Meta-analysis of Fluids and Electrolytes Balance in Postoperative Patients
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ABSTRACT
The primary objective of this research was to systematize the existing studies done on the commonly used intravenous (IV) fluids, electrolytes and trace elements in the fluid replacement postoperative procedure. This particular meta-analysis was done in place of the traditional use of literature review, and for this reason, this research paper has compared opinions from various existing studies done by different scholars on synthesis. Also, this analysis has explored the best-identified guidelines that should be applied to postoperative patients. Although this analysis would give various advisories on the type of fluids and electrolytes used for replacement in postoperative patients, the primary emphasis would be to highlight the advantages and disadvantages of each identified replacement fluid. This also included the surgical and anesthetic techniques that should apply in the best practice guideline used, when dealing with postoperative patients.

Keyword: Postoperative, replacement fluid, electrolytes, anaesthesiologist, Intravenous fluids

INTRODUCTION
As explained by various anesthesiologists, surgeons and scholars, the postoperative fluid replacement process has a direct relation to fluid and electrolyte abnormalities. Based on the patient’s electrolyte and body fluid status, different types of fluid replacement therapies are applied in addition to the maintenance therapy so as to compensate for any form of preoperative and intraoperative losses. Additionally, postoperative patients may require the fluid replacement therapy due to other reasons such as ongoing gastrointestinal fluid loss, the stress response to surgery or any other bodily fluid loss.

Ideally, in the postoperative process, the standard maintenance fluid requirements, which give guidance to the fluid and electrolyte replacement, will vary depending on various factors on the patient. Some of these aspects are the patient’s body weight, body surface area, gender and age. Despite the fact that any possible abnormalities in the patient’s hemodynamic milieu will have been identified and corrected before or during the surgical process, a postoperative calculation of the patient’s fluid requirement is done. This calculation is made prior to the fluid replacement therapy, so as to make a distinction between the fluid and electrolyte volume required to maintain the body’s normal functions and the significant amount that is needed to replace possible abnormal losses.

Since there is a substantial variation in the electrolyte composition of the intracellular and extracellular fluids (ECF) in a normal and healthy person, it is crucial to identify that sodium is the most useful element in ECF while potassium, on the other hand, predominates in the Intracellular fluid. With the knowledge of these body fluids and electrolyte composition, surgeons, nurses and caregivers can identify the common fluid replacement type, electrolyte and trace element replacement type to administer in the postoperative therapy.

According to a 2007 SAFE Study investigation done, the most common intravenous (IV) fluids that are primarily used in postoperative fluid replacement are those that are within the group of volume expanders. Therefore, in most cases, fluid replacement in postoperative patients is provided either in the form of colloids and crystalloids which, due to their nature and composition, are known to have varying advantages and disadvantages when administered to different postoperative patients. Thus, taking an overview of four prospective and retrospective research available on replacement fluids and postoperative patient care, this research paper focuses on two aspects; the commonly used replacement fluids with both their advantages and disadvantages and the most appropriate guideline to use when dealing with postoperative patients.
Best Guidelines to Apply on Postoperative Patients

While general medical guidelines include a systematically developed outline and recommendations designed to help the healthcare practitioner in making informed clinical circumstances, as well as the appropriate care, prospective research such as the study by the Korean Knee Society, have highlighted that the postoperative phase requires more advanced guidelines as compared to other intraoperative procedures \(^{(5)}\). Guidelines in the postoperative period are considered essential for both the surgeons and the Anaesthesiologists since it is vital for them to consider several universal recommendations as well as prevention of any harm when looking after the postoperative patients. According to a study done by the Korean Knee Society, the need for advanced evidence-based guidelines when dealing with postoperative patients is substantially attributed to the fact that adequate monitoring and sufficient care are paramount in patients who are in their immediate postoperative period. Therefore, the recommendations guidelines that are crucial for the care and therapy of postoperative patients may either be modified or adopted in accordance to the clinical and the patients’ needs and constraints. Thus, regarding previous researches done, those guidelines that were considered most effective and best appropriate for patients in their postoperative phase were those who were centered on pain management strategies, concerning anesthetic care \(^{(6)}\).

There seems to be a broad agreement in both prospective and retrospective types of research done by various scholars on the most appropriate guidelines that should be applied when dealing with postoperative patients. For instance, in a randomized study, Cheville et al. investigated the use of pre-emptive opioids as the best pain management based guideline on postoperative patients \(^{(7)}\). Being a retrospective research, the researchers of this particular study concluded that the pre-emptive opioid use in surgery patients, before rehabilitation, fostered accelerated functional recovery, reduced number of rehabilitation sessions and also improved the overall pain control. However, contrasting studies have advocated for a trend to exclude the administration of opioids from the pre-emptive pain management process since they are known to cause complications such as vomiting and nausea for patients in their postoperative period \(^{(8)}\).

METHODS

Method of Analysing the Commonly Used Replacement Fluids and Electrolytes in Postoperative Patients

Previous studies have made extensive use of different search strategies and methodologies while analyzing the conventional replacement fluids used in the postoperative therapy. Some of the methods used are such as Archival research, the use of case studies and content analysis. For instance, a prospective study by Dinc & Coskun made use of several existing case studies available in medical journals has considerably shown the consistency in the various results derived from the application of different replacement fluids and electrolytes on different postoperative patients with varying diseases and illnesses. Additionally, information found in existing medical and health journals inform of archival research have also been considered by various scholars to determine the most appropriate replacement fluids to use on patients in the postoperative phase, their benefits as well as their limitations when used on different patients. The use of archival research has revealed various incidences of patients in their postoperative period and the kind of care, needs as well and the constraints that they face when common replacement fluids are administered after the surgical process \(^{(9)}\).

To a lesser perspective, available studies have sampled different surgery patients in their postoperative phases so as to determine their hemodynamic milieu, body fluid, and electrolyte status, which are the conventional measures that are used to determine the type of replacement fluid and electrolytes to be used on the patient. According to an archive research-based study by El-Sharkawy, et al., Google Scholar and PubMed databases used conclude that, despite the fact that any possible abnormalities in the patient’s hemodynamic milieu will have been identified and corrected during the surgical process, a postoperative calculation of the patient’s fluid requirement is mandatory \(^{(10)}\). This is done so as to determine the type of replacement fluid to be administered concerning their body fluid status and hemodynamic milieu. Nevertheless, considering the archival research done about the available case studies, it is uncertain on the most appropriate replacement fluids and electrolytes or measures to be applied when a postoperative patient has excessive body fluids and electrolytes.
Having considered Colloids and Crystalloids as the most commonly used replacement ad electrolyte fluids in postoperative patients, various prospective studies seek to resolve the existing controversies of the most effective replacement fluid to be administered to postoperative patients (11). Thus, studies achieve this by comparing the results of different case studies whose results indicate both the advantages and disadvantages of the two. From case study content analysis, the type of replacement fluid considered to be the most applicable to postoperative patients fell under the group of volume expanders. In the same vein, on conduction of prospective, larger and multiple types of research that made use of the web of Science, PubMed and Google Scholar archival sources, key terms that were relevant to the related study topics were used. In this regard, available research published in English on fluid replacement and electrolyte balance in postoperative patients have continuously been used to show which replacement fluid is most effective on various postoperative patients, based on the patient’s status and the advantages and disadvantages of the replacement fluid used.

In addition to archival research, there are those studies that made use of the retrospective cohort design technique to identify the advantages and disadvantages of using blood, through blood transfusion as a fluid and electrolyte replacement method. For instance, a Carson et al. carried out a cohort study that sought to investigate the benefits of blood and hemoglobin as replacement fluids in both perioperative and postoperative mortality. This study sampled different patients across 20 United States hospitals in the years between 1983 and 1993 . The postoperative care that was accorded to the sampled patients highlighted the essence of administering human blood and hemoglobin on various postoperative patients with whom surgery had been done in the treatment of a certain disease. Thus, in this regard archived data on different postoperative patient data, clinical and laboratory variables on the blood results of various patients were analyzed. This also involved the comparison of the immune system and the blood capacity of the different patients, before and after the surgery.

Empirical Findings and Results

Considering the four prospective and retrospective studies analyzed, individual results relating to the types of replacement fluids used on various patients differed. A study that evaluated the use of colloids on multiple surgery patients in their postoperative phase indicated that natural colloids employed in intravenous fluids include blood products such as albumin solution and frozen plasma. In the results of the study, those postoperative patients who exemplified low albumin levels had colloids administered as the replacement fluid since they are beneficial for patients with low albumin due to the fact that they have low risks for adverse reactions (12).

While various previous studies explored the use of colloids and crystalloids as the primary replacement fluids in postoperative patients, the research that examined the use of human blood as a postoperative replacement fluid came up with results which highlighted both the advantages and disadvantages of the use of blood transfusion as a fluid replacement strategy. This study made an evaluation of the benefits and limitations of using blood as a replacement fluid for the use of 76 patients as participants and compared their immune system before and after the surgery and the blood transfusion. According to the results, the overall postoperative infection rate which was as a result of the use of human blood as a postoperative replacement fluid was at 28% and 4.6% for those patients who did not get any blood transfusion in their postoperative phase (13). Regarding immunological tests done, the results of this study did not show any significance difference between the transfused and un-transfused patients groups, after the surgery had been done. Nevertheless, a comparison is done on the pre- and postoperative patients’ data, indicated an impairment of natural killer (NK) in all patients regardless of their postoperative blood transfusion status. Additionally, those patients who did not get any blood transfused indicated a significant synthesis of the interferon-gamma and interleukin-2 (14). Therefore, the results showed that, when blood is used as a replacement fluid, there is a possibility of the blood transfused to induce immunosuppressive effects the postoperative patient. This, in turn, increases the patient’s susceptibility to various infections during their postoperative phase.

On the other hand, several other studies done sought to determine the benefits of the use of blood as a replacement fluid when blood transfusion is administered to the postoperative patient. The result of a study that made use of 8787 hip fracture postoperative patients at the
age of 60 and above, indicated that blood transfusion on postoperative patients who had high haemoglobin levels of about 80 g/l and above did not seem to influence the risk of postoperative mortality in the elderly patients, who were used as participants in this particular study. However, patients who had hemoglobin levels that were less than 80g/L are the patients who required blood transfusion in their postoperative phase. These results, however, were in preclusion of additional analysis of the relation between transfusion and mortality.

Advantages of Blood When Used as a Replacement Fluid

1. Blood transfusion is the most physiological way to replace any blood lost during and after surgery.
2. One of the greatest advantages of blood transfusion is that it is the only approved type of fluid replacement method that is capable of carrying oxygen; this is because a majority of the blood substitutes that are intended to carry oxygen are usually underdeveloped.
3. In postoperative fluid replacement, blood transfusion corrects any hypotension that is secondary to blood loss.
4. It is a fluid replacement strategy that is more effective than the crystalloids and a lot cheaper than the colloids when it comes to correcting hypotension (15).

Additionally, other retrospective studies analyzed highlighted the advantages of using colloids over crystalloids. According to the findings of the study, colloids were characterized as fluids that can be effectively used in the postoperative phase especially for critically ill patients since they may consist of synthetic molecules which cannot distribute across vascular barriers. This is because these synthetic molecules that characterize the colloids are much larger than those electrolyte components in the crystalloid solutions. As a result, the colloids are characterized by the fact that they tend to provide less free water, as compared to the crystalloids and for this reason, they primarily stay in the intravascular space (16).

Some typical examples of these large synthetic molecules are: dextrans, gelatins and hydroxyethyl starch (HES). Usually, in the postoperative procedure, colloid solutions, which in the event of by dissolving colloid molecules in isotonic saline solutions, are most commonly used in the body fluid resuscitation. One of the reasons why colloids are used in the postoperative fluid replacement procedure is because they are crucial for increasing the body’s osmotic pressure as well as increasing the intravascular volume (17). When compared to the crystalloids, colloids are the most preferred postoperative replacement fluids since they require less volume to produce the desired effects. Different studies examining the relevance and importance of resuscitation postoperative fluids have continually highlighted that various types of colloids such as Albumin are mostly used for fluid replacement in Severe Sepsis (ALBIOS) postoperative patients. In this regard, different crystalloid and colloid products have both their advantages and disadvantages when used in postoperative intravenous replacement fluids.

DISCUSSION

The Benefits of Colloids over Crystalloids

While a majority of previous studies done cited colloids and crystalloids as the primary components of replacement fluids used on postoperative patients, there seemed to be a significant agreement on the discussions done by different scholars, on the type of replacement fluid that is beneficial than the other. However, from a broader perspective, fluid replacement and fluid resuscitation in postoperative patients are directly related to the replacement of the standard blood volume with intravenous (IV) fluids which are intended to maintain the patient’s adequate organ perfusion that also ensures healthy body metabolic processes (18).

Usually, the types of intravenous fluids that are primarily used in postoperative fluid replacement are those fluids that are within the group of volume expanders. Therefore, in most cases, fluid replacement in postoperative patients is provided either in the form of colloids and crystalloids. When used as replacement fluids, each type of fluid has its advantages and disadvantages, based on the patient’s disease state or cell enzyme composition.

On the other hand, when these two common types of replacement fluids are used as plasma volume expanders, colloids, crystalloids or a mixture of the two are mostly used in fluid replacement in patients suffering postoperative hypovolaemia. In the same vein, physiologic saline solutions which are characterized by a 0.9% Sodium chloride solution are used in postoperative fluid replacements. This is due to
the fact that they are isotonic and for this reason, they are highly preferred on ailing, postoperative patients because they do not cause the potentially dangerous fluid shifts\(^{(19)}\).

**Age Relation to Postoperative Replacement Fluids**

According to some studies analyzed, changes in body fluid, water, and electrolyte content in the body tissues in the postoperative phase may be as a result of various factors. The age of the patient, to be precise, determines the type of replacement fluid that can be applied on different postoperative patients, at different times\(^{(20)}\). Several analyzed studies that made use of content analysis as the primary method of the study concluded that elderly postoperative patients are more susceptible to dehydration and electrolyte abnormalities, as compared to younger patients. These results were highly attributed to by factors such as physical body weakness which restricts access to fluid intake and also the loss of more fluids during surgery as compared to younger patients. Besides, older patients are more prone to physiological stress, as a result of the surgical process. This, in essence, causes them to be more predisposed to water retention and electrolyte abnormalities. This being said, previous studies done have increasingly indicated that positive fluid balance is an independent risk factor for both mortality and morbidity in postoperative critically ill patients\(^{(21)}\). Colloids and crystalloid solutions are therefore used to rectify this condition since it is due to the age-related pathophysiological changes that are related to age, that affect the handling of fluids and electrolytes in older postoperative patients. For this reason, the analyzed studies consider elderly patients undergoing the postoperative phase as a high-risk group, requiring special attention during the postoperative therapy.

**Postoperative Oedema**

According to the results and discussions of the aforementioned studies, body fluid and electrolyte balance can be done to solve various medical conditions; which either have a relation with the patient’s health needs and age. Therefore, the determination of the replacement fluid to choose highly depends on the patient’s needs and the kind of illness being treated. For instance, through the use of archival research and literature, various studies concluded that most postoperative patients suffer from postoperative oedema which is a reflection of the accumulation of water in the intravascular space. This, in essence, has a substantial relation to the body’s positive fluid balance as well as the increase in the patient’s weight. In postoperative patients with chronic illness or various post-surgery complications, studies contend that the mobilization of postoperative oedema is made more complex by hyperchloraemia and the depletion of potassium electrolytes in the body\(^{(22)}\). Thus, in many cases, the approach to this kind of treatment is through the treatment of intravascular hypovolemia and also the desire to achieve a negative overall fluid and electrolyte; in this case, sodium balance.

In this regard, being the fluids whose main component is water, with additional electrolytes and dextrose, crystalloids are known to be the most appropriate fluids in the replacement of body fluids and electrolyte balance in patients suffering postoperative oedema. This is due to the fact that an approximate of about 25% of the crystalloids remain in the intravascular part of the body, at least an hour after administration. For this reason, they are characterized by a high volume of distribution. Usually, crystalloid products include Normal salines (NS) such as sodium chloride or lactated Ringer’s (LR) such as glucose solutions. These types of fluids, LR and NS, are also known to contain dextrose to supply calories and glucose source, especially for postoperative patients. Both the Normal Saline and the Lactated Ringer’s usually distribute the body’s extracellular spaces. However, Crystalloids differ in the osmolarity of the solution which in turn, determines whether the solution is hypertonic, hypotonic or isotonic. Regarding the electrolyte balance of the commonly used crystalloids, Sodium (Na), Chlorine (Cl) and Potassium (K) are the major components of crystalloids. When compared to colloids, isotonic crystalloids have the closest osmolarity to plasma\(^{(23)}\).

In the same vein, most postoperative databases contend that crystalloids are highly recomendable regarding the treatment of postoperative oedema due to their characteristics regarding salinity, the saline solutions which contain an average of 0.9 g of Sodium Chloride in every liter of water is commonly defined as an isotonic saline solution. This, in essence, is the most commonly used intravenous fluid worldwide. In the same vein, isotonic glucose solutions contain 50 g of glucose in each liter of water and are often referred to as isotonic glucose. Therefore, when
used in the human body during postoperative procedures, the glucose that is common in these solutions is metabolized immediately after administration and the solvent is mixed in the human body water. Saline solutions, which are highly concentrated with Sodium chloride, on the other hand, ensure that the solvent water in the extracellular compartment maintained. According to new studies such as the Saline versus Albumin Fluid Evaluation (SAFE) as well as updated meta-analyses, crystalloids have a significant advantage over the colloids since they contain only ions and small sized molecules which can efficiently be metabolized in small amounts, in the bodies of the postoperative patients (24).

Below are the derived advantages and disadvantages of common types of crystalloids, especially Lactated Ringer’s (LR) and Normal Saline (NS) as discussed in the various meta-analysed researches done in the past.

**Lactated Ringer’s (LR)**

Glucose solutions are typical examples of Lactated Ringer’s that are used in the replacement fluids. As a common type of crystalloids, LRs are administered to different kinds of patients through the intravenous fluid infusion or replacement. Usually, when LRs are used, they are intended to replace any extracellular fluid and electrolyte losses. Additionally, LRs can be administered to postoperative patients in form of injections. For every 100mL of Lactated Ringer’s, there is a significant amount of sodium chloride, approximately 600mg. Other than Sodium Chloride, sodium lactate, potassium chloride, and calcium chloride are common elements that are found in the Lactated Ringer’s electrolyte replacement fluids. Similar to other types of crystalloids, Lactated Ringer’s have various advantages and disadvantages.

**Advantages of Lactated Ringer’s in Replacement Fluids**

i. Since most LRs contain dextrose, they are efficient for the supply calories and glucose source, especially for postoperative patients.

ii. The use of LRs in IV replacement fluids is advantageous since they usually are at lower risks for adverse reactions (25).

**Disadvantages**

i. As crystalloids, LRs are slightly hypotonic, and therefore, they can freely distribute across vascular barriers.

ii. For surgery patients with severe diseases such as chronic liver disease, an administration of LRs can lead to impaired metabolism of lactate to bicarbonates.

iii. In a scenario of a postoperative replacement for a patient suffering brain trauma, the administration of replacement fluids containing LRs may increase risks of brain swelling due to its slightly hypotonic nature.

iv. Unlike other crystalloids, Lactated Ringer’s have 4mEq/Liter potassium concentration, which may expose the postoperative patients to risks of hyperkalemia.

v. They also have a high concentration of carbon dioxide which may also put the patient at risks of respiratory acidosis (25).

**Normal Saline (NS)**

Usually the physiologic saline solution with a 0.9% sodium chloride (NaCl) concentration. For most surgery patients Normal Saline is often used in replacement fluids due to its isotonic nature which means that means that it will not cause any form of potentially fluid shifts which are dangerous for the patient (26). Thus, as a commonly used crystalloid fluid, Normal Saline has various advantages and disadvantages.

**Advantages**

i. Usually at low risks of causing adverse reactions.

ii. In a scenario where it is anticipated that blood transfusion will occur, NS is used due to the fact that it is the only fluid that is highly compatible with blood transfusion and blood administration.

iii. It is isotonic and is, therefore, preferable for critically ill, and surgical patients since it does not cause potentially fluid shifts in the patient’s body.

iv. NS is preferred over LR for postoperative patients with brain trauma.

**Disadvantages.**

i. Since it is a common crystalloid, its administration can lead to risks of hyperchloremic metabolic reactions and hypernatremia.

ii. Similar to other crystalloids, NS freely distribute across the vascular barriers of the body.

**Colloids**

An analysis of the available databases on different researches contends that, other than crystalloids, various colloids are commonly used in intravenous fluids. These colloids are in the form of blood products such as albumin solution and frozen plasma. Usually, colloids are homogenous, non-crystalline substances that
are in a water base. Additionally, colloids may consist of synthetic molecules which cannot distribute across vascular barriers since these synthetic molecules are much larger than those electrolyte components in the crystalloid solutions. As a result, the colloids are characterized by the fact that they tend to provide less free water, as compared to the crystalloids and for this reason, they primarily stay in the intravascular space (27).

Some typical examples of these large synthetic molecules are; dextrans, gelatins and hydroxyethyl starch (HES). Usually, in the postoperative procedure, colloid solutions, which in the event of by dissolving colloid molecules in isotonic saline solutions, are most commonly used in the body fluid resuscitation. One of the reasons why colloids are used in the postoperative fluid replacement procedure is because they are crucial for increasing the body’s osmotic pressure as well as increasing the intravascular volume. When compared to the crystalloids, colloids are the most preferred postoperative replacement fluids since they require less volume to produce the desired effects. Different studies examining the relevance and importance of resuscitation postoperative fluids have continually highlighted that various types of colloids such as Albumin are mostly used for fluid replacement in Severe Sepsis (ALBIOS) postoperative patients. In this regard, different crystalloid and colloid products have both their advantages and disadvantages when used in postoperative intravenous replacement fluids.

**Albumin**

Researches done over the last 25 years have increasingly advanced the understanding of the role of albumin in replacement fluids, especially for critically ill patients in their postoperative phase. Nevertheless, available studies do not clearly explain why it is important to circulate albumin in critically ill postoperative patients, and for this reason, discussions from various studies only analyze the fact that low serum albumin concentration in postoperative patients is directly associated with a poor outcome. Additionally, various studies analyzed to highlight the advantages of using human albumin solution as a plasma substitute in critically ill postoperative patients. However, despite these theoretical advantages, these previous studies indicate that correcting hypoalbuminemia does not have any significant impact on the postoperative outcome of the patients with adverse and chronic illnesses.

Thus, in the creation of this meta-analysis, the following are the various albumin advantages and disadvantages as highlighted in the analyzed studies (28).

**Advantages**

i. Due to their nature, colloids are crucial for providing greater intravascular volume expansion. They are therefore known to be more efficient in increasing the body osmotic pressure more than equal amounts of crystalloids.

ii. Albumin fluids modulate inflammation and may also increase mortality when compared to Normal Saline (NS) solutions.

iii. They are beneficial for patients with low albumin since they have low risks for adverse reactions.

iv. In particular forms of fluid imbalance, the albumin fluid is the most efficient in reducing both morbidity and mortality significantly.

v. Judged on the need of administration of far lesser fluid volumes, colloids, and especially the Albumin Fluids, are more effective than crystalloids in attaining resuscitation outcomes.

vi. When compared to other artificial colloids, Albumin is more beneficial due to less restrictive dose limitations.

**Disadvantages**

Despite its many benefits, albumin use has several limitations. Some of the fluid’s limitations are such as;

i. Albumin is more expensive when compared to other intravascular fluids such as HES and crystalloids.

ii. Unlike other forms of Albumins, hyper oncotic albumin may cause kidney damage.

iii. Since Albumin is a common blood product, it has a limitation that it is often allergic to reactions.

**Hydroxyethyl Starch**

In addition to albumin, the hydroxyethyl starch is a synthetic colloid that has a larger molecular weight than the normal albumin. Recent tests done by different scholars have proved that the adverse effects which may result due to the postoperative administration of hydroxyethyl starch, are usually dose-related (29). Thus, this synthetic colloid has various advantages and disadvantages which include:

**Advantages**

i. As a conventional synthetic colloid, hydroxyethyl starch is to in the modulation of inflammation, especially in patients suffering from chronic illnesses.
ii. Hydroxyethyl starch provides a higher intravascular volume expansion than equal amounts of crystalloids and crystalloid products.

**Disadvantages**

i. Since hydroxyethyl starch consists of synthetic molecules, they have a higher possibility of impairing the blood platelet function.

ii. Intravascular fluids made out of these types of colloids may have the potential for anaphylactoid reactions.

iii. They have various adverse dose-related effects which may accumulate in tissues and result in prolonged itching.

iv. A common limitation of the hydroxyethyl starch is that, when administered to certain patients, they have a likelihood of causing an increase in Serum amylase.

**Need for Proper Guideline**

Guidelines are essential factors when dealing with postoperative patients. While general medical guidelines include a systematically developed outline and recommendations designed to help the healthcare practitioner in making informed clinical circumstances, as well as the appropriate healthcare, when dealing with postoperative patients, more advanced guidelines, are required. This is attributed to the fact that adequate and monitoring and sufficient care are paramount in patients who are in their immediate post-operative period (30). The recommendations guidelines that are crucial in the care and therapy of postoperative patients may either be modified or adopted in accordance to the clinical and the patients’ needs and constraints.

The recovery from anesthesia for many postoperative patients is usually a daunting and a life-threatening process. For this reason, appropriate prompt intervention, together with sufficient resources are provided to these patients by the post-anesthetic care unit staff, with the assistance of other health care trained personnel. However, the practice guidelines that relate to postoperative patient care differ from the general healthcare usual guidelines. This is in the sense that, there are those practice guidelines that are developed by the American Society of Anaesthesiologists (ASA) which are not intended as an absolute standard requirement. This means that the use of these guidelines cannot guarantee any particular outcome (31).

Ideally, most postoperative patients deal with moderate to acute pain. Therefore, the best possible evidence-based guideline that needs to be applied on these patients need to be centered on postoperative pain management.

**CONCLUSION**

Both prospective and retrospective studies analyzed in this meta-analysis make a conclusion that the electrolytes and replacement fluids that can be applied to postoperative patients, during the postoperative phase vary due to various aspects. While the amount and type of electrolyte or fluid to be used in the replacement are primarily based on the patient’s hemodynamic status as well as their fluid body compositions, the typical types of replacement fluids differ in both their advantages and disadvantages. In the same vein, postoperative patients can have a variety of conditions which can lead to their alteration of their body fluid composition as well as their body water homeostasis. In this regard, the administration of IV fluids in both critically ill and surgery patients is an essential component of the postoperative supportive care. Thus, a reliable evidence-based guideline that applies to postoperative patients is needed so as to understand the patient’s needs as well as achieve both fluid and electrolyte balance.

**REFERENCES**


