused by acute or chronic hyponatremia, corrects minor

extracellular fluid (ECF) depletion, replaces ongoing losses, prevents oliguria, and provides maintenance fluids to replace insensible fluid and electrolyte losses (such as sweat and GI-tract losses). However, ICU doctors reportedly have trouble everyday maximizing patients' hydration status, according to Cannes son. (Hinkle 2018)

Critical illness and electrolyte and fluid abnormalities the differential between intake and outflow is known as fluid balance, which takes into account the total body water (TBW), its compartmental distribution, and the composition of the plasma. A patient's volume status is affected by a number of factors. The vast spectrum of physiological anomalies associated with critical illness increase the risk of fluid and electrolyte imbalances in the critically ill patient. (Scales 2008).

Balance of fluids and electrolytes depends on dynamic processes, which are essential for maintaining life and homeostasis. Every situation, disorder, and variety of changes that affect both healthy people (such as increased fluid and sodium loss with strenuous exercise and high environmental temperature, inadequate intake of fluid and electrolytes) and those who are ill can lead to potential or actual disorders of fluid and electrolyte balance. (Roumelioti 2018).

For nurses to be prepared for, recognize, and address potential imbalances, they must be knowledgeable about the physiology of fluid, electrolyte, and acid-base balance. Nurses can prevent and manage a variety of fluid and electrolyte abnormalities by using appropriate education and communication techniques (Roumelioti 2018).

A fluid balance chart has been set up to record the patient's intake and output of fluids in order to determine their status (Fig.2.4). The measurement of the fluid balance is simpler and non-intrusive. Similar to a chart, a fluid balance sheet records the patient's intake and outflow over the course of a day. The fluid

balance chart was noted as essential for assisting decision-makers while considering medical and surgical procedures. The efficient care of patients depends on appropriate fluid balance monitoring. A problem could result from improper fluid balance monitoring or faulty recording, and the patient's condition could deteriorate. (Scales & Pilsworth, 2008).

Fluid balance documentation is significantly hampered by inadequate education and training, though. Inaccurate fluid balance recording may be caused by new nurses, recent graduates, and student nurses. The nurses who are skilled at accurately documenting information regarding the patient's state and fluid balance should be assigned to monitoring it. To accurately complete the fluid balance documentation and give it over to the next shift's workers, time should be allocated per shift. However, adequate time is necessary for correct fluid balance documentation, and insufficient time may result in faulty documentations, which could threaten the patient's safety. (Scales & Pilsworth, 2008).

Fluid Intake/Output Chart

Name		Likes to be called												
Room number		Date of birth												
Prepared by														
G.P/Consultant signature														
Date plan agreed														
Please record as accurately as possible on this form the quota of fluids you drink and volume of urine you pass. Please record the fluids in millitres (1fluid ounce = 30ml). Bring this form with you when you next attend the clinic. Each time you pass urine you will need to catch it in a container calibrated in volumes.														
	MON		TUES		WEDS		THURS		FRI		SAT		SUN	
	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
8.00 AM														
9.00 AM														
10.00 AM														
11.00 AM														
12.00 MIDDAY														
1.00 PM														
2.00 PM														
3.00 PM														
4.00 PM														
5.00 PM														
6.00 PM														
7.00 PM														
8.00 PM														
9.00 PM														
10.00 PM														
11.00 PM														
12.00 MIDNIGHT														
1.00 AM														
2.00 AM														
3.00 AM														
4.00 AM														
5.00 AM														
6.00 AM														
7.00 AM														
TOTAL VOLUME														
Day time visits														
Night time visits														

Fig2.4: Chart for measuring fluid intake and output of patients in hospitals (Holroyd, S. 2020).

Additionally, correct fluid balance records are necessary for health professionals including doctors, nurses, surgeons, and dieticians to develop future patient treatment plans. For quality care, it is essential to know the precise amounts of urine, drainage, and vomiting output. Such knowledge is necessary

to shield patients from issues like fluid overload. (Jeyapala, Gerth, Patel, & Syed, 2015).

The study also found that fluid monitoring enhances the procedures for precise fluid balance documentation. (Scales & Pilsworth, 2008). For cardiac surgery patients, the nurse's expertise in fluid and electrolyte management is crucial to preventing complications and ensuring high standards of care. (Eastwood *et al.*, 2012).

2.9.1. Intravenous Fluid Management in Critically ill patient:

In the intensive care unit, intravenous fluid delivery is a nearly universal intervention (ICU). It might be difficult to administer intravenous fluids to critically ill patients because of risk factors that change fluid distribution and hasten volume losses. The dynamic nature of critical illness, where fluid requirements might vary frequently and quickly, contributes to these complications. Because uncorrected fluid imbalances are linked to higher morbidity and death, critical care nurses must be prepared to handle these difficulties. A full grasp of fluid homeostasis, composition, and effects on hemodynamics is necessary for effective fluid management. The available intravenous fluids can be roughly categorized as colloids or crystalloids. Fluid treatment is indicated in cases when there have been insensible fluid losses, volume deficits, or intravascular volume depletion that needs to be restored. The purpose of fluid therapy should be taken into consideration while choosing the fluid composition, dose, and duration. For instance, an essential part of caring for critically unwell sepsis patients is intravenous fluid resuscitation to quickly restore systemic circulation. Although intravenous fluids can save lives, side effects from the medication also have the potential to affect how patients respond to it. Therefore, fluids should be treated as medications with specific

prescriptions and close patient monitoring. The critical care nurse's knowledge of fluid physiology, intravenous fluid composition, dosages, indications, and side effects will be improved by this review article. (Barlow A. *et al.* 2020).

2.10. Types of Intravenous Fluids

Crystalloids and colloids are the two main types of fluids available for intravenous usage. Given the lack of compelling evidence demonstrating the superiority of one type over another, the best fluid is still a subject of intense discussion. Due to the lack of agreement, the main guiding criteria for choosing fluids include fluid composition, impact on hemodynamics, and specific negative consequences. (Lewis *et al.* 2018).

2.10.1. Crystalloid Solutions

The majority of intravenous fluids still used in intensive care units (ICU) are crystalloid solutions, with normal saline (0.9 % sodium chloride) being the most frequently recommended. Crystalloids are aqueous solutions made up of different amounts of substances like electrolytes and dextrose that affect each solution's total osmolality. Additionally, these solutions can be generically characterized as isotonic, hypotonic, or hypertonic based on their tonicity. The best crystalloid should be chosen by matching its physicochemical characteristics to the desired hemodynamic outcome. (Rudloff & Hopper 2021).

2.10.1.1 Isotonic Solutions.

The basis for volume resuscitation and maintenance therapy in the critically ill are isotonic crystalloids, which can be classed as balanced or unbalanced. These solutions can be freely distributed throughout the body in the same proportions as total body water, of which one-third is distributed intravascularly

and interstitially and the remaining two-thirds intracellularly, thanks to their tonicity being roughly equivalent to that of human plasma (roughly 300 mOsm/L) (Brown. *et al.* 2019)

Normal saline, which has an equal amount of sodium and chloride (154 mEq/L of each), is the model isotonic crystalloid (Zhou *et al.* 2018). The word "normal" is misleading because this solution has little in common with human plasma. The amount of chloride in the solution is far higher than what is necessary for human health (154 mEq/L vs. roughly 100 mEq/L), and it also lacks an acid-base buffer and all other necessary electrolytes. Normal saline is slightly hypertonic because it contains more sodium than human plasma (154 mEq/L vs. roughly 140 mEq/L). These reasons led to the subcategorization of normal saline as an imbalanced solution. Human plasma is intended to be complemented with balanced crystalloids, such as lactated Ringer solution, Hartmann solution, and multiple electrolytes injection (Plasma-Lyte A, Baxter). Magnesium, potassium, and calcium are added to create a fluid with a composition resembling that of human plasma by replacing excess chloride with a buffering agent such lactate, acetate, or gluconate, which helps to balance the pH and lower osmolality. The table (2.3) offers a thorough comparison of the chemical make-up of the available crystalloid solutions. In sepsis, volume depletion, or dehydration situations, isotonic solutions are utilized as the initial intervention for resuscitation or replacement treatment to restore intravascular volume. When maintaining both electrolytes and fluid volume, balanced crystalloids may be chosen (eg, with burns, fistula drainage, gastrointestinal tract losses, trauma, or surgery). Critical care nurses should be aware of the connections between crystalloid composition and associated outcomes and the existing evidence for their usage in the ICU given the prevalence of isotonic solution use. (Lira *et al.* 2014).

Peripheral edema and hemodilution are universal side effects of all isotonic crystalloid solutions. Poor intravascular retention is caused by the fast, uneven diffusion of isotonic crystalloids from the plasma into the interstitium. Therefore, to restore intravascular volume, large quantities and frequent delivery are needed. (Brown *et al* 2019 and Finfer *et al* 2018). The increased volume may contribute to pulmonary or peripheral edema, which may impair respiratory performance and lengthen the time that mechanical ventilation is required. Hemodilution results in the dilution of clotting components intravascularly, which might make bleeding more difficult in individuals who are not receiving blood product treatment (Semler 2016).

There is mounting evidence that the chloride-rich composition of normal saline has negative impacts on patient outcomes (Lee *et al.* 2016). Given the frequency of usage and large amounts needed for resuscitation, the incidence of hyperchloremia with the injection of normal saline is frequent. Recent research has linked hyperchloremia to a higher risk of ICU-related mortality, metabolic acidosis, and acute kidney injury (AKI). (Gross *et al.* 2017 and Van *et al.* 2016). The hallmark toxicity of normal saline treatment is hyperchloremic metabolic acidosis, which is predictable, dose-dependent, and common. (Gross *et al.* 2017). This iatrogenic acid-base disruption can make it more difficult to interpret arterial blood gas findings, which are used as indicators of clinical improvement in patients with diabetic ketoacidosis or sepsis, and it can exacerbate preexisting metabolic problems in these individuals. Chloride-induced renal vasoconstriction and decreased diuresis brought on by an excessive salt load are what create the unfavorable effects on the kidney, which then lead to decreased renal perfusion, decreased glomerular filtration, and a consequent fluid overload (Yau and Kuan 2016). When substantial fluid volumes are required, balanced

solutions are now more frequently used as a result of growing understanding of these negative effects (Semler 2016).

Although in theory balanced solutions are identical to physiological fluids, there are several drawbacks to their electrolyte makeup and buffers that are used to restore acid-base balance. For instance, the liver metabolizes buffer sodium lactate from lactated Ringer solution primarily into bicarbonate. Advanced liver disease patients have impaired lactate metabolism, which leads to an excessive buildup of sodium lactate and can artificially raise serum lactate levels. (Reddy 2016).

Hyperglycemia is produced as a result of the conversion of exogenous lactate to glucose through gluconeogenesis. Large-volume dosing of lactated Ringer solution may also result in temporary cerebral edema and elevated intracranial pressure due to its relative hypotonicity. Patients who have suffered brain damage or who run the risk of experiencing an increase in intracranial pressure should use lactated Ringer solution with caution. Patients with advanced liver illness may find Plasma-Lyte A to be an appealing alternative because the acetate buffer in it is quickly digested through extrahepatic pathways (Weinberg 2016).

Acetate does carry some risk, though. Particularly in patients receiving renal replacement treatment, it may inhibit myocardial contractility and result in severe hypotension. (Finfer *et al.* 2018)

Selecting a fluid also depends on the various auxiliary cations added to balanced crystalloid solutions. Lactated Ringer solution and Hartmann solution both include calcium, which can chelate the anticoagulant citrate found in dialysis catheters and blood products given through the same intravenous catheter, increasing the chance of clot formation. (Reddy 2016). To provide

citrate-containing solutions, normal saline is the preferable fluid (Carson *et al.* 2016)

Due to the possibility of insoluble calcium precipitation, ceftriaxone, a common cephalosporin antibiotic, cannot be administered using a Y connection with lactated ringer solution or Hartman solution. (Spencer *et al.* 2018)

Despite having a very low potassium level, balanced crystalloids are typically avoided by individuals with hyperkalemia. Clinical trial data disprove this myth, showing that balanced crystalloid solutions and normal saline both carry the same risk of hyperkalemia in high-risk populations (kidney transplant recipients and patients with AKI) (Weinberg 2016).

In fact, due to the extracellular shifting of potassium, metabolic acidosis related to normal saline delivery caused a greater frequency of hyperkalemia. Nurses need to be aware of each crystalloid solution's side effects and how they affect critically sick patients' ability to receive patient-centered care. (Gross *et al.* 2017).

Due to the potential risk of potentiating intracranial pressure increases, balanced crystalloids were rarely randomly administered to patients with traumatic brain injury. Balanced crystalloids cannot be advised for patients with traumatic brain injury until additional research are completed because many patients with traumatic brain damage in these trials were given normal saline by the doctors. Additionally, no differences were reported between balanced crystalloids and normal saline in terms of in-hospital and ICU mortality, the development of AKI, or the demand for new renal replacement treatment in critically sick patients in two recent meta-analyses. The quality of the included studies, some of which reported small sample sizes, receipt of other fluid types prior to study enrolment, various designs, and brief (24–72-hour) durations of

fluid administration, imposes limitations on these meta-analyses. (Spencer *et al.* 2018).

To definitively say that there are no differences between the therapies, additional clinical trials must be carried out. According to the results of these meta-analyses, it is feasible to use balanced crystalloid solutions in the patient groups under study to lower the risks of developing new or worsening AKI and needing new renal replacement treatment. (Jackson *et al.* 2019).

2.10.1.2. Hypotonic Solutions.

Dextrose at 5 % in water, sodium chloride at a concentration of 0.45 %, and the two substances together are examples of hypotonic solutions. Although glucose increases the osmolarity of a solution, it does not increase its tonicity because, unlike sodium and chloride ions, glucose may pass through cell membranes. Free water is present in hypotonic solutions, which replenish intracellular fluid deficits. States of excessive free-water loss, such as diabetic ketoacidosis and hyperosmolar hyperglycemic syndrome, as well as the treatment of hypernatremia, are frequent indications for the administration of hypotonic solutions. (Edwards 2014) Hypotonic fluids have low intravascular retention after injection and diffuse into the interstitial or intracellular regions. Because they will not restore intravascular volume, hypotonic solutions are not employed for resuscitation or to treat hypovolemia. Furthermore, redistribution into the central nervous system can cause cerebral edema and elevated intracranial pressure. More than 100 examples of iatrogenic death or long-term neurological disability due to hyponatremic encephalopathy have been linked to large-volume or prolonged duration of hypotonic fluid treatment (Hankins2010).

Avoiding hypotonic fluids in patients with traumatic brain injuries or other central nervous system problems has become standard practice. Concerning is

the possibility of peripheral edema, particularly in patients with redistribution tendencies. As part of normal maintenance, it is common practice to deliver hypotonic fluids, frequently in the form of a solution of dextrose 5% in water and sodium chloride 0.45%. Depending on the rate of infusion, this dextrose level may supply enough calories to prevent hypoglycemia but is insufficient for comprehensive nutritional support. (Hankins 2010).

2.10.1.3 Hypertonic Solutions.

Human plasma has a significantly lower osmolarity and sodium and chloride content than hypertonic solutions like three percentage sodium chloride. Because of the significant osmotic force that pulls extravascular fluid into the intravascular region, these substances are known as plasma expanders. In comparison to isotonic solutions, lower quantities are needed to restore intravascular volume, lowering the risk of volume-related negative effects. Severe symptomatic hyponatremia and increased intracranial pressure are two common reasons to administer hypertonic saline. (Aber 2002)

Critically ill individuals with predisposed factors like cardiac or renal disease require watchful management since hypertonic solutions carry a risk of fluid overload. Hypertonic saline, as opposed to hypotonic fluids, can exacerbate cellular dehydration and ought to be avoided in patients who are dehydrated or have diabetic ketoacidosis. Rapid correction of hyponatremia (greater than 10–12 mEq/L/d) with hypertonic saline may cause central pontine myelinolysis, an irreversible neurological disease. To avoid sudden rises, careful monitoring of sodium levels and osmolality is required. (Myburgh 2013)

Due to its high osmolarity, hypertonic saline should only be injected using a special central catheter to prevent phlebitis. Hypertonic saline should only be used in high-acuity locations with heightened nurse supervision due to the

potential dangers involved. Table 2.3 show the commonly used intravenous fluid (Hankins 2010).

Table 2.4. Commonly used intravenous fluid

Name of Solution	Type of Solution	Ingredients in 1 L	Uses	Complication
0.45 % Sodium Chloride <u>Shorthand</u> <u>Notation:</u> 1\2 NS	Hypotonic PH 5.6	77 mEq Sodium 77 mEq chloride	Hypotonic hydration; replace sodium and chloride; hyperosmolar diabetes	It too much is mixed with blood cells during transfusions, the cells will pull water into them and
0.9% Sodium Chloride <u>Shorthand</u> <u>Notation:</u> NS	Isotonic pH 5.6	154 mEq Sodium 154 mEq chloride	Isotonic hydration; replace sodium and chloride; alkalosis; blood transfusions (will not hemolyze blood cells)	rupture None known
3% Sodium Chloride	Hypertonic pH 5.0	513 mEq Sodium 513 mEq chloride	Symptomatic hyponatremia d/t excessive sweating, vomiting, renal impairment, and excessive water intake	Rapid or continuous infusion can result in hypernatremia or hyperchloremia

5% Sodium Chloride	Hypertonic pH 5.8	855 mEq Sodium 855 mEq chloride		
5% Dextrose in water <u>Shorthand</u> <u>Notation:</u> D5W	Isotonic pH 5.0	5g Dextrose (170 calories\L)	Isotonic hydration; provides some calories	Water intoxication and dilution of body's electrolytes with long. continuous infusions
10% Dextrose in water <u>Shorthand</u> <u>Notation:</u> D10W	Hypertonic pH 4.3	10g Dextrose (340 calories\L)	May be infused peripherally; hypertonic hydration; provides some calories	
5% Dextrose in 0.25% (or 1\4 Strength) Saline <u>Shorthand</u> <u>Notation:</u> D5 1\4 NS	Hypertonic pH 4.4	5g Dextrose 34 mEq Sodium 34 mEq chloride	Fluid replacement; replacement of sodium, chloride, and some calories	
5% Dextrose in 0.45%	Hypertonic pH 4.4	5g Dextrose 77 mEq Sodium 77 mEq chloride	Hypertonic fluid	Vein irritation because of acidic pH, causes agglomeration (clustering) if used with blood transfusions; hyperglycemia with rapid infusion leading to osmotic diuresis

<p>Sodium Chloride <u>Shorthand</u> <u>Notation:</u> D5 1\4 NS</p>			<p>replacement; replace sodium, chloride, and some calories</p>	
<p>5% Dextrose in 0.9% Sodium Chloride (or Normal Saline) <u>Shorthand</u> <u>Notation:</u> D5NS</p>	<p>Hypertonic pH 4.4</p>	<p>5g Dextrose 154 mEq Sodium 154 mEq chloride</p>	<p>Hypertonic fluid replacement; replace sodium, chloride, and some calories</p>	
<p>Ringers Injection U. S. P</p>	<p>Isotonic pH 5.8</p>	<p>147 mEq Sodium 4 mEq Potassium 155 mEq Calcium 4 mEq Chloride</p>	<p>Electrolyte replacement; hydration; often used to replace ECF losses</p>	<p>Rapid administration leads to excessive introduction of electrolytes and leads to fluid overload and congestive conditions; provides no calories and is not an adequate maintenance solution if</p>

Adopted for (Timby, B. K. 2009)

2.10.2. Colloid Solutions

Large insoluble molecules present in colloidal solutions, such as proteins or starches, are largely impervious to cell membranes. By creating a strong oncotic pressure gradient that pulls fluid from the interstitium into the intravascular space, these molecules restore fluid balance. These solutions, which resemble hypertonic crystalloids, are frequently referred to as plasma expanders. Colloids have a long-lasting duration of fluid expansion of 12 to 24 hours thanks to intravascular persistence, compared to 1 to 4 hours for crystalloids. in 2004 (American Thoracic Society). Colloids are regarded as volume-sparing because they remove excessive fluid from interstitial spaces. Older studies in patients with critical illnesses showed that the true ratio is closer to 1 L of the colloid solution to 1.4 L of the crystalloid solution. Traditionally, administration of 1 L of the colloid solution was thought to provide a similar volume expansion as 3 to 4 L of the crystalloid solution. (Frazee 2015).

Large endogenous protein called albumin, which is only produced by the liver, keeps the intravascular space's oncotic pressure at a high level. Albumin is a protein that is extracted from pooled human plasma and sold as a five percent or 25 percent solution. It is considered iso-oncotic to use the 5 percent solution. This remedy successfully increases intravascular fluid content by 100% and is utilized for hypovolemic conditions. The 25 percent solution is hyper oncotic and causes a 400% increase in plasma volume. For critically ill patients with third spacing who need fluid mobilization from the interstitium, this approach is used. Because mobilization depends on sufficient interstitial fluid reserves, the 25% albumin solution may damage the circulatory system when there is a total body water deficit. (Gross *et al.* 2017).

Although albumin is the most often utilized colloid in the ICU, there has long been debate concerning its place in clinical practice. As a result of severe

illness brought on by starvation, advanced liver disease, sepsis, inflammation, or trauma, hypoalbuminemia may develop. The American Thoracic Society (2004). Although extended ICU hospitalizations and worse mortality are linked to low levels of circulating endogenous albumin, replacing it with exogenous albumin has not always been associated with better clinical results. (Feldman *et al.* 2020)

The four percent albumin and regular saline were contrasted in the saline versus albumin fluid assessment experiment for ICU resuscitation. No differences were found between the two groups for the primary outcome of 28-day all-cause mortality (relative risk, 0.99; 95 percent CI, 0.91-1.09; P=.87). In all populations, these results weren't universal. Compared to patients who got normal saline, there was a higher relative risk of death in the subgroup of patients with traumatic brain injury who received albumin (relative risk, 1.62; 95 percent confidence interval, 1.12-2.34; P=.009) (Hunter. *et al.* 2016). The blood-brain barrier's increased permeability, which allowed albumin to leak into the cerebral space and cause dangerous elevations in ICP, was the primary cause of this discrepancy (Cooper 2013). Those who got albumin while being treated for severe sepsis showed a tendency toward lower mortality (relative risk, 0.87; 95% confidence interval, 0.74-1.02). Although encouraging, additional clinical trials and meta-analyses have not consistently replicated this result (Hunter *et al.* 2016).

The sepsis recommendations advise considering albumin if crystalloids fail to restore intravascular volume because the evidence suggests no serious safety issues and overall outcomes are comparable to those of crystalloids. It is wise to save the use of albumin for conditions where albumin has shown survival benefits other than sepsis, given the equivalent efficacy of albumin and crystalloids and the higher cost of albumin. Hepatorenal syndrome, large volume paracentesis, spontaneous bacterial peritonitis, and therapeutic plasmapheresis

are the indications with the strongest supporting data (American Thoracic Society 2004).

In critically ill or malnourished individuals, albumin should not be administered only for the goal of bringing plasma albumin levels back to normal. Regarding security, albumin is a plasma-derived substance with a potential for spreading blood-borne diseases. Anaphylactic responses are an uncommon but possibly fatal side effect. During albumin infusions, nurses should be watchful to examine patients' allergy histories and regularly monitor patients for bronchospasm, an increase in the need for oxygen or a ventilator, and any new or worsening tachycardia or hypotension. (Boldt 2010).

The semisynthetic carbohydrate colloids hetastarch and dextran provide a variable period of volume expansion and are linked to serious side effects include AKI, hepatotoxicity, coagulopathies, and bone marrow failure. (Myburgh 2012).

Hetastarch and dextran usage in sepsis-related critical illness patients has been linked to negative outcomes in several clinical trials. 2012 (Perner A) Additionally, hetastarch has been linked to an increased risk of AKI needing renal replacement treatment and mortality, according to a recent meta-analysis. (Zarychanski *et al.* 2013).

The Food and Drug Administration required a black box warning for hetastarch and imposed a contraindication for its use in critically sick patients, particularly people with sepsis, to reflect the increased risk of mortality and AKI necessitating renal replacement treatment. Consequently, there is little use of these products in clinical practice. (Hespan 2018).

2.11. Complications of fluid administration.

According to Hilton *et al.* (2008), a patient's tolerance for relative hypo- or hypervolemia declines as the severity of their acute illness rises.

2.11.1 Hypovolemia

Whether there is an electrolyte deficit or not, a drop-in water volume can lead to hypovolemia, which is classified as an ECF deficit. Lack of control over water intake typically results in hypovolemia as a water deficit on its own (e.g., concentrated EN or loss of the thirst mechanism). To reestablish sodium homeostasis and return serum osmolality to normal, the goal of treatment in this situation is to replace lost water. In the event of hypotension, IV fluid replacement should be given as 5% dextrose in water or as a hypotonic solution. A combined water and electrolyte imbalance that results in hypovolemia is brought on by excessive losses (e.g., GI losses, diuretic therapy, or postoperative fluid sequestration). To ascertain the requirement for fluid and electrolyte replenishment, the sodium and volume deficits are computed. Treatment options include replacing sodium in the diet, restricting water use, and addressing the root cause of the issue. (Rhoda 2011).

Vasopressin-receptor antagonists are frequently used in conjunction with an isotonic solution (such as normal saline) to help block the activity of the anti-diuretic hormone (ADH) (Rhoda 2011).

The effects of hypovolemia depend on the amount of fluid lost, when and how much volume needs to be replaced, as well as the patient's clinical situation. Minor hypovolemia can cause symptoms such as postural hypotension, increased thirst, exacerbation of perioperative nausea and vomiting, and a longer hospital stay (Hilton AK 2008). Clinically, severe acute hypovolemia presents as shock. It causes organ damage, cellular dysfunction, and circulatory and tissue

hypoperfusion as a result of which there is tissue hypoxia. (Heckel *et al.* 2011), (Shields 2008).

Consequently, the chance of organ failure rises (Heckel K *et al.* 2011). Because of this, oliguria and occasionally severe kidney injury are frequently seen as side effects of hypovolemia (AKI). Additionally, it might reduce the microvascular blood flow in vascular beds like the splanchnic circulation, which might have a negative effect on one's ability to tolerate EN (Allison S. 2004). Therefore, maintaining enough tissue perfusion and oxygenation is the goal of volume resuscitation (Marsh 2012).

2.11.2 Hypervolemia

Alterations in renal function, a shift in the ratio of plasma to interstitial fluid, or excessive fluid administration can all lead to hypervolemia, which is characterized by an increase in ECF volume (Rhoda, 2011). According to Hilton *et al.* (2008), the degree to which the fluid balance is positive, the severity of the underlying cardio-respiratory disease, as well as the nature and severity of critical illness, all affect the signs and symptoms of fluid overload.

When cardiac dysfunction is present and acute respiratory distress syndrome (ARDS) is present, there is a substantial correlation between crystalloid excess and the occurrence of pulmonary edema (Hilton *et al.* 2008). The ability to tolerate an excessive infusion of crystalloids decreases in critical illness and major surgery, especially the capillary leak as mentioned above, compared to an otherwise healthy patient, increasing the likelihood of symptomatic respiratory failure. Additionally, abdominal compartment syndrome (ACS), peripheral and gut edema, as well as cerebral edema in patients with concurrent brain injuries are all linked to crystalloid excess. (Hilton *et al.* 2008).

Several significant consequences are linked to postoperative fluid excess. Soft tissue edema slows down the lymphatic drainage process and local oxygenation, which causes tissue hypoxia and delays anastomotic and wound healing. Gut edema may cause EN intolerance, the translocation of germs or endotoxins, and other potentially harmful effects like sepsis and multi-organ failure. Additionally, it might lead to an extended post-operative ileus. The risk of postoperative thrombosis may also be increased by crystalloid infusion, which can increase coagulation. (Shields 2008).

Restriction of fluid intake and/or sodium intake, together with or without the use of diuretics, are treatments for hypervolemia. Hyponatremia and hypoosmolality are two common biochemical disorders linked to hypervolemia, and salt restriction may be necessary to prevent further deterioration of fluid retention. To effectively mobilize fluid in patients who are hypervolemic and hyponatremic, free water intake and sodium intake must be restricted, and in rare circumstances, diuretics must be used. (Rhoda 2011).

2.11.3. Fluid Overload

Increased central venous pressure and blood pressure result from overdosing the circulatory system with IV fluids. Fluid overload is characterized by moist crackles on auscultation of the lungs, cough, restlessness, edema, weight gain, dyspnea, and quick, shallow respirations. Hepatic, cardiac, or renal illness are examples of potential causes, as well as a rapid IV solution infusion. In elderly patients with cardiac illness, a condition known as circulatory overload increases the risk of fluid excess and consequent pulmonary edema. The IV rate must be lowered, vital signs must be routinely checked, breath sounds must be evaluated, and the patient must be placed in a high Fowler position. An urgent call is made to the main provider. Using an infusion pump and closely monitoring

all infusions will help you avoid this issue. Heart failure and pulmonary edema are two complications of circulatory overload. (Hansen 2021).

2.11.4. Air Embolism

Air embolism is an uncommon but constant risk. It is strongly connected to the size of the embolus and the rate of entry and is most frequently associated with the cannulation of central veins. When air from central veins reaches the right ventricle, it presses up against the pulmonary valve and prevents blood from leaving the ventricle and entering the pulmonary arteries. Palpitations, dyspnea, persistent coughing, jugular venous distension, wheezing, and cyanosis are symptoms of an air embolism. Other symptoms include hypotension, a weak, quick pulse, changed mental status, and chest, shoulder, and low back discomfort. A leaking or open infusion system must be replaced right away, the patient must be positioned in the Trendelenburg position on their left side, vital signs and breath sounds must be monitored, and oxygen must be given. By using locking adapters on all lines, completely filling all tubing with solution, and utilizing an air detection alarm on an IV infusion pump, air embolism can be avoided. Shock and death can result from air embolism complications. Although the amount of air required to cause human death is unknown, the rate of entry is likely just as significant as the actual volume of air. (Gordy2013).

2.11.5 Infection

Pyogenic substances in either the infusion solution or the IV administration set can cause bloodstream infections. Signs and symptoms include an abrupt temperature elevation shortly after the infusion is started, backache, headache, increased pulse and respiratory rate, nausea and vomiting, diarrhea, chills and shaking, and general malaise. Additional symptoms include erythema, edema,

and induration or drainage at the insertion site. In severe sepsis, vascular collapse and septic shock may occur (Hinkle 2018).

2.12. Electrolyte

In critically ill patients, electrolyte abnormalities frequently occur. The development of electrolyte problems can be caused by a variety of illness conditions, including many of those that are frequently found in intensive care units, but drugs can also exacerbate these disturbances. Drugs may modify hormonal responses that affect homeostasis, disrupt the organ function in charge of maintaining electrolyte balance, and directly affect the organ's ability to absorb electrolytes. The goal of this study is to talk about the most often given medications in the critical care unit and possible electrolyte abnormalities that can happen as a result of their use. The proposed processes underlying these drug-induced illnesses are also discussed in this review. An abnormality in sodium, potassium, calcium, phosphate, or magnesium is one of the drug-induced electrolyte disorders that is covered in detail. Clinicians should keep a close eye on their patients' drugs as a possible cause of electrolyte abnormalities when they are treating them. A physician should be able to give the best medical treatment for the critically sick patient with knowledge of these drug-induced problems, improving the quality of care received by all patients. (Buckley *et al* 2010).

Elevated electrolyte levels are typical in critically unwell patients. The incidence of electrolyte disturbances in ICU patients has been reported at 25%. Patients in the intensive care unit (ICU) may be more sensitive to electrolyte abnormalities than the non-critically ill population. The use of pharmaceutical therapy frequently results in electrolyte abnormalities in critically ill individuals. Since the vast majority of these patients have numerous complicating factors as

potential causes, it is regrettable that an exact incidence of drug-induced illnesses is still unclear. The incidence also varies according to the particular electrolyte problem. (Lee 2010)

Electrolytes are essential to several crucial physiological processes that take place within the body. The complicated system that regulates normal electrolyte homeostasis includes numerous organs, neurohormonal pathways, fluid state, and acid-base balance. Depending on the particular electrolyte problem and the severity of the patient's serum concentration abnormalities, the clinical symptoms might range from asymptomatic to lethal. However, common symptoms of most illnesses include a change in mental status, weakness in the muscles, irregular heartbeat, and respiratory failure. (Dhondup 2017).

Unfortunately, it's possible that few ICU patients are aware of these medication-induced problems. The complexity of the patient may make it more difficult for clinicians to identify common ICU drugs as probable causes of electrolyte imbalances. Multiple acute and chronic illness conditions are frequently present in intensive care unit patients, which may be regarded as the only reason. Additionally, it's possible that not enough people are aware of both direct and indirect drug-induced anomalies. This review's objective is to raise awareness of typical drugs as a possible cause of electrolyte abnormalities in ICU patients. (Ibrahim *et al.* 2022).

2.12.1. Pathophysiology

In the intensive care unit, drug-induced electrolyte abnormalities can arise via a variety of intricate pathways involving one or more processes. The precise way that a drug can cause or exacerbate electrolyte imbalances depends on the agent's characteristics and perhaps even on how it works. Some hypothesized drug-induced illnesses processes, however, have absolutely nothing to do with

the pharmacology of the drug's documented side effects. Osmotic diuretics like mannitol have been found to cause hypernatremia as a result of volume loss. Given its well-known method of action, this effect should be predicted, but other drugs may not have the same obvious effects on electrolyte serum concentrations. For instance, hyperkalemia has been linked to both heparin and low molecular-weight heparins. A decrease in angiotensin II receptor affinity and number is the suggested mechanism. A hyperkalemic state results from a reduction in aldosterone production. The most well accepted cause of increased electrolyte serum concentrations is aggressive electrolyte replacement given to ICU patients. (Milionis 2021)

2.12.2. Component of electrolytes

Normal biochemical reactions and homeostatic functioning depend on the electrolytes (sodium, potassium, magnesium, calcium, and phosphorus). The functions of cell membranes, nerve conductivity, muscle contraction, hormone activity, bone construction, and fluid and acid-base balance are all maintained by electrolytes in concert. Renal function controls serum electrolyte balance as well as normal balance. (Meyers 2009).

The electrolyte balance is maintained by natural mechanisms. Electrolyte abnormalities can also be brought on by medical disorders and drugs. Determine the reason, categorize it as acute or chronic, and decide on a therapeutic plan to address the electrolyte abnormalities. These are the three fundamental phases in electrolyte assessment. Each electrolyte will be covered in the discussion that follows, along with details of its typical function, excess, and deficiency. (Meyers 2009).

2.13. Type of electrolytes

2.13.1. Sodium

2.13.1.1. Primary Physiologic Function and Normal Homeostasis

The most prevalent cation in the body, sodium (average range 135-145 mEq/L), has three key roles: fluid balance, osmotic control, and maintenance of membrane potential (Schmidt 2010). Instead of consumption, sodium excretion predominantly controls sodium homeostasis. The primary regulators of sodium homeostasis are the RAAS and glomerular filtration rate (GFR), with RAAS activation resulting in an increase in renal tubular sodium reabsorption. The quantity of sodium that is filtered changes when GFR fluctuates. Other elements that contribute to sodium regulation include intrarenal blood flow, renal prostaglandins, and natriuretic peptides, albeit to a lesser extent. The Na⁺-K⁺-ATPase pump maintains the potential of the cellular membrane. Under typical physiological conditions, the body's sodium intake and sodium losses are equal (Schmidt 2010).

2.13.1.2. Hypernatremia

The term "hypernatremia" refers to a serum sodium level that is more than 145 mEq/L. (Schmidt 2010). Dehydration, gastrointestinal sickness, fever, a lack of intake, and drugs like diuretic treatment and hypertonic saline are just a few of the factors that contribute to hypernatremia. Increased thirst, weariness, restlessness, and muscle irritation are symptoms of hypernatremia (Rhoda 2011). Cerebral cellular dehydration in severe hypernatremia can lead to bleeding, neurologic complications such as seizures, coma, and death. The underlying cause of hypernatremia must be found and then treated in order to manage it. For instance, if dehydration from a lack of oral fluid intake led to hypernatremia, treating the dehydration would also treat the elevated serum sodium. Similarly,

if diuretic therapy is the culprit, changing the drug will, if it's possible, fix the electrolyte abnormalities. To prevent the risk of cerebral edema and maybe even death, correction should not take place any faster than 0.5 mEq/L/hour over the course of 48 hours if the serum sodium level is more than 160 mEq/L. (Powers 2015; Rhoda 2011)

2.13.1.3 Hyponatremia

A serum sodium content of less than 135 mEq/L is considered hyponatremia (Schmidt 2010). One of the most frequent electrolyte disorders is hyponatremia. There are numerous potential causes, such as diarrhea, dehydration, enterocutaneous fistulas, and the use of loop and thiazide diuretics. Hyponatremia is frequently accompanied by headache, GI symptoms such as nausea, myopathy, lethargy, and restlessness. Patients who have severe hyponatremia (serum sodium less than 125 mEq/L) run the risk of developing CNS symptoms like lethargy and convulsions (Meyers 2009). In order to restore the proper fluid and sodium balance during treatment for hyponatremia, intravenous fluids must be administered carefully. It is recommended to use normal saline or hypertonic saline to rectify the sodium deficiency more quickly in individuals who are experiencing acute symptoms in order to prevent symptoms. Calculating the sodium deficiency in milliequivalents is done as follows: [(desired sodium concentration) - (current sodium concentration)] x k x weight (kg), where K is 0.6 (for males) and 0.5 (for females), equals a sodium deficit (females). To prevent the onset of central pontine myelinolysis, acute hyponatremia without concomitant end-organ symptoms (such as a seizure) should be corrected at a rate of no more than 0.5 mEq/L/hour, or roughly 12 mEq/L/24 hours. Patients should be checked on every 2-4 hours when they are exhibiting symptoms and every 4-8 hours when they are not.

2.13.2. Potassium

2.13.2.1. Primary Physiologic Function and Normal Homeostasis

The predominant intracellular cation in the body, potassium plays crucial roles in cellular metabolism, maintains membrane potential, and supports neuromuscular and cardiac function (normal range 3.5–5 mEq/L, depending on age) (Rhoda 2011; Schmidt 2010). The principal mechanism for maintaining potassium homeostasis is renal excretion, which fluctuates according to serum concentrations, aldosterone, and angiotensin II release. Hormones, acid-base balance, and osmolality are examples of nonrenal systems that contribute to potassium regulation (Rhoda 2011). Drugs like diuretics or nephrotoxic substances may have an impact on potassium balance. (Rhoda 2011).

2.13.2.2. Hyperkalemia

A serum potassium concentration of more than 4.7–5.9 mEq/kg, depending on age, is considered to be hyperkalemic (Schmidt 2010). Before making an assessment, pseudo hyperkalemia should be ruled out because potassium is the main intracellular cation. For instance, hemolysis brought on by laboratory blood tests may unintentionally increase serum potassium amounts. Medications (such as potassium-sparing diuretics) as well as high potassium consumption, dehydration, impaired renal function or metabolic acidosis, burns, and hemolysis are common causes of hyperkalemia. Muscle twitching, cramping, or weakness are typical indications of high potassium, as well as progressive paralysis. Changes in cardiac conductivity are likely at serum potassium concentrations higher than 6 mEq/L, which might result in arrhythmias (Rhoda 2011; Schmidt 2010; Meyers 2009). Due to these consequences, hyperkalemia is one of the most hazardous electrolyte imbalances. All sources of potassium intake, both dietary and pharmaceutical, must be evaluated and modified while controlling

hyperkalemia. Drugs that move potassium intracellularly (such as dextrose/insulin, albuterol, and sodium bicarbonate) as well as drugs that remove potassium from the body are used in the pharmacologic treatment of hyperkalemia (i.e., sodium polystyrene sulfonate, loop diuretics). Patients with symptoms may benefit from the cardioprotective effects of calcium, which stabilizes the cardiac myocytes. Dialysis may be necessary in extreme circumstances to eliminate potassium from the body.

2.13.2.3. Hypokalemia

Medication (such as loop and thiazide diuretics, antibiotics, and amphotericin B), metabolic alkalosis, low dietary intake, hypomagnesemia, hyperaldosteronism, refeeding syndrome, and GI losses can all contribute to hypokalemia (serum sodium of less than 3.4 mEq/L) (Schmidt 2010). Despite the fact that the symptoms are vague, the presentation may include ileus or constipation, dysrhythmias, paralysis, muscle necrosis, and in extreme cases, maybe even death. Depending on the severity, management may involve administering potassium supplements intravenously or orally. Oral potassium supplementation is preferred if the patient has a healthy GI tract and is asymptomatic in order to prevent rapid overcorrection; nonetheless, oral potassium is irritating to the GI system. Patients who are able to swallow pills may benefit from sustained release medicines to reduce GI distress. If intravenous potassium is administered, the patient must be on a continuous cardiac monitor or the infusion rate should not be greater than 0.5 mEq/kg/hour. Peripheral fluid content must not be higher than 0.06 mEq/mL due to the irritation that potassium supplementation has on veins. During potassium supplementation, patients should be closely watched every 2-4 hours to

determine whether further addition is necessary. Last but not least, magnesium concentrations need to be adjusted concurrently with hypomagnesemia.

2.13.3. Magnesium

2.13.3.1. Primary Physiologic Function and Normal Homeostasis

Magnesium serves as a critical component for numerous enzymatic activities, such as those involving the metabolism of glucose, fatty acids, DNA, and proteins (typical range: 1.6-2.3 mg/dL, depending on age) (Schmidt 2010). Magnesium also participates in the Na⁺-K⁺ ATPase pump, which has downstream effects on cardiac excitability, neuromuscular transmission, and vasomotor tone. Magnesium plays a crucial role in the production of parathyroid hormone as well as bone health (more than 50% of magnesium is found in bone). The parathyroid hormone helps to keep the GI tract, renal system, and bone in a state of homeostasis. In the jejunum, magnesium is absorbed, and intake has an inverse relationship with absorption. The GI tract absorbs between 30 and 40 percent of dietary magnesium, with the remaining 60 to 70 percent being expelled in the stool (Rhoda 2011). Magnesium will be leached from the bone to maintain normal circulation amounts if dietary intake is minimal. (Schmidt 2010).

2.13.3.2. Hypermagnesemia

Hypermagnesemia is characterized by a blood magnesium level greater than 2.4 mg/dL. (Schmidt 2010). Common causes include over supplementation, renal illness, excessive laxative usage, and/or increasing consumption of antacids that include magnesium (Rhoda 2011). When serum magnesium concentrations are above 3 mg/dL, however, neurologic, neuromuscular, and cardiac symptoms may be present. Mild hypermagnesemia is typically easily tolerated (Schmidt

2010). Other symptoms and indicators include nausea, flushing, sweating, weakness in the muscles, hypotension, and bradycardia. When cardiac anomalies are evident, intravenous calcium should be given to stabilize the heart muscle in severe situations. In some circumstances, dialysis may also be necessary. However, the majority of cases are minor, and they can be treated by taking less magnesium or using a diuretic. Hypermagnesemia in newborns may be brought on by the placental transfer of magnesium from moms who have taken high doses of magnesium sulfate to delay labor. Prior to administering magnesium in intravenous fluids or parenteral feeding to premature newborns, magnesium concentrations should be measured. (Schmidt 2010).

2.13.3.3. Hypomagnesemia

Magnesium levels of less than 1.3 mg/dL are considered hypomagnesemia (Schmidt 2010). Reduced intake, increased renal/GI loss, and intracellular magnesium changes are common causes of hypomagnesemia. Patients with acute tubular necrosis, renal tubular acidosis, hyperaldosteronism, Bartter syndrome, and in the presence of specific drugs experience hypomagnesemia (e.g., tacrolimus, cyclosporine, aminoglycosides). Hospitalized individuals frequently have hypomagnesemia, which is linked to apathy, depression, muscle weakness, ataxia, cramping, and cardiac problems. Other electrolyte imbalances, such hypokalemia and hypocalcemia, are linked to hypomagnesemia. The intravenous route is favored for acute therapy due to low GI tolerance of magnesium, with a maximal infusion rate of 0.1 mEq/kg/hour due to dose-dependent renal absorption. Monitoring should take place between two and four hours after magnesium treatment, and more doses should be given as necessary to keep normal magnesium concentrations. Hemodynamics, particularly blood pressure, should be watched during administration. Oral or intravenous treatment

is acceptable for people who need home administration or continuing magnesium supplements.

2.13.4. Calcium

2.13.4.1 Primary Physiologic Function and Normal Homeostasis

One of the most prevalent ions in the body, calcium is needed for healthy neuromuscular activity, membrane integrity, endocrine function, coagulation, and bone metabolism (normal range 6.2-11 mg/dL, depending on age) (Schmidt 2010). The parathyroid gland is principally in charge of regulating serum calcium levels. When levels are low, parathyroid hormone is released, which boosts renal conservation, bone resorption, and vitamin D activation, which enhances calcium absorption from the GI tract. When levels are high, the thyroid releases calcitonin, which reduces bone resorption and boosts renal elimination. The majority of the calcium in the body is found in the teeth and bones and is either ionized, complexed, or protein-bound.

2.13.4.2. Hypercalcemia

Definitions of hypercalcemia depend on age-related normal levels as well as dietary parameters such circulating albumin.

The main causes of hypercalcemia are hyperparathyroidism or cancer with bone metastases, though it can also be brought on by increased caloric intake, elevated vitamin A or D concentrations, renal dysfunction, or some drugs (such as calcium-containing antacids or vitamin A or D supplements) (Schmidt 2010). Fatigue, vomiting or nausea, constipation, and confusion are common symptoms of hypercalcemia in patients. heart conductivity anomalies could be present in extreme situations. Fluid therapy is the first line of treatment and is typically successful in mild to moderate cases of hypercalcemia. To avoid dysrhythmias,

kidney failure, and mortality in extreme cases, intravenous fluid therapy, loop diuretics, and dialysis therapy may be required.

2.13.4.3. Hypocalcemia

A corrected calcium level or ionized calcium level below age-appropriate normal norms is referred to as hypocalcemia (Schmidt 2010). Although the aforementioned equation can be used to compute adjusted calcium, for greater accuracy, an ionized calcium level should always be acquired. Hyperphosphatemia, decreased parathyroid hormone activity, blood transfusions, rhabdomyolysis, poor vitamin D intake, and vitamin D insufficiency are all potential causes of hypocalcemia. Alterations in calcium concentrations can also be brought on by drugs like diuretics and anticonvulsants. Hypotension, reduced cardiac contractility and QT interval lengthening, muscle cramps, and seizures are among the symptoms that patients with hypocalcemia display. The presence of hypomagnesemia in hypocalcemia must be checked for and treated if found. Hypocalcemia in newborns receiving parenteral nutrition may happen when it is unable to give enough calcium due to compatibility concerns with intravenous fluids. Treatment options include intravenous or oral calcium supplements, depending on the severity of the hypocalcemia. (Schmidt 2010).

2.13.5. Phosphorus

2.13.5.1. Primary Physiologic Function and Normal Homeostasis

Phosphorus, which is the primary intracellular anion and typically ranges from 2.7-9 mg/dL depending on age, is crucial for sustaining cellular function, pH, energy (ATP), and all physiologic processes requiring energy (Schmidt

2010). Through GI absorption, renal excretion, and parathyroid hormone action, homeostasis is preserved.

2.13.5.2. Hyperphosphatemia

Hyperphosphatemia is defined as serum readings exceeding age-expected normal concentrations (Schmidt 2010). Hypocalcemia, hypoxemia, and metastatic calcifications are all potential causes of hyperphosphatemia (Rhoda 2011). Many individuals may experience no symptoms, and most hyperphosphatemia patients tolerate it well (Schmidt 2010). Anorexia, nausea, vomiting, dehydration, decreased appetite, neuromuscular symptoms, and tachycardia are typical symptoms when they do occur (Rhoda 2011; Schmidt 2010). Metastatic calcifications, which happen when serum calcium is also increased, are the most serious worry. A low-phosphorus diet and/or phosphate binder are used to treat hyperphosphatemia (Rhoda 2011). Repletion of the volume can be necessary if low volume is suspected. Dialysis might be required in extreme circumstances.

2.13.5.3. Hypophosphatemia

Depending on age, blood values of less than 2.7–4.5 mg/dL are considered hypophosphatemia (Schmidt 2010). Children who are critically unwell, malnourished, or experiencing refeeding syndrome all frequently have this problem. Patients receiving phosphate binders or those with alkalosis may also have hypophosphatemia. Neurologic and neuromuscular symptoms, as well as cardiac, respiratory, or hematologic abnormalities, are only a few examples of clinical indicators. If the appearance and symptoms are minimal, oral replacement is usually the best course of action. The GI tolerance is poor, however, when higher doses are required. Therefore, when moderate or severe

hypophosphatemia is evident, supplementing by intravenous route is necessary. When intravenous doses are administered, patients should be checked every two to four hours.

2.14. previous study:

2.14.1. First study:

A study conducted by (Furat Hussein Mahmoud 2023) Nurse's Knowledge and Practice Regarding Care of Fluids and Electrolytes Imbalance among Critically Ill Patients, Egypt.

Objective: to assess nurses' knowledge and practice regarding care of fluids and electrolytes imbalance among critically ill patients

Methods: A descriptive exploratory research design was used to conduct this study.

Results: two thirds of the studied nurses (66.7%) had unsatisfactory level of knowledge among studied nurses. On the other hand. 33% had satisfactory level of knowledge.

2.14.2. Second study:

A study conducted (Maria 2023) The investigation of nurses' knowledge according to their level of education regarding the pathological electrolyte disturbances of patients during their hospitalization in a rehabilitation center.

Objective: study was to investigate the knowledge of nurses regarding the electrolyte disorders of patients during their hospitalization in a rehabilitation center and to correlate their education with the knowledge regarding electrolyte disorders.

Methods: A quantitative research was carried out using a structured questionnaire.

Results: Through the results it was initially observed that the largest sample considers that the recording of fluid intake and output is important. The vast majority (92%) know about electrolyte disturbances. A large part (84%) has not attended any training program. Inaccurate diagnosis of electrolyte disturbances can be a risk to the patient

2.14.3. Third study:

A study conducted by (Heba Mohamed 2021) Assessment of Nurses' Knowledge and Practice Regarding Fluid and Electrolyte Imbalance in Critical Care Unit.

Objective: study was to assess nurses' knowledge and practice regarding fluid and electrolyte imbalance in critical care units.

Methods: A descriptive research design was used.

Results: Show a defect in the nurses' knowledge and practice as for general knowledge of nurses had unsatisfactory knowledge with Mean±SD 26.8±5.6. for general nurses' practice regarding fluid & electrolyte imbalances monitor and management 97.2% of nurses had unsatisfactory level. of practice with Mean±SD 57.3±7.5.

2.14.4. Forth study:

A study conducted (Falih 2020), Assessment of nurses' knowledge about intravenous fluid administration at basra general hospital.

Objective: study was to assessment of nurse's level of education about intravenous fluid administration at Basra General Hospital.

Methods: A descriptive, cross-sectional research design was used.

Results: This study showed that 34%of the sample were males and 66%were femaleless regarding the age 65%of the sample age 19-28 and 213%

were 29-38 and 5,3% were 39-48 and 8,4% were 49 and above that's mean The highest Percent was the age 19-28 Regarding the distribution according to working place 24% in emergency ward , also 24% in the medical ward, 28% in the surgical ward ,6% in ICU and 15% in the pediatric ward and 2% in the other ward . regarding the level education 7% primary school level, 9,7% intermediate school, 38,7% secondary school, 50,7% health institute and 3% college level Regarding years employment 77% were from 1-19 years, 10, 6% were from 10-19 years, 6% were from 20-29 years 6, 4% were from 30-39 years. Regarding years of practice in these wards 71% less than one year, 9,6% for one year, 4% for five years, 6% for three years, 14% for years , and 2% for six and seven years . So the nurses scoring of knowledge about IV fluid administrations we found 11% of the study nurses had 51% scores, 14% had scores 52-61, 34,4% had scores 62-71, 27% had scores 72-81, 3% had scores 82-91 and 5,3% had scores 92 and above and when we had down Pearson correlation between age and scores and between gender and scoring also the ward and scoring, the level of education and scoring, years of employment and scoring, years of practice and scoring we found all of these correlations are negative there is no correlation between every one

2.14.5. Fifth study:

A study conducted (Aslam *et al.*, 2017), The Assessment of Nurses' Knowledge and Practices about Fluid and Electrolytes Monitoring and Administration among Cardiac Surgery Patients: A Case of Punjab Institute of Cardiology.

Objectives: To assess the knowledge and practice of the registered nurses about fluid and electrolytes monitoring and administration in the cardiac surgery patients.

Method: This study is of descriptive and cross sectional study design..

Result: The findings of the current study show that the nurses have poor knowledge and practices of nurses, so, public hospital's administration should focus on the strategies and activities which become helpful to increase the knowledge and practices of nurses regarding fluid and electrolytes administration

2.14.6. Sixth study:

A study conducted by (Eldsouky *et al.*, 2016) Nurses' knowledge and practice concerning fluid and electrolyte balance among patients with congestive heart failure.

Objective: to assess nurses' knowledge and practice concerning fluid and electrolytes balance among patients with congestive heart failure and investigating the relation between their knowledge and practice.

Methods: Research design: Cross-sectional analytic design.

Results: The level of nurses' understanding of CHF and the fluid/electrolyte balance it affects was strong, with a generally positive percentage having fully sufficient knowledge. The examination of peripheral circulation, skin and mucous membranes, indicators of altered tissue perfusion, inadequate breathing pattern, and change in fluid balance were all lacking in the practice. Age and gender of nurses had a favorable impact on their knowledge. The quantity of medications the patient was taking and the knowledge score both had a detrimental impact on the practice, and there is a negative correlation between the knowledge and practice ratings.

Chapter Three

Methodology

Chapter Three Methodology

These pages, presented all methods and principles which carried-out systematically to reach the specific objectives of the current study.

3.1. Design of the study:

Descriptive – observational design is chosen to carry out this study to achieve the objectives which structured to analyze the knowledge and practices of nurses who work in the intensive care unit according to intravenous fluid and electrolyte administration and specifically as phenomena of interest, from the period between 9 November 2022 to 5 June 2023.

3.2. Administrative arrangements:

To achieve the study objectives the following administrative steps were performed:

- The Council of the College of Nursing – University of Babylon awarded its primary acceptance after a brief presentation of the interested phenomena in a formal seminar session.
- After getting the validity of the study checklist, the protocol and the checklist were submitted to gain the approval of the ethical committee College of the Nursing University of Babylon (Appendix A).
- Official letter issued and submitted to the Health director proven to get formal agreement to facilitate data collection from the teaching hospitals in Al-Hilla City (Appendix B).

3.3. Setting of the study:

The study was carried out at intensive care units in Al Hilla teaching hospitals, which includes the following:

3.3.1. Al-Imam Al-Sadiq Teaching Hospital:

This hospital was established to receive Babylonian citizen in 2017, the total capacity of this hospital is (503) beds. The intensive care unit (respiratory care unit) (RCU) consists of (20) beds and coronary care unit (CCU) consists of (15) beds.

3.3.2. Marjan Medical City:

This hospital established on (1957) and considered as the first general teaching hospital in Al-Hilla City, it specialized to receive the medical cases, the total capacity of the hospital is (316) beds. The intensive care unit (coronary care unit) (CCU) includes (15) beds.

3.3.3. Al- Hilla Surgical Teaching Hospital:

This hospital established on (1972), the total capacity of the hospital is (400) beds. intensive care unit (respiratory care unit) (RCU) includes (18) beds.

3.4. Sample of the study:

Non- probability purposive sampling method selected to carrying out this study, (174) nurses elected out of (269) intensive care unit nurses who provided direct care to the patients. The sample size has been determined using Richard Geiger's equation (Abdelhady, 2019).

Richard Geiger's equation:

$$n = \frac{\left[\frac{z}{d}\right]^2 * [0.5]^2}{1 + \frac{1}{N} \left[\left(\frac{z}{d}\right)^2 * (0.5)^2 - 1\right]}$$

$d = 0.05$

$z = 1.96$

$N =$ population

$n =$ sample size

Table 3.1: Distribution of Study Sample Related to Teaching Hospitals.

Hospitals names		N	n	%
Al-Imam Al-Sadiq Teaching Hospital	RCU	69	51	29%
	CCU	37	25	15%
Marjan Medical City	CCU	52	20	<i>Pilot study</i>
Al- Hilla Surgical Teaching Hospital	RCU	111	98	56%
Total		269	174	100%

3.5. Study Instrument:

3.5.1. Questionnaire form:

To achieve the objectives of this study and to facilitate data collection comprehensive review of related literature take place, special questionnaire form consist of multiple-choice question were developed to assess nurse's knowledge (Appendix C1, C2), it's from books of NCLEX-RN Examination (2022) and NCLEX Practice Questions (2022) divided to three parts as the following:

Part I: Demographical Characteristic

This part consists of 5 items (sex, age, marital status, education level, residency).

Part II: Employment Characteristics:

This part consists of 3 items (Years of experience, training sessions, self-education)

Part III: Intensive Care Unit Nurses Knowledge Related to Intravenous Fluid and Electrolyte Administration:

This part consists of 5 domains as the following:

- **The first domain:** this domain includes general information related to fluid and electrolyte It consists of (11) questions for fluid and (9) questions for electrolytes.
- **The second domain:** this domain includes (10) questions for fluid and electrolytes assessment
- **The third domain:** this domain includes (8) questions for fluid and electrolytes administration
- **The fourth domain:** this domain includes (9) questions for fluid and electrolytes complication.
- **The five domains:** this domain includes (4) questions for fluid and electrolytes policy

3.5.2. Checklist:

In order to assess the practices of intravenous fluid and electrolyte administration for nurses who intensive care unit employment, a comprehensive review of literature, and a unique checklist were prepared with slight modifications to few items to make it more proper and relevant for our intensive care unit context and to assess nurses' practices from book of (Fundamentals of Nursing) (Appendix D1, D2). This checklist consists of the following:

Part I: This part consists (3) domain to assess the practices for intravenous fluid and electrolyte administration including the following:

- **First domain:** Nursing practices related to the preparation of for intravenous fluid included (13 items).
- **Second domain:** Nurses' practices related to intravenous administration included (23 items)
- **Third domain:** Nurses' practices related to electrolyte monitoring included (7 items)

3.6. Rating and Scoring:

3.6.1. Questionnaire form and Checklist:

The prepared questionnaire content (51) multiple choice questions rated as correct and in- correct the scoring system which adapted (2) for correct answer and (1) for in-correct answer. While for the checklist a Likert scale level was employed as a pattern of rating and scoring as: (always = 3, sometimes = 2, and never = 1).

Mean weight:

$$W = \frac{\sum_{i=1}^n w_i X_i}{\sum_{i=1}^n w_i}$$

1	→	1.6	poor
1.7	→	2.3	fair
2.4	→	3	good

3.7. Validity:

To obtain the face validity of the questionnaire to assess nurse knowledge and checklist to assess their practices which were prepared to facilitate data collection, distributed among (10) experts in order to estimate the clarity and relevancy, multi-disciplinary field experts with experience not less than 10 years in their field selected. Deep revision take place, changes performed related to their opinion and advises (Appendix E1, E2).

3.8. Pilot Study:

A pilot study was carried out to evaluate the applicability, visibility, clarity, and item arrangement of the questionnaire as well as to calculate the time required complete the questionnaire.

The nurses who participated in the pilot study were not included in the sample study were excluded from the original sample.

A pilot study is conducted up on (20) nurses with coronary care unit (CCU), selected from Marjan Teaching Hospital. The pilot study takes about (10) days, started from 26 Feb to 8 March 2023. The knowledge questionnaire was used. While is the checklist used to assess the participants practices.

The practices were collected by observing the nurses by three observations to be sure that the questionnaire prepared to achieve the study objectives was

understandable and well. Determine the related consistency - reliability of the questionnaire. Determine the time required which needed to complete the questionnaire for each participant. To complete the necessary data, it takes an average of 20 to 35 minutes every nurse.

3.9. Reliability:

3.9.1. Questionnaire form:

To determine the stability of the used questionnaire prepared to reach the objectives of the study, the result of the pilot study was statistically managed, (12) questions from knowledge were modified linguistically to be understood by the participants with the Cronbach's Alpha method used, and the estimated reliability was (0.83) which is statistically accepted.

Table (3.2.) Questionnaire form reliability

<i>Reliability Statistics</i>	<i>Case Processing Summary</i>			
Cronbach's Alpha			N	%
.831	Cases	Valid	20	100.0
N of Items		Excluded ^a	0	.0
51		Total	20	100.0
a. Listwise deletion based on all variables in the procedure.				

3.9.2. Checklist:

The inter-observer or inter-rater approach is used to assess the stability of a research instrument by determining how much homogeneity or consistency exists in the scores provided by different judges. The researcher enlisted the help of two master student from nursing college to complete this step. Each participant in the pilot study was exposed to 3 observers at the same time for

each practice, giving each participant 3 observation. (12) questions from check list were modified linguistically. The reliability of the checklist calculated by special equation, the statistical results recorded (0.84), which is statistically accepted.

Table (3.3.) checklist reliability.

<i>Reliability Statistics</i>	<i>Case Processing Summary</i>			
inter-rater			N	%
.841	Cases	Valid	20	100.0
N of Items		Excluded ^a	0	.0
43		Total	20	100.0
a. Listwise deletion based on all variables in the procedure.				

3.10. Ethical consideration:

One of the most significant aspects of quantitative and qualitative research is ethical considerations since this type of study often employs human beings. Ordinarily, the agreement can be gained verbally (orally or in writing) depending on the study's needs. This level of ethical assessment may safeguard the subjects' privacy and respect. In order to gain their formal approval, a formal permission form was used for each participant once the research aims were explained (Appendix F).

3.11. Data collection:

The structured questionnaire which was previously prepared was used to collect the data. self-report method used to complete the knowledge questionnaire after obtaining the agreement of the nurses to participate in the study, every nurse take about 20 to 35 minutes to complete the questionnaire. While checklist used to assess intensive care unit nurses' practices related to

intravenous fluid and electrolytes administration. Each participant exposes to three observation. Data collection started from 10 March to 20 April 2023.

3.12. Data analysis:

The data was compiled and analyzed using descriptive and inferential statistical methods utilizing the (Statistical Package for the Social Sciences) program version 26 in order to meet the specific goals of this study.

3.12.1. Descriptive data analysis:

The following parameters were calculated using descriptive statistics to explain socio - demographics and item responses:

Frequency (F)

Percentage (%) as $\text{part} \times 100$.

Whole

3.12.2. Inferential data analysis.

Mean of score (M.S) as sum of score $\frac{\text{sum of score}}{n}$

Standard Deviation (\pm SD) is calculated as following

$$SD = \sqrt{\sum ni = 1(xi - \mu)^2}$$

Where

n = Number of replicates

x_i = Replicate i

\bar{x} = Mean of replicates

Formula for Correlation Coefficient

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n \sum x^2 - (\sum x)^2][n \sum y^2 - (\sum y)^2]}}$$

Formula for Chi Square

$$x^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

x^2 = chi square

O_i = observed value

E_i = expected value

Chapter Four

Results

Chapter Four Results

This chapter presents the collected data after statistical management as structured tablets, to make it easy for scientific and logical interpretation in order to reach the study objectives

Table 4.1: The study sample was distributed according to their demographic parameters.

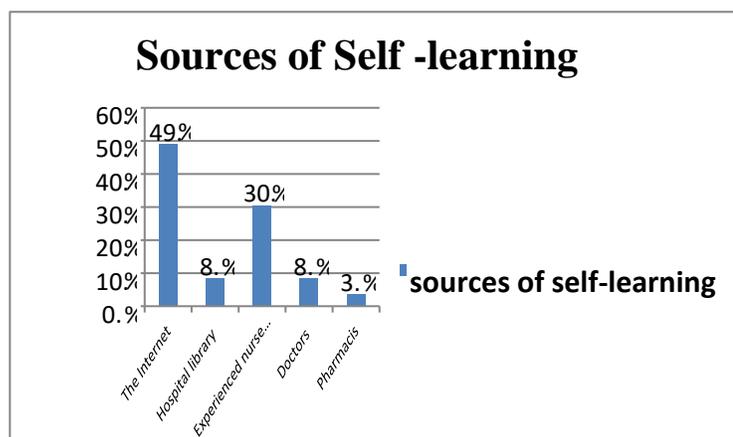
Variables	Categories	Frequency	Percent
Sex	Male	88	50.6
	Female	86	49.4
	Total	174	100.0
Age	20-25 years	91	52.3
	26-30 years	68	39.1
	31-35 years	15	8.6
	Total	174	100.0
Marital status	Married	90	51.7
	Single	82	47.1
	Widow	2	1.1
	Total	174	100.0
Qualification	Nursing school	10	5.7
	Diploma	51	29.3
	Bachelor	110	63.2
	Post graduate	3	1.7
	Total	174	100.0
Residency	Rural area	54	31.0
	Urban area	120	69.0
	Total	174	100.0

Table (4.1.) revealed that most of the study sample 88(50.6%) were male. The results recorded that most of their age 91(52.3%) were between (20-25) years age group, the higher percentage 90 (51.7%) were married, the majority of the study sample, 110 (63.2%) had bachelor's degrees, and 120 (69.0%) lived in urban resident.

Table 4.2: Distribution of the study sample related to their employment characteristics:

Variables		Frequency	Percent
Years of experience in hospital	Less than 1 year	59	33.9
	1 to 3 years	49	28.2
	More than 3 years	66	37.9
	Total	174	100.0
Participation in training sessions concerned to intravenous fluid and electrolyte administration:	No	131	75.3
	Yes	43	24.7
	Total	174	100.0
Do you work on educating yourself about the field of specialization in a self-reliant way?	No	21	12.1
	Yes	153	87.9
	Total	174	100.0

Table (4.2) revealed that a higher percentage of 66 (37.9%) were more than 3 years related to years of employment in hospital, regarding the training sessions concerning fluid and electrolyte administration the results recorded that most of the study sample 131(75.3%) didn't involve to any training courses, according to percentage table 153 (87.9%) of the participate were depend on self- learning.

**Figure 1: Distribution of study sample related to self-learning sources**

This figure presented that most of the participant was depend on internet as main source of their information.

Table 4.3: Knowledge of the study sample related to general information related to fluid and electrolyte.

Items		Frequency	Percent	Mean	St Deviation	Assessment
Plasma is a body fluid which located at	Incorrect	122	70.1	1.30	.460	Poor
	Correct	52	29.9			
	Total	174	100.0			
The extracellular fluid comprises	Incorrect	117	67.2	1.33	.471	Poor
	Correct	57	32.8			
	Total	174	100.0			
The most commonly used type of parenteral fluid is	Incorrect	110	63.2	1.37	.484	Poor
	Correct	64	36.8			
	Total	174	100.0			
Crystalloids are classified as	Incorrect	148	85.1	1.15	.358	Poor
	Correct	26	14.9			
	Total	174	100.0			
The mechanism of Hypotonic fluids is	Incorrect	119	68.4	1.32	.466	Poor
	Correct	55	31.6			
	Total	174	100.0			
Isotonic solutions commonly used for	Incorrect	152	87.4	1.13	.333	Poor
	Correct	22	12.6			
	Total	174	100.0			
Hypertonic solutions are contraindication for	Incorrect	139	79.9	1.20	.402	Poor
	Correct	35	20.1			
	Total	174	100.0			
A patient is hypotensive related to extensive bleeding in surgery. Which type of fluid would be most appropriate to administer to this condition?	Incorrect	75	43.1	1.57	.497	Fair
	Correct	99	56.9			
	Total	174	100.0			
	Incorrect	125	71.8	1.28	.451	Poor

Normal saline 0.9% and Dextrose 5% are example of	Correct	49	28.2			
	Total	174	100.0			
Which type of intravenous fluid quickly metabolized, leaves free water for even distribution on all fluid	Incorrect	165	94.8	1.05	.222	Poor
	Correct	9	5.2			
	Total	174	100.0			
When assessing patient for signs of fluid overload the nurse would expect to observe:	Incorrect	151	86.8	1.13	.340	Poor
	Correct	23	13.2			
	Total	174	100.0			
General mean and standard deviation				1.25	.407	Poor

MS. Poor knowledge > 1.5, fair knowledge =1.5, good knowledge < 1.5

Table (4.3) indicated that general information related to intravenous fluid and electrolyte administration of the study sample recorded low mean score at all presented items, except item (8) which recorded fair level. The overall mean score of this domain were recorded poor (1.25±.407).

Table 4.4.: knowledge of the study sample related to electrolyte administration

Items		Frequency	Percent	Mean	St Deviation	Assessment
Serum electrolyte concentrations are most often expressed as	Incorrect	82	47.1	1.53	.501	Fair
	Correct	92	52.9			
	Total	174	100.0			
The cation that plays a major role in determining the osmotic pressure of the plasma is	Incorrect	75	43.1	1.57	.497	Fair
	Correct	99	56.9			
	Total	174	100.0			
The major route of excretion for sodium	Incorrect	66	37.9	1.62	.487	Good
	Correct	108	62.1			
	Total	174	100.0			

ions (under normal conditions) is the						
Most of the calcium in the body is find in the	Incorrect	21	12.1	1.88	.327	Good
	Correct	153	87.9			
	Total	174	100.0			
Calcium's roles in the body include	Incorrect	114	65.5	1.34	.477	Poor
	Correct	60	34.5			
	Total	174	100.0			
The main regulator of serum phosphate levels is a transport process in the	Incorrect	127	73.0	1.39	1.229	Poor
	Correct	47	27.0			
	Total	174	100.0			
Potassium is the most abundant intercellular cation in the body and plays a role in multiple body functions which include all The following except	Incorrect	135	77.6	1.22	.418	Poor
	Correct	39	22.4			
	Total	174	100.0			
Magnesium is absorbed into the human body	Incorrect	104	59.8	1.40	.492	Poor
	Correct	70	40.2			
	Total	174	100.0			
Potassium has the following characteristics, except	Incorrect	126	72.4	1.28	.448	Poor
	Correct	48	27.6			
	Total	174	100.0			
General mean and standard deviation				1.47	0.541	Poor

MS. Poor knowledge > 1.5 , fair knowledge =1.5 , good knowledge < 1.5

Table (4.4.) knowledge of the study sample related to electrolyte administration recorded low mean score in the following items (5,6,7,8 and 9). while item (1 and 2) recorded fair level and items (3 and 4) recorded high level. The overall mean score of this domain were recorded poor (1.47±0.541).

Table 4.5.: Knowledge of intravenous fluid and electrolyte administration of the study sample related to assessment:

Items		Frequency	Percent	Mean	St Deviation	Assessment
The nurse has obtained a unit of blood from the blood bank and has checked the blood bag properly with another nurse. Just before beginning the transfusion, the nurse should assess which PRIORITY item	Incorrect	94	54.0	1.46	.500	Poor
	Correct	80	46.0			
	Total	174	100.0			
Which of the following are advantages to having intravenous insertion team? Select all that apply	Incorrect	142	81.6	1.18	.389	Poor
	Correct	32	18.4			
	Total	174	100.0			
The clinical manifestations of a magnesium deficiency include	Incorrect	59	33.9	1.66	.475	Good
	Correct	115	66.1			
	Total	174	100.0			
The nurse assessing skin turgor in an elderly patient should remember that	Incorrect	105	60.3	1.40	.491	Poor
	Correct	69	39.7			
	Total	174	100.0			
Which of the following might the nurse assess in a patient diagnosed with hypermagnesemia?	Incorrect	148	85.1	1.15	.358	Poor
	Correct	26	14.9			
	Total	174	100.0			
The nurse is admitting a patient with a suspected fluid imbalance. The most	Incorrect	162	93.1	1.07	.254	Poor
	Correct	12	6.9			

sensitive indicator of body fluid balance is:	Total	174	100.0			
A patient has a Magnesium level of 1.3 mg/dL. Which of the following is NOT a sign or symptom of this condition?	Incorrect	121	69.5	1.30	.462	Poor
	Correct	53	30.5			
	Total	174	100.0			
A patient has a calcium level of 8.7 mg/dL. What sign below is indicative of this lab value?	Incorrect	98	56.3	1.44	.497	Poor
	Correct	76	43.7			
	Total	174	100.0			
The results of laboratory analyze showed that the percentage of chloride was 70% in the blood. Choose one of the answers below that explains this result	Incorrect	142	81.6	1.18	.389	Poor
	Correct	32	18.4			
	Total	174	100.0			
Hypernatremia happened due to all the list below, except	Incorrect	121	69.5	1.30		Poor
	Correct	53	30.5			
	Total	174	100.0			
General mean and standard deviation				1.31	0.511	Poor

MS. Poor knowledge > 1.5 , fair knowledge =1.5 , good knowledge < 1.5

Table (4.5.) shows that all the items related to assessment recorded low in all items except item (3) recorded high level and the overall mean score of this domain were recorded poor (1.31±0.511).

Table 4.6: Knowledge of the study sample related to intravenous fluid and electrolyte administration:

Items		Frequency	Percent	Mean	St Deviation	Assessment
The nurse is caring for a client with dry mucous membranes, alteration blood pressure, and decreased urine output. Which of the following intravenous fluids would the nurse anticipate administering?	Incorrect	125	71.8	1.28	.451	Poor
	Correct	49	28.2			
	Total	174	100.0			
The nurse is caring for a client with nausea, vomiting and diarrhea for 3 days. The nurse would anticipate which of the following fluid choices as best for this client? (<i>Mixed solution between Normal saline and 5% Dextrose</i>)	Incorrect	99	56.9	1.43	.497	Poor
	Correct	75	43.1			
	Total	174	100.0			
Potassium chloride was added to an intravenous solution of a patient with a potassium level of (2.6). The color of the fluid inside the intravenous bottle has changed. What is the procedure for the nurse?	Incorrect	74	42.5	1.57	.496	Fair
	Correct	100	57.5			
	Total	174	100.0			

A regular infusion device was used to infuse fluids to a patient while giving 300 mL of Normal Saline to infuse over 6 hours. What is the amount of fluids given in one hour?	Incorrect	76	43.7	1.56	.497	Fair
	Correct	98	56.3			
	Total	174	100.0			
When potassium is given by intravenous injection, the maximum infusion rate is _____ to avoid complications	Incorrect	119	68.4	1.32	.466	Poor
	Correct	55	31.6			
	Total	174	100.0			
The morning labs results, indicated that the patient have a potassium level of 2.9 mEq/L and a magnesium level of 1.5 mEq/L , the patient is unable to take medications by mouth, and the provider has ordered intravenous replacement of both potassium and magnesium. In what order should the medication to administer correct the electrolyte imbalance?	Incorrect	127	73.0	1.27	.445	Poor
	Correct	47	27.0			
	Total	174	100.0			
The emergency unit received a patient suffering from bleeding in the	Incorrect	64	36.8	1.63	.484	Good

gastrointestinal tract, showing signs of anemia, hypotension, intravenous fluids were administered. Which of the following intravenous solutions can be given in addition to blood products?)	Correct	110	63.2			
	Total	174	100.0			
How much fluid should the patient consumed during 24 hours to maintain normal fluid balance?	Incorrect	106	60.9	1.39	.489	Poor
	Correct	68	39.1			
	Total	174	100.0			
General mean and standard deviation				1.43	0.478	Poor

MS .Poor knowledge > 1.5 , fair knowledge =1.5 , good knowledge < 1.5

Table (4.6.) shows that most of the items related to intravenous fluid and electrolyte administration recorded low in item (1,2,5,6 and 8) while item (3 and 4) recorded fair level and the item 8 recorded high level. The overall mean score of this domain were low (1.43±1.43).

Table 4.7. Knowledge of intravenous fluid and electrolyte administration of the study sample related to complications:

Items		Frequency	Percent	Mean	St Deviation	Assessment
The nurse determines that a client is having a transfusion reaction. After the nurse stops the transfusion, which action should be taken NEXT?	Incorrect	125	71.8	1.28	.451	Poor
	Correct	49	28.2			
	Total	174	100.0			
The nurse who assesses the patient's peripheral IV site and notes edema around the insertion site will document which complication related to IV therapy?	Incorrect	136	78.2	1.22	.414	Poor
	Correct	38	21.8			
	Total	174	100.0			
During intravenous fluid administration the following signs appears of postoperative patient such as dyspnea alteration of lung sound by use auscultation. Which action is prepare of this situation :	Incorrect	145	83.3	1.17	.374	Poor
	Correct	29	16.7			
	Total	174	100.0			
The nurse is making initial rounds on the nursing unit to assess the condition of assigned clients. The nurse notes that a client's IV site is cool, pale, and swollen, and the solution is not infusing. The nurse concludes that which of the following complications has occurred	Incorrect	123	70.7	1.29	.456	Poor
	Correct	51	29.3			
	Total	174	100.0			
The nurse notes that the site of a client's peripheral IV catheter is reddened, warm, painful, and slightly edematous proximal to the insertion point of the IV catheter. After taking appropriate	Incorrect	101	58.0	1.42	.495	Poor
	Correct	73	42.0			

steps to care for the client, the nurse documents in the medical record that the client experienced:	Total	174	100.0			
Which of the following complications causes the of signs in the intravenous leakage area such as pain, warmth, redness, stiffness of the vein and a slow rate of infusion:	Incorrect	69	39.7	1.60	.491	Good
	Correct	105	60.3			
	Total	174	100.0			
Which of the following complications causes the of signs/ symptoms Pain in chest, shoulder, or back, dyspnea, hypotension thread pulse, cyanosis; loss of consciousness of	Incorrect	73	42.0	1.58	.495	Fair
	Correct	101	58.0			
	Total	174	100.0			
If a blood clot accompanies the inflammation of the vascular endothelial wall it is referred to as	Incorrect	47	27.0	1.73	.445	Good
	Correct	127	73.0			
	Total	174	100.0			
A nurse finds a patient's IV insertion site red, warm, and slightly edematous. Which of the following actions should the nurse perform first?	Incorrect	127	73.0	1.27	.445	Poor
	Correct	47	27.0			
	Total	174	100.0			
General mean and standard deviation				1.39	0.451	Poor

MS .Poor knowledge > 1.5 , fair knowledge =1.5 , good knowledge < 1.5

Table (4.7.) shows that most of the items related to complications related to fluid and electrolyte administration recorded low in item (1,2,3,4,5 and 9) while item (7) recorded fair level and the item (6 and 8) recorded high level. the overall mean score of this domain were low (1.39±0.451).

Table 4.8.: Knowledge of intravenous fluid and electrolyte administration of the study sample related to caring:

Items		Frequency	Percent	Mean	St. Deviation	Assessment
Is there written protocol to treat infiltration available?	No	90	51.7	1.48	.501	Poor
	Yes	84	48.3			
	Total	174	100.0			
Is there written policy for treating phlebitis available?	No	100	57.5	1.43	.496	Poor
	Yes	74	42.5			
	Total	174	100.0			
	Yes	112	64.4			
	Total	174	100.0			
You need to attend educational course related to intravenous fluid administration and electrolytes management:	No	49	28.2	1.72	.451	Good
	Yes	125	71.8			
	Total	174	100.0			
It is important to have special manual content caring, complication and management of intravenous fluid administration in each hospital unit	No	84	48.3	1.52	.501	Fair
	Yes	90	51.7			
	Total	174	100.0			
General mean and standard deviation				1.55	0.485	Fair

MS .Poor knowledge > 1.5 , fair knowledge =1.5 , good knowledge < 1.5

Table (4.8.) shows that most of the items related to related to Manual for caring recorded low in item (1 and 2) while item (4) recorded fair level and the item (3) recorded high level. The overall mean score of this domain were fair (1.55±0.485).

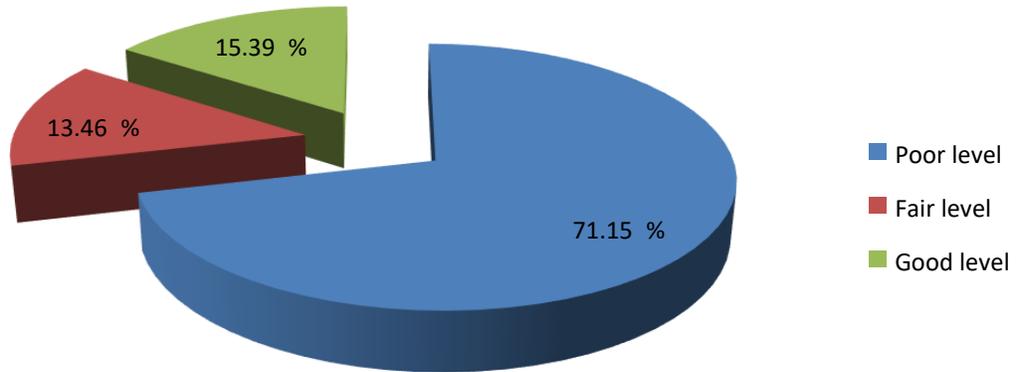


Figure 2: Over all knowledge regarding intravenous fluid and electrolyte administration

This figure present that over all nurse’s knowledge recorded unsatisfied related to intravenous fluid and electrolyte administration.

Table 4.9: Practices of intravenous fluid and electrolyte administration of the study sample related to preparation:

Items	Never		Sometimes		Always		Mean	St Deviation	Level
	F	%	F	%	F	%			
Verify IV solution order on MAR/CMAR with the medical order	5	2.9	48	27.6	121	69.5	2.67	.530	Good
Check the patient chart for allergies	147	84.5	20	11.5	7	4.0	1.20	.489	Poor
Check the solution for color, leaking, and expiration date	139	79.9	33	19.0	2	1.1	1.21	.438	Poor
Prepare the tools he needs during the intervention	4	2.3	63	36.2	107	61.5	2.59	.538	Good
Perform hand hygiene	161	92.5	11	6.3	2	1.1	1.09	.320	Poor
Identify the patient	25	14.4	96	55.2	53	30.5	2.16	.652	Fair
Pull the curtains around the bed or close the room door to maintain privacy	138	79.3	36	20.7	0	0	1.21	.406	Poor
Explain what are going to do and why are to the patient	98	56.3	73	42.0	3	1.7	1.45	.533	Poor
The patient is asked if there is an allergy to some drugs	83	47.7	70	40.2	21	12.1	1.64	.688	Poor
Ensures that the intravenous solution is matched to the contents the label is on the solution package	20	11.5	120	69.0	34	19.5	2.08	.553	Fair
Compare label solution container with the patient's name, solution type, additives, date, and time.	100	57.5	71	40.8	3	1.7	1.44	.532	Poor

Observe the principles of sterilization when opening sterile instruments	39	22.4	104	59.8	31	17.8	1.95	.634	Fair
Apply label to tubing reflecting the day/date for next set change	155	89.1	18	10.3	1	.6	1.11	.337	Poor
General mean and standard deviation							1.67	0.511	Poor

MS, Poor practice =1-1.6, fair practice =1,7-2.3, good practice =2.4-3

Table (4.9.) shows that the mean and standard deviation 1.67 ± 0.511 , (good level) related to 2 items (1, 4), a fair practice shows for items (6,10 and 12), while remain items (2,3,5,7,8,9,11 and 13) recorded poor level. The table recorded that the overall level of fluid and electrolyte preparation recorded poor.

Table 4.10.: Practices of intravenous fluid and electrolyte administration of the study sample related to fluid administration and monitoring:

Items	Never		Sometimes		Always		Mean	St. Deviation	Level
	F	%	F	F	%	F			
Hang the intravenous solution container on the fluid hook	3	1.7	4	2.3	167	96.0	2.94	.299	Good
Open the intravenous set from its package	3	1.7	49	28.2	122	70.1	2.68	.502	Good
Close the clamp on the existing intravenous administration set	1	.6	34	19.5	139	79.9	2.79	.420	Good
Remove the cover of the container	54	31.0	59	33.9	61	35.1	2.04	.814	Fair
Wear gloves	60	34.5	35	20.1	79	45.4	2.11	.890	Fair
Clean the tip of the container by sterile swab	166	95.4	8	4.6	0	0	1.05	.210	Poor

Insert the end of the administration set into container	5	2.9	51	29.3	118	67.8	2.65	.536	Good
Open the clamp on the extension tube to wash out air	0	0	28	16.1	146	83.9	2.84	.369	Good
Check the drip chamber of the administration set	0	0	72	41.4	102	58.6	2.59	.494	Good
Connect the tip of the administration set with the cannula	0	0	20	11.5	154	88.5	2.89	.320	Good

Slowly open the roller clamp on the administration set and count the drops, adjust the correct drop rate is achieved as order	11	6.3	109	62.6	54	31.0	2.25	.561	Fair
Make sure that the dropping and flow is continuous	10	5.7	109	62.6	55	31.6	2.26	.555	Fair
A sticker shall be attached to the solution indicating the time of explanations by infusion, time of completion and number of drops. Write a name medicines added to the solution with the dose if needed	8	4.6	128	73.6	38	21.8	2.17	.486	Fair
Ensure patients comfort with the proper position	18	10.3	112	64.4	44	25.3	2.15	.580	Fair
Dispose of used tools	1	.6	14	8.0	159	91.4	2.91	.309	Good
Remove gloves	66	37.9	77	44.3	31	17.8	1.80	.721	Fair
Wash hands	122	70.1	49	28.2	3	1.7	1.32	.502	Poor

After 30 minutes from starting infusion , nurse ask the patient if he or she is experiencing any pain or discomfort related to the IV infusion	62	35.6	102	58.6	10	5.7	1.70	.571	Fair
Record the patient's reaction to the procedure, the patient experiences any pain from the IV or notices any swelling at the site. If necessary	147	84.5	22	12.6	5	2.9	1.18	.457	Poor
Document the type of IV solution and the rate of infusion	6	3.4	12	6.9	156	89.7	2.86	.435	Good
Check the IV site for possible problems with the catheter, such as bending of the catheter.	102	58.6	68	39.1	4	2.3	1.44	.542	Poor
Position patient extremity	102	58.6	56	32.2	16	9.2	1.51	.661	Poor
Inspect the IV site for complication such as swelling, leakage, redness, infiltration.	90	51.7	77	44.3	7	4.0	1.52	.576	Poor
Records intake, output fluids according to a form evaluation	66	37.9	98	56.3	10	5.7	1.68	.579	Poor
Examines lung sounds using a stethoscope	171	98.3	3	1.7			1.02	.131	Poor
Attempt to flush the (5_10) ml of saline solution with heparin at stop the fluid leak to open the intravenous catheter	107	61.5	64	36.8	3	1.7	1.40	.526	Poor
Review the finding of serum electrolytes to avoid imbalance	163	93.7	11	6.3	0	0	1.06	.244	Poor

Assess vital signs	44	25.3	67	38.5	63	36.2	2.11	.779	Fair
Assess for edema	155	89.1	19	10.9	0	0	1.11	.313	Poor
Assess skin turgor	164	94.3	10	5.7	0	0	1.06	.233	Poor
General mean and standard deviation							1.96	0.487	Fair

MS, Poor practice =1-1.6, fair practice =1,7-2.3, good practice =2.4-3

Table (4.10.) shows that the mean and standard deviation 1.96 ± 0.487 , (good level) related to items (1,2,3,7,8,9,10,15 and 20), a fair practice shows for Items(4,5,11,12,13,14,16,18,and 28), while remain items (6,17,19,21,22,23,24,25,26,27and 29) recorded poor level .The table recorded that the overall level of intravenous administration recorded fair .

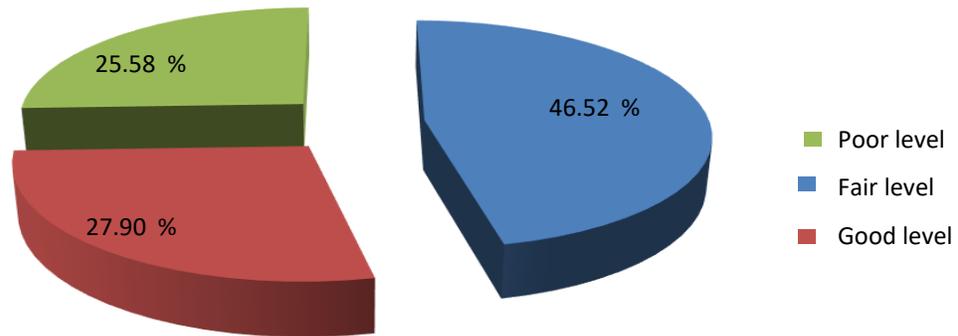


Figure 3: Over all practices regarding of intravenous fluid and electrolyte administration

This figure presented that the critical care nurses who participate in study recorded unsatisfied practice related to the studied phenomena.

Table 4.11.: Association between intensive care unit nurse's knowledge and demographical characteristics

Parameter	Chi square value	Df	p.value
Gender	35.352 ^a	23	.048 S
Age	68.257 ^a	46	.018 S
Marital status	73.655 ^a	46	.350 NS
Qualification	82.501 ^a	69	.128 NS
Residency	25.976 ^a	23	.302 NS

P. probability ≤ 0.05 , DF=degree of freedom,

Table (4.11.) shows that there are no significant relationships between the intensive care unit nurses' knowledge and demographical characteristics related to educational qualification, while significant relationship founded between the knowledge and nurses age and gender in $P \leq 0.05$

Table 4.12.: Association between intensive care unit nurse's knowledge and employment characteristics

Parameter	Chi square value	Df	p.value
Years of experience in hospital	58.413 ^a	46	.031 S
training sessions	19.275 ^a	23	.033 S
An educating yourself about the field of specialization in a self-reliant way?	17.007 ^a	23	.076 NS

P. probability ≤ 0.05 , DF=degree of freedom

Table (4.12.) shows that there are no significant relationships between the nurse's knowledge and employment characteristics related to education, while significant relationship founded between the knowledge and nurses' years of experience in hospital and training sessions in $P \leq 0.05$.

Table 4.13.: Association between intensive care unit nurses' practices and demographical characteristics

Parameter	R	p.value
Gender	-.069	.365 NS
Age	-.039	.068 NS
Marital status	-.120	.116 NS
Qualification	-.075	.361 NS
Residency	-.044	.567 NS

P. probability ≤ 0.05 . R= Person correlation

Table (4.13.) shows that there is no significant relationship between the nurse's practice and demographical characteristics.

Table 4.14.: Association between intensive care unit nurses' practices and employment characteristics

Parameter	R	p.value
Years of experience in hospital	.068	.370 NS
Training sessions	.065	.052 S
An educating yourself about the field of specialization in a self-reliant way?	.017	.082 NS

P. probability ≤ 0.05 . R= Person correlation

Table (4.14.) shows that there are no significant relationships between the nurse's practice and employment characteristics, except training sessions were distributed with $P \leq 0.05$

Chapter Five

Discussion

Chapter Five Discussion

This chapter will present interpretation over logical lattices and reasonably driven argumentation for static outcomes which were supported by the available literature and the researcher's opinion. The results of the study will be interpreted according to the study objectives.

5.1. Demographical and employment features of the study sample.

Study sample regarding demographic characteristics of the studied group in the current study showed (Table 4.1) that 88 (50.6%) were male this study results are similar with (Samar M. Khaled *et al.*, 2019). Male nurses made up 153 (54.6%) of the total number of nurses, making up the majority of nurses (121; 43.2 %)

Related to age the results were recorded 91(52.3%) between (20-25) years ago, this result is similar to (Aml A. Khalifa, *et al.* 2018) the result of the current study showed with a mean age of 43.32 ± 7.64 , 43.3 % of the study volunteers were between the ages of 20 and 29.

The results show that the factors impacting nurses' expertise are their age, gender, and attendance at training sessions.

Related to the study sample marital status and residency, the percentage 90 (51.7%) were married, 120 (69.0%) were urban residency, these results are similar with (Abd Elfatah *et al.*, 2018) who showed marital situations in 60% of the nurses who had completed the study were married and resided in urban areas (60.0 %)

As regards to educational level, while most of the study sample 110 (63.2%) were Bachelor degree holder, the findings of this study are comparable to that of

(Furat Hussein Mahmoud. et al 2023) the result of current study showed that more than half of the studied nurses had bachelor's degree of nursing.

From the investigator's point of view, this result might be due increased number of graduates from nursing faculties and new policies for nurses who had bachelor's degrees in nursing working at ICU.

(Figure 1) shows the internet represents (49%) of self-learning sources among nurse participants. The study (Web-based resources for critical care education. Critical care medicine) for (Kleinpell, R., *et al.* 2011) reported that integration of e-learning in medical education has been found to result in enhanced learning, increased interactivity, and an improved self-learning experience it becomes important that e-learning sources that are utilized in medical education are reliable and credible sources of information.

(Table 4.2) the current study showed years of experience in the hospital the findings show that 37.9 percent have More than 3 years of experience, this study's results is similar to the study (Heba Mohamed Ahmed Hassan et al 2021) Given that half of the nurses have experience from between one and five years ago, the majority of them are recently graduated (56.9 %)

There are relationships between the intensive care unit nurse's practice and employment characteristics, except training sessions were distributed with $P \leq 0.05$

5.2: Knowledge of the study sample related to intravenous fluid and electrolyte administration:

In order to be able to provide nurses with the right education to update their knowledge and to prevent any improper handling of high-risk medications that could endanger patients' lives, it is necessary to assess nurses' knowledge about

intravenous fluid and electrolyte administration. This was revealed by this portion of the current research.

5.2.1. General information related to fluid and electrolyte

Table (4.3) indicated that general information related to intravenous fluid recorded a low mean score in all items, while item (8) recorded a fair level. The overall level of general information was recorded as poor ($1.25 \pm .407$). Knowledge related to body fluid balance assessment, this outcome was in accordance with (Aslam *et al.* 2017) who found that nurses' knowledge regarding fluid and electrolyte administration, in public hospitals struggle, which lowers the standard of nursing care, when they carried out their study of general information nurses working in the cardiac surgery patients.

Table (4.4.) general information related to electrolyte administration recorded the overall level recorded poor (1.47 ± 0.541). Since these nurse's care for critically ill patients, they should have a solid background in nursing knowledge to be able to give these patients the care they require. However, the nurses' knowledge of this topic was insufficient, indicating the need for interventions to increase nursing knowledge.

Both (Mogileeswari and Ruth., 2016) and (Mohamed *et al.*, 2018) demonstrated that there was an unacceptable degree of awareness about fluid balance monitoring, which was particularly prevalent in their studies of the pre-educational protocol. Additionally, in a study by (AbdElalem and Fouad 2018), they evaluated the knowledge and practice of critical care nurses in relation to the assessment of fluid balance and discovered that the majority of the nurses were underprepared.

From the researcher's point of view, organ systems cannot operate properly and eventually die if an imbalance is not discovered and addressed. So that they

can act quickly, nurses must be able to spot minute changes in the fluid or electrolyte balances of their patients.

5.2.2. Knowledge of the study sample related to Intravenous Fluid and Electrolyte Administration (Assessment)

The study's goals were to evaluate nurses' fluid and electrolyte administration and monitoring knowledge and practices in the intensive care unit. Table (4.5.) shows that most of the items related to assessment recorded low ill items except item (3) recorded a high level, and the overall mean score of this domain was low (1.31 ± 0.511). This is the same result of (Mona Abdel, Ghany Leilah et al 2019) The findings of the present investigation revealed that experts concurred on the significance of central venous pressure (CVP) monitoring in the evaluation and treatment of fluid and salt imbalance in critical ill patients.

This result is compatible with a prior investigation by (Li *et al.* 2017) into the relationship between high central venous pressure (CVP) and the outcomes of critically ill patients.

5.2.3. Knowledge of the study sample related to intravenous fluid and electrolyte administration (administration fluid and electrolyte)

Table (4.6.) shows that most of the items related to intravenous fluid and electrolyte administration recorded a low overall score in this domain (1.43 ± 1.43). To improve the quality of care in public hospitals, nurses' knowledge and practices regarding the administration of fluids and electrolytes need to be improved. This is the same result of (Shumaila Aslam *et al.* 2017) showing that there is a knowledge gap among the nurses at the Punjab Institute

of Cardiology because the majority of them disagree on knowledge-related issues.

The findings show that nurses' procedures regarding the administration of fluids and electrolytes following heart surgery also fall short on a moderate to high level. Additionally, the nurses' disregard for low to moderate-level protocols and standards may be hazardous to the patient's safety. Regarding their knowledge of responsible parties for fluid monitoring, n=37 nurses (17.79%) indicated that they strongly disagreed, n=56 nurses (26.92%) disagreed, n=4 nurses (1.92%) were unsure, n=53 nurses (25.48%) agreed, and n=58 nurses (27.88%) highly agreed.

5.2.4. Knowledge of the study sample related to intravenous fluid and electrolyte administration (complication)

Table (4.7.) shows that most of the items related to complications related to fluid and electrolyte administration recorded the overall mean score of this domain were low (1.39 ± 0.451). That is similar with (Abd Elfatah *et al.*, December 2018) according to the study's findings, only one-fourth of participants received strong knowledge scores for all knowledge questions, while more than a quarter had fair knowledge and close to half had low knowledge. Considering that nurses are crucial in the treatment of critically ill patients who have fluid, electrolyte, and acid-base imbalances. Lack of understanding of fluid and electrolyte imbalances is seen as a barrier to treating patients; this may be because nurses have not paid enough attention to continuing education or training programs, particularly those that address fluid and electrolyte imbalances.

This finding is consistent with (Mogileeswari & Ruth Grace, 2016), which found that among 100 samples, there are three levels of understanding of fluid and electrolyte replacement therapy: The knowledge levels of 15 (15%), 62

(62%), and 23 (23%), respectively, were adequate, fairly adequate, and insufficient.

From the researcher's point of view, nurses must be able to spot tiny changes in patients' fluid or electrolyte balances so they can act quickly. Nurses must have the knowledge and skills required to recognize the signs of fluid loss and hypovolemia, assess and monitor patients' fluid balance, manage IV fluid delivery, control vascular access devices, and, possibly, give IV fluids.

5.2.5. Knowledge of the study sample related to manual for caring

The current study assesses the knowledge and practices regarding caring for and maintaining Peripheral intravenous cannulation among nurses. This study indicated that most nurses are practicing appropriately and have a fair understanding of IV cannula guidelines. Nurses may find it difficult to follow evidence-based recommendations for reducing IV catheter-related infections if they lack expertise in infection control and adequate nursing care. There are still nurses that don't follow the recommended standards and insert, remove, and maintain IV cannulas incorrectly despite the acknowledged risks of PICs table (4.8.) shows that most of the items related to manual for caring recorded low in items (1 and 2) while item (4) recorded fair level and the item (3) recorded high level. the overall mean score of this domain was low (1.55 ± 0.485).

On August 9, 2002, the Centers for Disease Control (CDC) replaced the 1996 edition of the Guidelines for the Prevention of Intravascular Catheter-Related Infections with a second edition. The goal was to provide evidence-based recommendations for lowering catheter-related infections (O'Grady *et al.*, 2011). The 2002 CDC Guidelines put a lot of emphasis on a number of things, including educating and training medical staff who insert and maintain catheters, using the maximum sterile barrier precautions, using a 2 percent chlorhexidine

preparation for skin antisepsis, avoiding routine central venous catheter replacement as a strategy of infection prevention, using antiseptic or antibiotic-impregnated short-term central venous catheters, and using chlorhexidine-impregnated catheters. The 2011 revision and update of the 2002 CDC guideline was created by a working group made up of members from professional organizations representing the fields of critical care medicine, infectious diseases, healthcare infection control, surgery, anesthesiology, interventional radiology, pulmonary medicine, pediatric medicine, and nursing (O'Grady *et al.*, 2011).

The quality of care, patient safety, and patient satisfaction ratings can all be improved as a result of nurses' understanding of and early identification of phlebitis risk factors, which can also shorten hospital stays and lower total healthcare costs (Milutinovic, Simin, & Zec, 2015). According to this study, 97% of respondents are aware that thrombophlebitis and infection are the most frequent side effects of IV cannulations. In a similar vein, 75.5 percent of those surveyed were aware of how ambient cleanliness affected IV site infections.

Overall knowledge regarding fluid and electrolytes (fig. 2) Intensive care Critically sick patients undergo physiological stressors that disrupt homeostasis, and nurses play a significant role in recognizing and treating these conditions. T (Hassan, A.2021). The current study showed that the majority of nurses had unsatisfactory knowledge regarding fluids and electrolytes, this sustained result might be referred to as that.

From the researcher's point of view, because these nurses care for important situations, it is necessary to develop interventions to increase nursing knowledge. This is because these nurses must have a solid knowledge base to be able to give these patients the care they require.

5.3. Practices of study sample related to fluid and electrolyte administration:

5.3.1 Preparation:

According to the current study's findings about nurses' level of practice, practically unsatisfactory work was done by all nurses. when monitoring and treating fluid and electrolyte imbalances. Table (4.9.) shows that the mean and standard deviation of 1.67 ± 0.511 that the overall level of fluid and electrolyte preparation recorded as poor.

The reason for this finding, sometimes, may be connected to the primary factor in inaccurate monitoring of fluid balance which is there is a staffing deficit for nurses and workload in the intensive care unit. It may also be because monitoring fluid balance is a routine nursing procedure; nurses may believe they are skilled in calculating and monitoring fluid balance and are not looking to update their knowledge.

The results of the current study are in line with those of (Vincent & Mahendiran, 2015), whose study used verbal presentation and e-Learning to raise nurses' awareness of fluid balance. Following the intervention, the researchers found that better nursing practice requires sufficient information.

The current investigation revealed that less than one-third of nurses at MGH and more than half of those at MUH correctly prepared and administered intravenous fluids. This finding is consistent with a study by Qamar *et al.* (2017) entitled "Assess Nurses Knowledge and Practices towards Care and Maintenance of Peripheral Intravenous Cannulation at Services Hospital Lahore, Pakistan," which found that more than half of the nurses in the study had poor practices.

Since nurses are in charge of properly preparing IV drugs, nurses need to improve their procedures for administering various IV fluids. More than 40% of the nurses were unaware that NaCl 3% could not be used in place of NaCl 0.9

percent when diluting antibiotic solution. This might be because people are unaware that different sodium chloride concentrations are treated differently as preparations, have different uses, and shouldn't be used interchangeably.

5.3.2. Administration and monitoring:

Table (4.10.) shows that the mean and standard deviation of 1.96 ± 0.487 recorded that the overall level of intravenous administration recorded fair. The majority of nurses had a reasonably adequate level of practice when it came to maintaining fluid and electrolyte balance for critically ill patients in ICUs. Given that the study's nurses did not participate in any training sessions on fluid and electrolyte control, this is an unexpected outcome.

The ability of nurses to provide satisfactory patient care may be a result of their prior experience with critically sick patients. This result is consistent with a prior study that evaluated nurses' competency in fluid and electrolyte management for burn patients. According to the study, nurses in the burn ICU practice high (37%) to moderate (42%) levels of fluid and electrolyte preservation. However, additional research revealed that most nurses had little experience managing the hydration and electrolyte balance for ICU patients. The increased workload of nurses and a lack of education were factoring the researchers blamed for their findings. This emphasized the requirement for ongoing education programs on maintaining fluid and electrolyte balance for critical care nurses.

Regarding nurses' practice related to measuring fluid input and output and assessing body fluid balance among nurses in the intensive care unit, the current study found that approximately two thirds of ICU nurses had incompetent and incomplete nursing practice related to these tasks before the intervention, which improved at the end of it after receiving instruction on body fluid balance.

These results were consistent with those of (Perren *et al.* 2011), who discovered that one-third of critically sick patients had erroneous fluid balance evaluations due to incomplete recording ranging from -3606 mL to +2020 mL. Additionally, (Johnson and Monckhouse 2009) concluded that there was a disparity between the fluids delivered and the fluids recorded in patients' charts. More than two thirds of critically ill patients had fluid balances that were more than 50 mL above the desired balance, according to (Diacon and Bell 2014).

Concerning on nurses' practices regarding monitoring an IV Site and Infusion, the result of present study revealed that majority of the studied nurses had did not " Perform hand hygiene and put on PPE", and check for bleeding at the site." on other hand, this result agreement with study by (Bayoumi, *et al.*, 2022) who conducted study about "changes in nurses' knowledge and clinical practice in managing local IV complications following an education intervention" and reported that most of the studied nurses had poor practices regarding monitoring an IV Site and Infusion.

The current study indicated that pre-program, half of the nurses (n = 156; 89.7%) accurately recorded the prescribed fluid and electrolyte replacement therapy for burn patients on charts; this number increased to the majority following program implementation.

The study "Knowledge and Practice Regarding Fluid and Electrolytes Replacement Therapy for Patients with Burns among Working Nurses" revealed that more than a third of nurses practiced safety, less than half did it in a moderately safe manner, and less than a quarter did so in an unsafe manner. These findings agreed with (Kanakalakshmi's 2014) study. Additionally, this outcome was consistent with (Waqas's 2017) findings in "The Assessment of Nurses' Knowledge and Practices about Fluid and Electrolytes Monitoring and Administration among Patients," which indicated that the majority of the study

sample correctly recorded the prescribed fluid on charts following educational programs.

According to the current study, the majority of nurses used a fair practice in assessment (46.52 %) for all practices involving fluid and electrolytes on the overall level of nursing practice during the practice's checklist. This difference was statistically significant.

The findings were consistent with (Mohamed *et al.* 2019), who noted that more than three-quarters of the nurses in the PICU had subpar practice in the auditing and improved practice in the re-auditing. Additionally, the current outcomes supported Cooper (2019). According to the researchers, the results of the current research could be attributed to a lack of nursing staff, an overload of nursing work, the need to interact with a there are many patients in a short amount of time, and the absence of awareness and knowledge due to a dearth of training programs about fluids and electrolytes, our findings showed this. Additionally, utilizing the study nursing standard improved their practice and understanding.

From the researchers' viewpoint, findings showed, the present study's conclusions study can be ascribed to nursing's lack of understanding of fluids and electrolytes resulting from a dearth of training programs in this area. Additionally, utilizing the study nursing standard improved their practice and understanding.

The mismatch between nurses' knowledge and what they actually experience in clinical settings is known as the knowledge-practice gap. 2017 (EL Hussein & Osuji). The majority of nurses are likely to wind up at either end of the spectrum if all nurses are employed in positions requiring competency in theory and practice. Evidence suggests that skilled nurses can develop the best

care plans, describe pathophysiology, consider treatment options, etc. but struggle with actual practice (Ajani and Moez., 2011).

5.4. Association between Intensive Care Unit Nurses Knowledge and demographical characteristics and employment characteristics:

The results of the present study showed that there was no statistically significant relationship between nurses' total knowledge scores and their demographic characteristics at marital status, qualification. Their gender and age did significantly affect their overall knowledge results. Table (4.11) shows that there is no significant relationship between the intensive care unit nurses' practice and demographical characteristics and Table (4.12) shows that there is no significant relationship between the Intensive Care Unit Nurse's practice and employment characteristics, except training sessions were distributed with $P \leq 0.05$

From the researchers' viewpoint, these findings may be the result of a lack of particular training programs for nurses in the hospital addressing the management of fluid and electrolyte imbalances, a scarcity of nurses, or a lack of nurses who understand the value of continuing education in this area.

According to (Pancorbo-Hidalgo, *et al.*, 2007), there was a negative correlation between years of experience and knowledge levels, with nurses with more years of working experience (21–30 years) having lower levels of knowledge than those with fewer years of working experience (1–10 years). The findings of the current study did not support this conclusion. The notion that nurses with more job experience may have had fewer opportunities to receive current knowledge may have helped to explain these findings. Last but not least, there was little connection between a nurse's experience and expertise.

5.5. Association between Intensive Care Unit Nurses Practices and demographical characteristics and employment characteristics:

The current study shown that, other from educational level, no statistically significant difference was found, relationship total between nurses practice scores and their demographic features at various study times. This conclusion may be the result of nurses just following medical directions, which renders them uniform in practice regardless of their age, degree of education, or the number of years of experience.

A different researcher disagreed with the findings of the current study by Miran and Gyeongae (2014), which found a highly significant positive association between age and a nurse's knowledge as well as a positive correlation between years of experience and a nurse's knowledge and practices.

The current study's findings showed a negative correlation between total knowledge and practice scores among the nurses who were the study's subject before the recommendations regarding general knowledge, fluid loss, knowledge of potassium, knowledge of calcium, knowledge of magnesium, and total knowledge score. regarding general knowledge, as well as immediately following those guidelines. Between the investigated nurses' overall knowledge and practice scores at various study durations, there was no statistically significant correlation.

From the researcher's point of view, this outcome was caused by the lack of a hospital-based continuous training program for nurses that is based on an educational plan for the fundamental courses and other courses according to work field requirements. Additionally, as the nurses said, the hospital only offered classes in CPR and infection control.

Other research claimed that fluid balance charts needed to be completed, but it was discovered that none were finished correctly across all wards.

Incomplete and erroneous charts have been attributed to staff shortages, a lack of training, and a lack of time (Asfour, 2016).

Therefore, from the researcher's perspective, there was an agreement with this viewpoint from (Thomas *et al.*, 2015), as their data demonstrated that patients run the danger of unnecessarily becoming dehydrated and/or developing an infection. The staff nurses' knowledge and competence to increase and positively impact in-patient care, there must be ongoing training for them. These dangers may be decreased by straightforward measures such as improving clinical staff awareness, education, and training. Additionally, newly licensed graduate nurses must possess the knowledge and abilities necessary to work as ICU nurses (Njung'e, Mbithi, & Okova, 2017).

Based on the results presented in the fourth chapter and discussed in the fifth chapter the results of the current study, three-quarters of the intensive care unit nurses working in Al-Hilla teaching hospitals did not have full knowledge of intravenous fluid and electrolyte administration, and this means that they are unable to solve patients' problems related to intravenous fluid and electrolyte administration. Concerning nurses' practice related to body fluid balance assessment among nurses in the intensive care unit, the current study conducted that less than half of ICU nurses had incompetent and incomplete nursing practice related to the assessment of fluid balance and measuring fluid input and output. Furthermore, there are significance relationships between nurse's knowledge and employment characteristics except self-education was non-significance. There are no significance relationships between nurses' practice and employment characteristics except training sessions was significance.

Chapter Six

Conclusions

and

Recommendations

Chapter Six Conclusions and Recommendations

6.1: Conclusions:

The conclusion of the presented finding can be as following:

Most of the study sample who agree to participate in the study were male, married, between (20-25) years of age group, bachelor's degree holders, and with urban residency. The majority of the study sample were nurses who have an experience with ≤ 5 years.

In conclusion, nurses' knowledge about intravenous fluid and electrolytes administration is overall unsatisfactory knowledge.

The practice is generally fair. The knowledge and practice scores are negatively correlated and the training courses have a positive influence on nurses' knowledge.

No significant relationships between the intensive care unit nurses' knowledge and demographical characteristics related to educational qualification, while significant relationship founded between the knowledge and nurses age and gender

No significant relationships between the intensive care unit nurses' practices and their demographical characteristics related to (educational status, residency, and marital status).

The statistical analysis finds the impact of age and gender related to nursing knowledge while the other variables (educational status, residency, and marital status) didn't play an affecting factor.

Significant relation was found between the intensive care unit nurses' knowledge and the training courses and years of experience, while no significant relationships between the intensive care unit nurses' practice and demographical characteristics.

6.2: Recommendations:

Depending on the presented finding it is beneficial to suggest the following recommendations:

1. Continuous in-service education programs can make it easier to provide high standards for training and teaching regarding fluid balance assessment, monitoring fluid and electrolyte replacement therapy.
2. Monitoring fluid and electrolyte replacement therapy for patients in intensive care units require regular training to update nurses' practices.
3. The intensive care unit should supply and have available educational guidelines, posters, booklets, and manuals on maintaining patient's fluid and electrolyte balance.

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Appendices

Appendices

Appendix A

Approval

University of Babylon
College of Nursing
Research Ethics Committee

جامعة بابل
كلية التمريض
لجنة اخلاقيات البحث العلمي

Issue No:3
Date: 31 / 1 /2023

Approval Letter

To, نوار رباح هادي

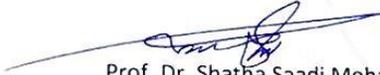
The Research Ethics committee at the University of Babylon, College of Nursing has reviewed and discussed your application to conduct the research study entitled " Intensive Care Unit Nurses Knowledge and Practices Related to Intravenous Fluid and Electrolyte Administration".

The Following documents have been reviewed and approved:

1. Research protocol
2. Research instrument/s
3. Participant informed consent

Committee Decision.

The committee approves the study to be conducted in the presented form. The Research Ethics committee expects to be informed about any changes occurring during the study, any revision in the protocol and participant informed consent.


Prof. Dr. Shatha Saadi Mohammed
Chair Committee
College of Nursing
Research Ethical Committee
31 / 1/2023

UNIVERSITY OF BABYLON
FACULTY OF NURSING

Appendices

Appendix B1

جمهورية العراق		
<p>Ministry Of Health Babylon Health Directorate Email:- Babel_Healthmoh@yahoo.com</p> <p>لأجل عراق الغض مستدام... سنعمل معا لترسيخ استهلاك تقلعة الكهربائية والمحافظة على البيئة من تلوث</p>		<p>وزارة الصحة دائرة صحة محافظة بابل المدير العام مركز التدريب والتنمية البشرية وحدة إدارة البحوث</p> <p>العدد: ٢٦٩ التاريخ: ٢٠٢٣/٢/٦</p>
<p>إلى / مستشفى الإمام الصادق (ع) / مستشفى الحلة التعليمي مستشفى مرجان التعليمي م // تسهيل مهمة</p> <p>تحية طيبة ... أشارة إلى كتاب جامعة بابل/ كلية التمريض / الدراسات العليا ذي العدد ٤٩٩ في ٢٠٢٣/٢/٦ نرفق لكم ربطا استمارات الموافقة المبدئية لمشروع البحث العائد للباحثة طالبة الدراسات العليا/ ماجستير (نوار رباح هادي). للتفضل بالاطلاع وتسهيل مهمة المومس إليه من خلال توقيع وختم استمارات إجراء البحث المرفقة في مؤسساتكم وحسب الضوابط والإمكانات لاستحصال الموافقة المبدئية ليتسنى لنا إجراء اللازم على أن لا تتحمل مؤسساتكم أية تبعات مادية وقانونية مع الاحترام</p> <p>المرفقات: استمارة عدد ٢/</p> <p>وزارة الصحة دائرة صحة محافظة بابل مركز التدريب والتنمية البشرية مدير مركز التدريب والتنمية البشرية ٢٠٢٣/ /</p> <p>نسخة منه إلى: مركز التدريب والتنمية البشرية / وحدة إدارة البحوث مع الأوليات ...</p> <p>دائرة صحة محافظة بابل / مركز التدريب والتنمية البشرية // ايميل المركز babiltraining@gmail.com</p>		

Appendix
B3

جمهورية العراق		
Ministry Of Health Babylon Health Directorate Email:- Babel_Healthmoh@yahoo.com لأجل عراق الخضرمستقام...منتمل معا لترشيد استهلاك طاقة الكبريتات والمحافظة على البيئة من التلوث		وزارة الصحة دائرة صحة محافظة بابل المدير العام مركز التدريب والتنمية البشرية وحدة إدارة البحوث العدد : ٢٦٩ التاريخ: ٢٠٢٣/٢/٦
<p>مستشفى مرجان للأمراض الباطنية والقلبية المتخصص (الواردة) العدد : التاريخ لا اله الا الله</p> <p>إلى / مستشفى الإمام الصادق (ع) مستشفى الحلة التطبيقي مستشفى مرجان التطبيقي م // تسهيل مهمة</p> <p>تحية طيبة ... أشارة إلى كتاب جامعة بابل/ كلية التمريض / الدراسات العليا ذي العدد ٤٩٩ في ٢٠٢٣/٢/٦ نرفق لكم ربطا استمارات الموافقة المبدينية لمشروع البحث العائد للباحثة طالبة الدراسات العليا/ ماجستير(نوار رباح هادي).</p> <p>للتفضل بالاطلاع وتسهيل مهمة الموما اليه من خلال توقيع وختم استمارات إجراء البحث المرفقة في مؤسساتكم وحسب الضوابط والإمكانيات لاستحصال الموافقة المبدينية ليتسنى لنا إجراء اللازم على أن لا تتحمل مؤسساتكم أية تبعات مادية وقانونية مع الاحترام</p> <p>المرفقات : استمارة عدد / ٢</p> <p>الدكتور محمد عبد الله عجرش مدير مركز التدريب والتنمية البشرية ٢٠٢٣ / ١</p> <p>الدكتور الاختصاص من الكورسي القرويني ايكو - فكية - باطنية</p> <p>الدكتور ضيف غام سيفه الدين معاون مدير القسم الفني</p> <p>نسخة منه إلى : • مركز التدريب والتنمية البشرية / وحدة إدارة البحوث مع الأوليات باطنية</p> <p>دائرة صحة محافظة بابل / مركز التدريب والتنمية البشرية // ايميل المركز babiltraining@gmail.com</p>		

**Appendix
C1**

**Intensive Care Unit Nurses Knowledge and Practices Related to
Intravenous Fluid and Electrolyte Administration**

Part One: Demographic data:

1. Gender:

- 1. Male
- 2. Female

2. Age: (years)

3. Marital status:

- 1. Married
- 2. Single
- 3. Divorced
- 4. Widow

4. Qualification:

- 1. Nursing School
- 2. Diploma
- 3. Bachelor
- 4. Post graduate

5. Residency:

- 1. Rural area
- 2. Urban area

Appendices

Part Two: Professional Data:

1. Years of experience in the hospital:

1. Less than 1 year
2. 1 to 3 years.
3. More than 3 years

2. Participation in training sessions concerned to intravenous fluid and electrolyte administration:

1. Yes
2. No

3. Do you work on educating yourself about the field of specialization in a self-reliant way?

1. Yes
2. No

• If your answer is (yes), please show us the sources of your self-learning:

1. The Internet
 - a. Solid sites like Google
 - b. Social networking sites
2. Hospital library
3. Experienced nurse colleagues
4. Doctors
5. Pharmacists

Part Three: Intensive Care Unit Nurse's Knowledge Related to Intravenous Fluid and Electrolyte Administration

First Domain: General information related to fluid and electrolytes:

I. Fluid

1. Plasma is a body fluid which located at :

- a) Extracellular compartment
- b) Intracellular compartment
- c) Around the cell
- d) Body cavities

2. The extracellular fluid comprises:

- a) Interstitial fluid
- b) Plasma
- c) Plasma and interstitial fluid
- d) Tissue cells

3. The most commonly used type of parenteral fluid is:

- a) Crystalloid
- b) Colloid
- c) Plasma
- d) Serum

4. Crystalloids are classified as:

- a) Isotonic
- b) Hypotonic
- c) Hypertonic
- d) Albumin

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5. The mechanism of Hypotonic fluids is:

- a) Maintained in the vasculature
- b) Move out to the cells
- c) Stay equally in the vasculature and cells
- d) Direct pass to the third spaces

6. Isotonic solutions commonly used for:

- a) Dehydration
- b) Resuscitation
- c) Replacement
- d) Nutrition

7. Hypertonic solutions are contraindication for

- a) Dehydrated patients
- b) Hypotensive patients
- c) Hemorrhaging patients
- d) Head trauma

8. A patient is hypotensive related to extensive bleeding in surgery. Which type of fluid would be most appropriate to administer to this condition?

- a) Hypertonic 3% saline (NaCl)
- b) Hypotonic D5W + 1/2 NaCl
- c) Isotonic lactated Ringers (LR)
- d) Glucose water 5%

9. Normal saline 0.9% and Dextrose 5% are example of:

- a) Hypotonic fluids
- b) Isotonic fluids
- c) Hypertonic fluids
- d) IV fluids

Appendices

10. Which type of intravenous fluid quickly metabolized, leaves free water for even distribution on all fluid

- a) Compartments
- b) Normal Saline
- c) Dextrose
- d) Lactated Ringers

11. When assessing patient for signs of fluid overload the nurse would expect to observe:

- a) Pounding pulse
- b) Flat neck veins
- c) Vesicular lung examination
- d) Poor skin turgor

II. Electrolyte

1. Serum electrolyte concentrations are most often expressed as:

- a) mg %.
- b) mmHg.
- c) mg/dl.
- d) mEq/L.

2. The cation that plays a major role in determining the osmotic pressure of the plasma is:

- a) Sodium.
- b) Potassium.
- c) Chloride.
- d) Phosphate.

Appendices

3. The major route of excretion for sodium ions (under normal conditions) is the:

- a) Skin.
- b) kidney.
- c) GI tract.
- d) Sweat.

4. Most of the calcium in the body is find in the:

- a) Bones.
- b) Plasma.
- c) kidneys.
- d) GI tract.

5. Calcium's roles in the body include the following except:

- a) Muscle contraction.
- b) Blood clotting.
- c) Action potentials in heart muscle.
- d) It works as a blood thinner

6. The main regulator of serum phosphate levels is a transport process in the:

- a) liver.
- b) kidneys.
- c) Pancreas.
- d) Small intestine.

7. Potassium is the most abundant intercellular cation in the body and plays a role in multiple body functions which include all The following except:

- a) Acid-Base balance
- b) Muscle contraction
- c) Conduction of nerve impulses
- d) Alteration of blood pressure

Appendices

8. Magnesium is absorbed into the human body

- a) liver
- b) Kidneys
- c) Intestine
- d) Sstomach

9. Potassium has the following characteristics, except:

- a) Major cation of extracellular fluid
- b) Major cation of intracellular fluid
- c) One of the negative electrolytes intracellular fluid
- d) Can easily consumed by eating banana

Second Domain: Assessment:

1. The nurse has obtained a unit of blood from the blood bank and has checked the blood bag properly with another nurse. Just before beginning the transfusion, the nurse should assess which **PRIORITY** item.

- a) Vital signs
- b) Skin color
- c) Urine output
- d) Latest hematocrit level

2. Which of the following are the advantages of having an intravenous insertion team? Select all that apply:

- a) Decrease nurses workload
- b) Decrease complication rates
- c) Review IV policies and procedures
- d) Improve patient outcomes

Appendices

3. The clinical manifestations of a magnesium deficiency include:

- a) Numbness, muscle weakness, fatigue
- b) Increased appetite, weight gain,
- c) Nausea, vomiting, diarrhea
- d) Shortness of breath, fever, cough

4. The nurse assessing skin turgor in an elderly patient should remember that:

- a) Overhydration causes poor skin turgor
- b) Dehydration causes the skin to appear edematous and spongy.
- c) Inelastic skin turgor is a normal part of aging.
- d) Normal skin turgor is moist and boggy

5. Which of the following might the nurse assess in a patient diagnosed with hypermagnesemia?

- a) Diminished deep tendon reflexes
- b) Tachycardia
- c) Cool clammy skin
- d) Increased serum magnesium

6. The nurse is admitting a patient with a suspected fluid imbalance. The most sensitive indicator of body fluid balance is:

- a) Daily weight
- b) Serum sodium levels
- c) Measured intake and output
- d) Blood pressure

7. A patient has a Magnesium level of 1.3 mg/dL. Which of the following is NOT a sign or symptom of this condition?

- a) Hypertension
- b) No symptoms
- c) Positive Trousseau's Sign
- d) Absent deep tendon reflexes

Appendices

8. A patient has a calcium level of 8.7 mg/dL. What sign below is indicative of this lab value?

- a) Disturbance in cardinal electricity
- b) Hypoactive bowel sounds
- c) Nausea and vomiting
- d) None, this is a normal calcium level

9. The results of laboratory analyzes showed that the percentage of chloride was 70% in the blood. Choose one of the answers below that explains this result

- a) None, this is a normal level.
- b) Cystic Fibrosis
- c) Metabolic acidosis
- d) Hypertonic fluids

10. Hyponatremia happened due to all the list below, except :

- a) Excess water intake
- b) Diabetes insipidus
- c) Sweating
- d) Burns
- e)

Third Domain: Administration fluid and electrolyte:

1. The nurse is caring for a client with dry mucous membranes, alteration blood pressure, and decreased urine output. Which of the following intravenous fluids would the nurse anticipate administering?

- a) Hypertonic
- b) Hypotonic
- c) Normal saline
- d) Potassium chloride

Appendices

- 2. The nurse is caring for a client with nausea, vomiting and diarrhea for 3 days. The nurse would anticipate which of the following fluid choices as best for this client?**
 - a) Normal saline
 - b) Isotonic (D5W)
 - c) Hypertonic
 - d) Mixed solution between Normal saline and 5% Dextrose (D5W)

- 3. Potassium chloride was added to an intravenous solution of a patient with a potassium level of (2.6). The color of the fluid inside the intravenous bottle has changed. What is the procedure for the nurse?**
 - a) Removing and changing the liquid
 - b) Continue to give fluids
 - c) liquid haste
 - d) Changing the fluid dispenser

- 4. A regular infusion device was used to infuse fluids to a patient while giving 300 mL of Normal Saline to infuse over 6 hours. What is the amount of fluids given in one hour?**
 - a) 1800
 - b) 90
 - c) 100
 - d) 50

- 5. When potassium is given by intravenous injection, the maximum infusion rate is _____ to avoid complications**
 - a) 40 mEq/hour
 - b) 20mEq/hour
 - c) 10mEq/hour
 - d) 30 mEq/hour

- 6. The morning labs results indicated that the patient has a potassium level of 2.9 mEq/L and a magnesium level of 1.5 mEq/L, the patient cannot take medications by mouth, and the provider has ordered intravenous replacement of both potassium and magnesium. In what order should the medication to administer correct the electrolyte imbalance?**

Appendices

- a) Potassium, Magnesium
 - b) Dual Administration
 - c) Magnesium, Potassium
 - d) No specific order of administration is recommended
- 7. The emergency unit received a patient suffering from bleeding in the gastrointestinal tract, showing signs of anemia, hypotension, intravenous fluids were administered. Which of the following intravenous solutions can be given in addition to blood products?**
- a) Hypotonic
 - b) Hypertonic
 - c) Isotonic % Dextrose in water
 - d) 0.9% NaCl
- 8. How much fluid should the patient consumed during 24 hours to maintain normal fluid balance?**
- a) 500 mL
 - b) 1,00 mL
 - c) 1,500 mL
 - d) 2,200 mL

Forth Domain: *Complications related to fluid and electrolyte administration:*

- 1. The nurse determines that a client is having a transfusion reaction. After the nurse stops the transfusion, which action should be taken NEXT?**
- a) Remove the intravenous (IV) line.
 - b) Isotonic of 5% dextrose in water.
 - c) Run normal saline at a keep -vein-open rate.
 - d) Obtain a culture of the tip of the catheter device removed from the client.

Appendices

- 2. The nurse who assesses the patient's peripheral IV site and notes edema around the insertion site will document which complication related to IV therapy?**
 - a) Air emboli
 - b) Phlebitis
 - c) Infiltration
 - d) Fluid overload

- 3. During intravenous fluid administration the following signs appears of postoperative patient such as dyspnea alteration of lung sound by use auscultation . Which action is prepare of this situation :**
 - a) Stop fluid
 - b) Decrease fluid and giving diuretic medicines
 - c) Change the type of fluid
 - d) Assess serum potassium rate in the blood

- 4. The nurse is making initial rounds on the nursing unit to assess the condition of assigned clients. The nurse notes that a client's IV site is cool, pale, and swollen, and the solution is not infusing. The nurse concludes that which of the following complications has occurred.**
 - a) Infection
 - b) Phlebitis
 - c) Infiltration
 - d) Thrombosis

- 5. The nurse notes that the site of a client's peripheral IV catheter is reddened, warm, painful, and slightly edematous proximal to the insertion point of the IV catheter. After taking appropriate steps to care for the client, the nurse documents in the medical record that the client experienced:**
 - a) Phlebitis of the vein
 - b) Infiltration of the IV line
 - c) Hypersensitivity to the IV solution
 - d) Allergic reaction to the IV catheter material

Appendices

- 6. Which of the following complications causes the of signs in the intravenous leakage area such as pain, warmth, redness, stiffness of the vein and a slow rate of infusion:**
- a) Phlebitis
 - b) Infiltration
 - c) Toxicity
 - d) Air embolism
- 7. Which of the following complications causes the of signs/ symptoms Pain in chest, shoulder, or back, dyspnea, hypotension thread pulse, cyanosis; loss of consciousness of:**
- a) Toxicity
 - b) Air embolism
 - c) Phlebitis
 - d) Infiltration
- 8. If a blood clot accompanies the inflammation of the vascular endothelial wall it is referred to as _____.**
- e) Toxicity
 - a) Phlebitis
 - b) Thrombophlebitis
 - c) Infiltration
- 9. A nurse finds a patient's IV insertion site red, warm, and slightly edematous. Which of the following actions should the nurse perform first?**
- a) Check for a blood return
 - b) Elevate the extremity
 - c) Discontinue the IV line
 - d) Apply warm, moist heat

Manual for caring:

1. Is there written protocol to treat infiltration available?

- a) Yes
- b) No

2. Is there written policy for treating phlebitis available?

- a) Yes
- b) No

3. You need to attend educational course related to intravenous fluid administration and electrolytes management:

- a) Yes
- b) No

4. It is important to have special manual content caring, complication and management of intravenous fluid administration in each hospital unit:

- a) Yes
- b) No

Appendix
C2

معارف الممرضين في وحدات العناية الحثيثة المتعلقة بالتسريب الوريدي
للسوائل والشوارد

❖ اخي الممرض/ اختي الممرضة

أرجو تعاونكم في الاجابة عن الأسئلة التالية:

الجزء الأول: البيانات الشخصية:

1. الجنس:

- أ. ذكر
- ب. أنثى

2. العمر: سنة

3. الحالة الاجتماعية:

- أ. أعزب
- ب. متزوج
- ج. مطلق
- د. أرمل

4. المؤهلات العلمية :

- أ. اعدادية تمريض
- ب. دبلوم
- ج. بكالوريوس
- د. شهادة عليا

5. السكن :

- أ. الريف
- ب. المدينة

الجزء الثاني : البيانات الاحترافية :

1. عدد سنوات الخبرة :

- أ. اقل من 1 سنة
 ب. من 1 الى 3 سنة
 ج. أكثر من 3 سنة

2. المشاركة في الدورات التدريبية الخاصة بإدارة السوائل والشوارد عن طريق الوريد:

- أ. نعم
 ب. لا

3. هل تتولى العمل على تثقيف ذاتك حول حقل الاختصاص بصيغته معتمده على الذات ؟

- أ. نعم
 ب. لا

• إذا كان جوابك (نعم) لطفًا بين لنا مصادر تعلمك الذاتي :

1. الانترنت
- أ. مواقع رصينة مثل Google
- ب. مواقع التواصل الاجتماعي
2. مكتبة المستشفى
3. الزملاء الممرضين ذوي الخبرة
4. الأطباء
5. الصيدلة

Appendices

الجزء الثالث: معارف الممرضين العاملين في وحدات العناية الحثيثة المتعلقة بإدارة السوائل والشوارد عن طريق الوريد

❖ اقرأ/ي الأسئلة التالية واختار/ي اجابة واحدة لكل سؤال بوضع دائرة حول الاجابة الصحيحة:

المجال الأول: معلومات عامة تتعلق بالسوائل والشوارد:

I. السوائل:

1. تعتبر البلازما أحد السوائل المهمة المتواجدة في الجسم، فهو عادة يتواجد في :

- أ. خارج الخلية
- ب. داخل الخلية
- ج. حول الخلية
- د. تجاوبف الجسم

2. يتكون السائل خارج الخلية من :

- أ. السائل الخلالي (Interstitial fluid)
- ب. البلازما
- ج. البلازما والسائل الخلالي
- د. خلايا الانسجة

3. النوع الأكثر استخداما من السوائل الوريدية هو :

- أ. البلورية (crystalloid)
- ب. الغروانية (colloid)
- ج. البلازما
- د. مصل الدم

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4. تصنف المحاليل الوريدية البلورية (crystalloid) على انها ما يأتي ماعدا :

- أ. متساوي التوتر (isotonic)
- ب. منخفض التوتر (hypotonic)
- ج. مفرط التوتر (hypertonic)
- د. الزلال (albumin)

5. ميكانيكية حركة السوائل الوريدية منخفضة التوتر (hypotonic) هي :

- أ. البقاء في الأوعية الدموية
- ب. الانتقال إلى الخلايا
- ج. البقاء متساوية في الأوعية الدموية والخلايا
- د. ينتقل الى الفراغ الثالث (Fluid Extravascular)

6. عادة ما تستعمل المحاليل الوريدية المتساوية التوتر (isotonic) في الحالات التالية ما عدا :

- أ. الجفاف
- ب. الإنعاش (resuscitation)
- ج. التعويض (replacement)
- د. التغذية

7. لا تستخدم السوائل الوريدية مفرطة التوتر (hypertonic) في الحالات الآتية:

- أ. مرضى الجفاف
- ب. مرضى انخفاض ضغط الدم
- ج. مرضى النزيف
- د. إصابة الرأس (head trauma)

8. مريض يعاني من انخفاض ضغط الدم نتيجة نزيف حاد في موضع العملية. ما نوع السائل الوريدي الأنسب لإعطائه في هذه الحالة ؟

- أ. محلول مفرط التوتر (hypertonic) 3 % محلول ملحي (كلوريد الصوديوم)
- ب. محلول منخفض التوتر (hypotonic) مع محلول جلوكوز بتركيز (5 % D5W) في الماء +1/2 كلوريد الصوديوم (NaCl)
- ج. محلول متساوية التوتر (LR)
- د. محلول الجلوكوز بتركيز 5%

Appendices

9. المحلول السكري 5% والمحلول الملحي 0.9% هي امثلة على :

- أ. محاليل مفرطة التوتر (hypertonic)
- ب. محاليل متساوية التوتر (isotonic)
- ج. محاليل منخفضة التوتر (hypotonic)
- د. محاليل الوريدية (IV)

10. أي نوع من المحاليل الوريدية يتم استقباله داخل الجسم بسرعة ويترك الماء حر موزع بالتساوي على جميع السوائل هو :

- أ. محلول الجلوكوز
- ب. محلول ملحي عادي
- ج. محلول السكر
- د. محلول متساوي التوتر (LR)

11. عند تقييم علامة زيادة السوائل (overload fluid), يجب على الممرض أن يلاحظ :

- أ. نبض شديد يقرع (Bounding pulse)
- ب. عروق الرقبة (veins neck)
- ج. فحص الرئة
- د. فقدان مرونة الجلد (skin turgor)

II. الشوارد (Electrolytes):

1. غالبا ما يتم التعبير عن وحدة قياس الشوارد ب :

- أ. ملغم (mg%)
- ب. مم زئبق (mmHg)
- ج. ديسيلتر/المليغرام (mg/dl)
- د. لتر/مكافئ (mEq/L)

2. أي من الايونات الاتية تلعب دور مهم ورئيسي في تحديد الضغط التناضحي للبلازما:

- أ. صوديوم
- ب. بوتاسيوم
- ج. الكلوريد
- د. الفوسفات

3. المسار الرئيسي لإفراز أيونات الصوديوم (في الظروف العادية) هو؟

- أ. الجلد
- ب. الكلى
- ج. الجهاز الهضمي
- د. التعرق

4. معظم الكالسيوم في الجسم موجود في؟

- أ. العظام.
- ب. البلازما.
- ج. الكلى.
- د. الجهاز الهضمي.

5. يساعد الكالسيوم على ما يلي ما عدا ؟

- أ. تقلص العضلات.
- ب. تخثر الدم.
- ج. ينظم عمل عضله القلب.
- د. يعمل كمميع للدم

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6. المنظم الرئيسي لمستوى مصل الفوسفات في الجسم هو عملية النقل في:

- أ. الكبد
- ب. الكلى
- ج. البنكرياس
- د. الامعاء الدقيقة

7. البوتاسيوم احد الشوارد الأكثر وفرة بين الخلايا في الجسم ويلعب دورا في وظائف الجسم المتعددة التي تشمل الاختيارات الاتية ما عدا؟

- أ. التوازن الحمضي القاعدي
- ب. تقلص العضلات
- ج. توصيل النبضات العصبية
- د. تغيير في ضغط الدم

8. يتم امتصاص عنصر المغنيسيوم في جسم الانسان في _____ ؟

- أ. الكبد
- ب. الكلى
- ج. الامعاء
- د. المعدة

9. يتصف عنصر البوتاسيوم بالصفات ادناه ما عدا ؟

- أ. احد الشوارد الرئيسية في السائل خارج الخلية
- ب. احد الشوارد الرئيسية في السائل داخل الخلايا
- ج. من الشوارد السالبة داخل الخلايا
- د. يوجد بكثرة في ثمره الموز

Appendices

المجال الثاني: التقييم:

1. قبل البدء في نقل الدم مباشرة , يجب على الممرض اعطاء اولوية في تقييم _____ للمريض:

- أ. العلامات الحيوية (vital signs)
- ب. لون البشرة
- ج. كمية طرح البول (urine output)
- د. معدل كريات الدم الحمراء في الدم (hematocrit)

2. اختر كل ما هو مناسب لتحديد الغرض من وجود فريق متخصص للتسريب الوريدي :

- أ. يقلل من اعباء التمريضيين
- ب. تقليل معدل المضاعفات الجانبية
- ج. مراجعة السياسات والإجراءات المتعلقة بالحقن الوريدي
- د. تحسين نتائج المرضى

3. تشمل العلامات السريرية لنقص المغنيسيوم ما يلي:

- أ. خدر ، ضعف العضلات ، التعب
- ب. زيادة الشهية ، زيادة الوزن ،
- ج. الغثيان والقيء والإسهال
- د. ضيق في التنفس والحمى والسعال

4. عند تقييم مرونة الجلد لدى المرضى المسنين يجب الأخذ بنظر الاعتبار ان :

- أ. فرط السوائل يؤدي الى فقدان المرونة (over hydration)
- ب. فقدان مرونة الجلد هي من علامات الشيخوخة
- ج. الجلد مرن رطب
- د. يبدو الجلد اسفنجي نتيجة الجفاف

Appendices

5. عند تقييم مريض مصاب بارتفاع المغنيسيوم (hypermagnesemia) في الدم يجب ملاحظة العلامات الآتية:

- أ. تضؤل ردود فعل الأوتار العميقة
- ب. عدم انتظام دقات القلب
- ج. بشرة رطبة باردة
- د. زيادة مصل المغنيسيوم في الدم

6. ماهو المؤشر الأكثر حساسية لتقييم توازن سوائل الجسم:

- أ. الوزن اليومي
- ب. مستويات الصوديوم في الدم
- ج. قياس كمية السوائل الداخلة والخارجة منه (intake and output)
- د. ضغط الدم

7. مريض لديه مستوى المغنيسيوم 1.3 ملغ / ديسيلتر. أي مما يلي ليس علامة أو عرضا لهذه الحالة؟

- أ. ارتفاع ضغط الدم
- ب. لا يوجد أي عرض
- ج. التشنج الرسغ
- د. عدم وجود ردود افعال الأوتار العميقة

8. مريض لديه مستوى الكالسيوم 8.7 ملغ / ديسيلتر اي من العلامات أدناه التي تشير إلى هذه القيمة المختبرية ؟

- أ. اضطراب في كهربائية القلب
- ب. قصور في نشاط الامعاء
- ج. الغثيان والقيء
- د. لا شيء ، هذا هو مستوى الكالسيوم الطبيعي

Appendices

9. أظهرت نتائج التحاليل المختبرية ان نسبة الكلوريد 70% في الدم . اختر احدى الإجابات ادناه تفسر هذه النتيجة :

- أ. لا شيء ، هذا مستوى طبيعي.
- ب. التليف الكيسي (cystic fibrosis)
- ج. الحماض الأيضي (metabolic acidosis)
- د. السوائل مفرطة التوتر (hypertonic)

10. يحدث فرط الصوديوم (hypernatremia) للأسباب المدرجة ادناه ما عدا:

- أ. اخذ كمية مياه فائضة
- ب. مرض السكري الكاذب
- ج. التعرق
- د. حروق

المجال الثالث : التسريب الوريدي للسوائل والشوارد:

1. عند ظهور علامات جفاف الاغشيه المخاطية ، انخفاض انتاج البول بالإضافة الى اضطراب ضغط الدم أي من السوائل الوريدية مناسبة لمعالجة هذه العلامات ؟

- أ. محلول عالي التوتر
- ب. محلول منخفض التوتر
- ج. محلول ملحي متعادل (N/S)
- د. كلوريد البوتاسيوم

2. يقوم الممرض برعاية مريض يعاني من الغثيان والقيء والإسهال لمدة (ثلاثة) أيام. أي من المحاليل الوريدية التالية هي الأفضل لهذا المريض؟

- أ. محلول ملحي متعادل (N/S)
- ب. محلول سكري متعادل (D5W)
- ج. محلول مختلط بين ملحي متعادل و 5% سكري
- د. محلول عالي التوتر

Appendices

3. تم اضافة كلوريد البوتاسيوم الى محلول وريدي لمريض معدل البوتاسيوم لديه (2.6) تغيير لون السائل داخل القنينة ماهو الاجراء الذي يتخذه الممرض :

- أ. التخلص من السائل وتغييره
- ب. الاستمرار في اعطاء السوائل
- ج. تسرع السائل
- د. تغيير جهاز اعطاء السائل

4. تم استخدام جهاز اعطاء اعتيادي لتسريب السوائل لمريض اثناء اعطاء (300) مل من المحلول الملحي العادي N/S على مدى 6 ساعات. ماهي كمية السوائل المعطاة خلال الساعة الواحدة ؟

- أ. 1800
- ب. 90
- ج. 100
- د. 50

5. عند إعطاء البوتاسيوم عن طريق الحقن الوريدي يكون الحد الأقصى لمعدل التسريب لتفادي حصول مضاعفات :

- أ. 40 mEq /hour
- ب. 20 mEq /hour
- ج. 10 mEq /hour
- د. 30 mEq /hour

6. أظهرت النتائج المخبرية إلى ان مستوى البوتاسيوم (2.9) ملي مكافئ / لتر ومستوى المغنيسيوم 1.5 ملي مكافئ / لتر. المريض غير قادر على تناول الأدوية عن طريق الفم ، ولغرض تعويض كل من البوتاسيوم والمغنيسيوم عن طريق الوريد. بأي ترتيب يجب أن تعطي الدواء لتصحيح اختلال توازن الشوارد بشكل أفضل؟

- أ. بوتاسيوم، مغنيسيوم
- ب. الإثنين معاً
- ج. المغنيسيوم ,البوتاسيوم
- د. لا توجد توصية خاصة للإعطاء

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7. استقبلت وحدة الطوارئ مريض يعاني من نزف في الجهاز الهضمي تظهر عليه علامات فقر الدم وانخفاض في ضغط الدم تم المباشرة بإعطاء السوائل الوريدية . أي من المحاليل الوريدية الاتية يمكن اعطاءها بالإضافة وحده الدم

- أ. محلول ملحي متعادل NS 0.9
- ب. محلول منخفض التوتر
- ج. محلول متعادل سكري (DW5)
- د. محلول عالي التوتر

8. ما مقدار السوائل التي يجب أن يستهلكها الفرد البالغ خلال 24 ساعة للحفاظ على توازن السوائل الجسم الطبيعي؟

- أ. 500 مل
- ب. 1,000 مل
- ج. 1,500 مل
- د. 2,200 مل

المجال الرابع : مضاعفات التسريب الوريدي للسوائل والشوارد:

1. عند ظهور العلامات والاعراض كمضاعفات لعملية نقل الدم للمريض . ما الاجراء الذي يجب اتخاذه؟

- أ. إزالة القسطرة الوريدية
- ب. محلول سكري متعادل التوتر (DW5).
- ج. القيام بتسريب المحلول الملحي في الوريد بمعدل تقطير مفتوح
- د. الحصول على عينة للزرع المختبري من طرف القسطرة التي تم ازلتها من المريض

2. أي من الاختيارات ادناه مناسب عنده توثيق الممرض لموقع قسطره وريدية لمريض وجد انها متورمة نتيجة تجمع السوائل :

- أ. الانصمام الهوائي (air emboli)
- ب. التهاب الوريد (phlebitis)
- ج. ارتشاح السوائل (infiltration)
- د. تجمع السوائل نتيجة افراط التسريب الوريدي (fluid overload)

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3. خلال اجراء عملية التسريب الوريدي لمريض ظهرت عليه علامات صعوبة التنفس واضطراب في اصوات الرنة. ما هو الاجراء المناسب الذي يجب اتخاذه

- التوقف عن اعطاء السوائل
- تقليل كمية السوائل المعطاة واعطاء ادوية مدرره
- تغيير نوع السوائل المعطاة
- قياس معدل البوتاسيوم في الدم

4. عند تقييم موقع الوريد الذي من خلاله يتم التسريب الوريدي للمريض لوحظ ان المنطقة باردة ، شاحبة ومتورمة ، وان المحلول لا يتسرب . ما هو استنتاج الممرض لهذه الحالة :

- عدوى
- التهاب الوريد
- ارتشاح السوائل
- تخثر (thrombosis)

5. خلال العناية اليومية للقسطرة الوريدية لوحظ ان نقطة ادخال القسطرة محمر ، دافئ و مؤلم . ما هو التشخيص الذي من الممكن توثيقه في الملاحظات اليومية للمريض؟

- التهاب الوريد
- ارتشاح السوائل خارج الخلية
- فرط الحساسية للمحلول الوريدي
- رد فعل تحسسي لمادة القسطرة الوريدية

6. أي من المضاعفات ادناه تسبب ظهور علامات على منطقة التسريب الوريدي مثل الالم ، الدفيء ، الاحمرار ، صلابة الوريد وبطئ في معدل التسريب :

- التهاب الوريد
- ارتشاح السوائل
- تسمم
- انسداد الهواء

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7. أي من المضاعفات ادناه تسبب ظهور العلامات التالية اثناء التسريب الوريدي مثل ألم في الصدر أو الكتف أو الظهر ، ضيق التنفس ، انخفاض ضغط الدم ، ضغط قوه النبض ، الازرقاق ومن الممكن ان يصل المريض الى حالة فقدان الوعي هي :

- أ. تسمم
- ب. الانصمام الهوائي (air embolism)
- ج. التهاب الوريد
- د. ارتشاح السوائل

8. الجلطة دموية تصاحب التهاب جدار بطانة الأوعية الدموية ، تعرف باسم _____ .

- أ. تسمم
- ب. التهاب الوريد
- ج. التهاب الوريد الخثاري (Thrombophlebitis)
- د. ارتشاح السوائل

9. خلال التقييم اليومي لموقع ادخال القسطرة الوريدية للمريض لاحظ الممرض احمرار ودفئ المنطقة مع تورم ، أي من الاجراءات التالية . على الممرض القيام بها او لا ؟

- أ. تحقق من ترويه الدم
- ب. رفع الطرف المصاب
- ج. ايقاف التسريب الوريدي
- د. تدفئة وترطيب الموضع

➤ دليل عناية:

1. تسرب السوائل الوريدية عنده موضع القسطرة الوريدية يعتبر من المضاعفات الشائعة. هل هنالك خطوات معينة وضعت من ادارة المستشفى للتعامل معها ؟

- أ. نعم
- ب. لا

2. هل هنالك خطوات محده وضعت من ادارة المستشفى للعناية بالالتهاب الوريدي الناتج عن وجود قسطره وريدية ؟

- أ. نعم
- ب. لا

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3. هل انت بحاجة الي إقامة دوره تعليمية متخصصة في عملية إعطاء السوائل عند طريق

التسريب الوريدي؟

أ. نعم

ب. لا

4. وجود دليل مكتوب في كل وحده في المستشفى يضم معلومات كافية عن كيفية التعامل مع

القسطرة الوريدية والتسريب الوريدي بالإضافة الى المضاعفات وكيفية علاجها للرجوع اليه

عند الحاجة. يساعد التمريضيين اثناء التعامل اليوم؟

أ. نعم

ب. لا

.....شكرا للطفكم وتعاونكم في الاجابة.....

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Appendix D1

NO:	Items	Observation 1		Observation 2		Observation 3	
		Yes	No	Yes	No	Yes	No
1.	Verify IV solution order on MAR/CMAR with the medical order						
2.	Check the patient chart for allergies						
3.	Check the solution for color, leaking, and expiration date						
4.	Prepare the tools he needs during the intervention						
5.	Perform hand hygiene						
6.	Identify the patient						
7.	Pull the curtains around the bed or close the room door to maintain privacy						
8.	Explain what are going to do and why are to the patient						
9.	The patient is asked if there is an allergy to some drugs						
10.	Ensures that the intravenous solution is matched to the contents the label is on the solution package						
11.	Compare label solution container with the patient's name, solution type, additives, date, and time.						
12.	Observe the principles of sterilization when						

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	opening sterile instruments						
13.	Apply label to tubing reflecting the day/date for next set change						
	Intravenous Administration						
14.	Hang the intravenous solution container on the fluid hook						
15.	Open the intravenous set from its package						
16.	Close the clamp on the existing intravenous administration set						
17.	Remove the cover of the container						
18.	Wear gloves						
19.	Clean the tip of the container by sterile swab						
20.	Insert the end of the administration set into container						
21.	Open the clamp on the extension tube to wash out air						
22.	Check the drip chamber of the administration set						
23.	Connect the tip of the administration set with the cannula						
24.	Slowly open the roller clamp on the administration set and count the drops, adjust the correct drop rate is achieved as order						

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25.	Make sure that the dropping and flow is continuous						
26.	A sticker shall be attached to the solution indicating the time of explanations by infusion, time of completion and number of drops. Write a name medicines added to the solution with the dose if needed						
27.	Ensure patients comfort with the proper position						
28.	Dispose of used tools						
29.	Remove gloves						
30.	Wash hands						
31.	After 30 minutes from starting infusion , nurse ask the patient if he or she is experiencing any pain or discomfort related to the IV infusion						
32.	Record the patient's reaction to the procedure, the patient experiences any pain from the IV or notices any swelling at the site. If necessary						
33.	Document the type of IV solution and the rate of infusion						
34.	Check the IV site for possible problems with the catheter, such as bending of the catheter.						
35.	Position patient extremity						
36.	Inspect the IV site for complication such as						

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	swelling, leakage, redness, infiltration.						
37.	Records intake, output fluids according to a form evaluation						
38.	Examines lung sounds using a stethoscope						
39.	Attempt to flush the (5_10) ml of saline solution with heparin at stop the fluid leak to open the intravenous catheter						
40.	Review the finding of serum electrolytes to avoid imbalance						
41.	Assess vital signs						
42.	Assess for edema						
43.	Assess skin turgor						

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Appendix D2

ت	الفقرات	المشاهدة الاولى		المشاهدة الثانية		المشاهدة الثالثة	
		لا	نعم	لا	نعم	لا	نعم
1.	يتحقق من وجود المحلول الوريدي على الوصفة الطبية						
2.	يتحقق من كارت المريض حول وجود حساسيه						
3.	يتحقق من المحلول وتاريخ انتهاء الصلاحية						
4.	يهيئ الادوات التي يحتاجها خلال التداخل						
5.	يغسل اليدين						
6.	التعرف على المريض						
7.	سحب الستائر حول السرير او غلق الباب الغرفة للحفاظ على الخصوصية						
8.	يشرح ما الذي ستفعله ولماذا تفعله للمريض						
9.	يسأل المريض عن وجود تحسس لبعض الادوية						
10.	يتأكد من مطابقة المحلول الوريدي مع محتويات الملصق على عبوه المحلول						
11.	يقارن ملصق قنينه المحلول الوريدي مع اسم المريض ونوع المحلول والمواد المضافة والتاريخ والوقت.						
12.	يراعي مبادئ التعقيم عند فتحه للأدوات المعقمة						
13.	يثبت الملصق مدون عليه اليوم ، التاريخ و وقت تغير المحلول						
اعطاء السوائل الوريدية							
14.	يلتصق قنينة المحلول الوريدي على عمود الحقن الوريدي						

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						15. يفتح جهاز التسريب الوريدي من الغلاف الخارجي
						16. يغلق الصمام لجهاز التسريب الوريدي
						17. يرتدي القفازات
						18. يفتح الغطاء المعدني للمحلول الوريدي المعلق
						19. يستعمل مسحة معقمة لتعقيم الغطاء
						20. يدخل منفذ جهاز التسريب الوريدي , تجنب تلوث الغطاء والمنفذ
						21. يفتح صمام جهاز التسريب لإخراج الهواء من انبوب التسريب
						22. يتأكد من حجره التنقيط مملوءة للنصف لتفادي دخول الهواء
						23. يربط جهاز التسريب مع القسطرة الوريدية
						24. يفتح الصمام لتسريب المحلول ضبط عدد القطرات المقرر اعطاءها حسب الوصفة الطبية
						25. يتأكد من استمرارية التنقيط
						26. يثبت ملصق على المحلول يدون عليه وقت الشروح بالتسريب ووقت الانتهاء وعدد القطرات. كتابة اسم الادوية المضافة على المحلول مع الجرعة. ان وجد
						27. يتأكد من راحة المريض
						28. يتخلص من الادوات المستعملة
						29. يزيل القفازات
						30. يغسل اليدين
						31. دقيقة من بدء التسريب يسال 30 بعد الممرض المريض عما إذا كان يعاني من أي ألم أو إزعاج مرتبط بالتسريب الوريدي.
						32. يسجل رد فعل المريض على الإجراء إذا كان المريض يعاني من أي ألم من الوريد أو لاحظ أي تورم في الكانيولا. إذا لزم الأمر
						33. يقوم بتوثيق نوع المحلول الوريدي ومعدل التسريب

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						يتحقق من موقع الأنبوب الوريدي بحثًا عن مشاكل محتملة في القسطرة، مثل ثني القسطرة	.34
						يوضع طرف المريض	.35
						يفحص موقع القسطرة الوريدية بحثًا عن مضاعفات مثل التورم والتسرب والاحمرار أو تسريب	.36
						يسجل السوائل الداخلة والخارجة حسب استمارة التقييم	.37
						يفحص اصوات الرئتين باستعمال السماعة الطبية	.38
						يدفع (5_10) مل من المحلول الملحي مع هبارين عند توقف تسريب السوائل لفتح القسطرة الوريدية	.39
						يراجع نتائج مصل الشوارد لتجنب عدم التوازن	.40
						يقيم العلامات الحيوية	.41
						يقيم الوزمة	.42
						يقيم مرونة الجلد	.43

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Appendix E1

استمارة تحكيم

..... حضرة الأستاذة/الفاضل/ة

تحية طيبة

نظرا لما تمتلكه من خلفية ومكانة علمية وخبرة عملية في مجال اختصاصك يرجى التفضل بمراجعة ورقة الاستبانة المرفقة والخاصة برسالة الماجستير الموسومة

(معارف وممارسات الممرضين في وحدات العناية الحثيثة المتعلقة بالتسريب الوريدي للسوائل والشوارد)

(Intensive Care Unit Nurse's Knowledge and Practices Related to Intravenous Fluid and Electrolyte Administration)

وابداء ملاحظتك القيمة عليها للأخذ بها مع فائق الشكر والتقدير.

الاسم الكامل:

اللقب العلمي:

مكان العمل:

سنين الخبرة:

التوقيع:

الباحث
طالبة الماجستير
نوار رباح هادي
جامعة بابل / كلية التمريض

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Appendix E2

قائمة اسماء الأساتذة الخبراء

ت	اسم الخبير	اللقب العلمي	الاختصاص	مكان العمل	سنوات الخبرة
1	د. حسن علوان بيعي	أستاذ	طب الأسرة والمجتمع	كلية الحلة الجامعة	43
2	د. راجحة عبر الحسن حمزة	استاذ	تمريض بالغين	جامعة الكوفة / كلية التمريض	38
3	د. امين عجيل الياسري	أستاذ	تمريض صحة مجتمع	جامعة بابل / كلية التمريض	38
4	د. حسن هادي عطية	أستاذ	تمريض بالغين	جامعة بغداد / كلية التمريض	37
5	د. حكيمة شاكر حسن	أستاذ	تمريض بالغين	جامعة بغداد / كلية التمريض	33
6	د. ناجي ياسر	أستاذ	تمريض صحة مجتمع	جامعة بابل / كلية التمريض	33
7	د. خالده محمد خضير	أستاذ	تمريض بالغين	جامعة بغداد / كلية التمريض	22
8	د. حسام عباس داود	أستاذ مساعد	تمريض بالغين	جامعة كربلاء / كلية التمريض	22
10	د. صادق عبد الحسين حسن	أستاذ مساعد	تمريض بالغين	جامعة بغداد / كلية التمريض	13

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Appendix F

السيد / السيدة

أنت مدعو للمشاركة بمشروع بحث علمي بعنوان:

(معارف وممارسات الممرضين في وحدات العناية الحثيثة المتعلقة بالتسريب الوريدي للسوائل والشوارد)

يرجى أن تأخذ الوقت المناسب لقراءة المعلومات الآتية بتأن قبل أن تقرر إذا ما كنت راغباً بالمشاركة أم لا. وبإمكانك طلب مزيداً من الإيضاحات أو المعلومات الإضافية عن أي أمر مذكور بالاستمارة أو عن الدراسة من الباحث أو أي مختص آخر.

أولاً: معلومات البحث	
اسم الباحث	نوار رباح هادي
اسم المشرف	ا.د. سحر أدهم علي
أهداف البحث:	
الفترة المتوقعة لمشاركة الشخص في البحث	
الاجراءات المتبعة في جمع العينات	
المخاطر المتوقعة كنتيجة للمشاركة في البحث	لا يوجد
الفوائد التي ستعود على الشخص مقابل الاشتراك في البحث	

المشارك	
1. ان المشاركة في هذا البحث طوعية	
2. بإمكانك سحب مشاركتك من الدراسة متى شئت ولأي سبب	
3. من حقك ان لا تجيب عن اي سؤال لا ترغب باجابته	
4. ان مشاركتك بالبحث لن تحملك اي نفقات مالية	
5. ان مشاركتك بالبحث لا يترتب عليها اي مسائلة قد تضر بك شخصيا أو بعملك.	
6. ان اسمك سيكون سرىا وإن المعلومات الناتجة عن مشاركتك سوف تعامل بسرية تامة ولن يطلع عليها أي شخص ما عدا الباحث والمشرف ولجنة الاخلاقيات عند الضرورة.	
7. وأن المعلومات التي ادليت بها والنتائج العلمية لهذا البحث هي للأغراض العلمية فقط ولن تكون هناك أية إشارة إلى لك أو لعائلتك في أي منشور عن هذه الدراسة.	
8. ان من حقك بمعرفة النتائج العامة للبحث، او اي نتائج تتعلق بك بصورة خاصة.	

ثالثاً: معلومات الاتصال	
في حال وجود اي استفسار او شكوى من قبلك حول مشروع البحث بإمكانك الاتصال بالباحث أو لجنة اخلاقيات البحث في جامعة بابل – كلية التمريض	
اسم الباحث	نوار رباح هادي
رقم الهاتف	07711688671 البريد الالكتروني nawarrbah503@gmail.com
لجنة أخلاقيات الابحاث العلمية- جامعة بابل – كلية التمريض	

اسم المشترك بالبحث:	اسم ولي أمر المشترك:
توقيعه	في حال كون عمر الشخص المشارك اقل من 18 سنة، او كونه غير قادر على فهم أو قراءة الاستمارة يرجى توقيع ولي أمره الشرعي.

المستخلص

الخلفية العلمية: يجب استخدام طريقة العلاج الأكثر فعالية إدارة دقيقة لتوازن السوائل، بما في ذلك التقييم الدقيق للسوائل، وخطة علاج السوائل الخاصة بالمريض، واجراء الفحوصات المتكررة لتوازن السوائل والشوارد مع اجراء التعديلات على خطه العلاج لتناسب الاستجابات السريرية للمرضى في وحدات العناية المركزة. لتعزيز نوع السائل المناسب وتوفير الرعاية التمريضية الآمنة والفعالة، يجب على الممرضين دائماً الإبلاغ عن أي حالات خطره يتم اكتشافها في سجل السوائل الخاص بالمرضى.

الاهداف: لتقييم معارف وممارسات الممرضين في وحدات العناية المركزة المتعلقة بالتسريب الوريدي للسوائل والشوارد.

المنهجية: أجريت دراسة وصفية لتحقيق الأهداف وتحليل معارف وممارسات الممرضين العاملين في وحدة العناية المركزة المتعلقة بالتسريب الوريدي للسوائل والشوارد، وعلى وجه التحديد تم اجراءها في الفترة من 8 اذار 2023 إلى 27 ايار 2023. تم اختيار عينة غير احتمالية من (174) ممرض من أصل (269) ممرض يعملون في وحدات العناية المركزة التابعة لمستشفيات الحلة التعليمية.

النتائج: أشارت النتائج إلى أن غالبية عينة الدراسة (50.6%) كانوا من الذكور. كما واطهرت أن معظمهم في الفئة العمرية 91 (52.3%) تتراوح أعمارهم بين (20-25) سنة، وكانت النسبة الأعلى 90 (51.7%) متزوجين، وأغلب عينة الدراسة 110 (63.2%) حاصلون على درجة البكالوريوس، و120 (69.0%) يعيشون في المناطق الحضرية. تم تسجيل معرفة ممرضات وحدة العناية المركزة (71.15%) مستوى غير مرضي، فيما يتعلق بالدورات التدريبية الخاصة بإدارة السوائل والشوارد، وسجلت النتائج أن معظم أفراد عينة الدراسة البالغ عددهم 131 (75.3%) لم يشاركوا في أي دورات تدريبية، في حين سجلت ممارساتهم (46.52%) غير راضين فيما يتعلق بإدارة السوائل والشوارد.

الاستنتاج: أظهرت النتائج بأن معلومات الممرضين المتعلقة بالتسريب الوريدي للسوائل والشوارد غير مرضية اما ممارساتهم فكانت بمعدل متوسط.

التوصيات: القيام بتوجيه برامج التعليم المستمر لتوفير المعلومات المتعلقة بتقييم ومراقبة السوائل الوريدية والشوارد اثناء التسريب الوريدي.



جمهورية العراق
وزارة التعليم العالي والبحث العلمي
جامعة بابل
كلية التمريض

معارف وممارسات الممرضين في وحدات العناية المركزة المتعلقة بالتسريب الوريدي للسوائل والشوارد

رسالة مقدمة

من قبل
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لنيل درجة الماجستير في علوم التمريض

بإشراف
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تشرين الاول / 2023 ميلادية

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