9 Post op Fluid, Electrolytes, and Nutritional Management: Present Perspective

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A good proverb is there, "Less you eat you will be malnourished. More you eat more you are diseased." So balance in life as well as any management is important.

As per the fluid and electrolytes management is concerned like others evidence-based treatment is always logical. I feel it is always better to die in logical way rather in the way of baba ji or guru ji wants!!

NICE (National Institute of Clinical Evidence) plays an important role in the practice of Medicine.

We know successful outcome of surgical patients depends on pre op preparation 30%, intra op care 40%, and post op care is 30%. And fluid electrolytes balance plays an impeccable part in surgical patients' outcome.

Technology has arrived in surgical arena in a big way in a short time. Many options are now available in treating surgical disease. Old is not always gold and everything at the cutting edge is not the last word. We must continually study the pros and cons, the efficacy of the old and the new, before discarding the old or embracing the new. The high-quality evidence from many sources will guide clinicians to discard unsubstantiated practices and follow the proven ones.

In industry when the quality improves, the cost comes down. But with introduction of technology, health care costs started spiraling and it has become a problem of global concern. The only answer is defensible practice according to the guidelines suggested by evidence-based surgery. The clinician has an important role to play in implementing the guidelines in everyday practice and also when faced with uncertain situations.

Every surgeon must constantly exert and improve in his area of work, to bridge a gap between his results and the best possible.

Few basic points I like to highlight:

1. Intravenous fluid administration constitutes an integral part of the clinical outcome. Fluid therapy has important role in maintenance of intravascular volume adequacy, hemodynamic stability, and delivery of oxygen. But adverse effects are underestimated. According to one survey, half of physicians were unaware of the composition of the fluids that they were prescribing and administering.
2. Consequences of Inappropriate Fluid Therapy.

In elderly, injudicious fluid administration can lead to dire consequences. United Kingdom National Confidential Enquiry was done in 1999, into perioperative Death report which concluded "errors in fluid management (usually excess fluid) were one of the most common causes of avoidable perioperative morbidity and mortality" at age extremity[11].It also stated that "fluid management in the elderly is often poor; they should be accorded the same status as drug

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M. D. Ray (ed.), *Multidisciplinary Approach to Surgical Oncology Patients*,
https://doi.org/10.1007/978-981-15-7699-7_9

Table 9.1 Risks associated with inappropriate fluid therapy

Hypovolemia Risks	Fluid Overload Risks
Hypotension and Tachycardia	Delayed bowel recovery and chance of anastomotic leak
Compromized function of multiple organs and failure consequently	Persistent hypertension
Renal function impairment and failure	Peripheral edema
Shock and its consequences	Poor wound healing
Headache, giddiness, weakness, Confusion, etc.	Respiratory distress or failure

prescription." Multidisciplinary reviews are needed to develop good local working practices. (Table 9.1).

9.1 Effects of Aging on Renal Function, Fluids, and Electrolytes

Inappropriate fluid administration places elderly patients more at risk to adverse consequences in comparison to young patients, because of reduced physiologic reserve. These patients also have multiple comorbidities such as elevated blood pressure, coronary vessel disease, and congestive heart disease[13]. The prevalence of chronic kidney disease in the Medicare population is about 8%.

Aging leads to progressive deterioration of renal and cardiovascular system. There is increased incidence of systolic/diastolic dysfunction and vascular stiffness as person ages. There are various changes in renal function also which are as follows:

1. Renal vascular dysautonomy.
2. Senile hypofiltration.
3. Tubular dysfunction.
4. Medullary hypotonicity.
5. Tubular frailty.

Body composition also changes with age. Age-related loss of muscle mass leads to a 10% to 15% decrease in intracellular fluid content. Although total fat content goes down, the amount of fat as a percentage of total body weight increases. Total energy expenditure also falls.

The clinical consequences of these changes are profound. The aging kidney is more vulnerable to injury, less able to accustom hemodynamic changes, and cannot deal perturbations of salt and water. Reduced GFR and decreased tubular function tend to reduce ability to concentrate urine, the result of which requires an increase in the obligatory urinary volume necessary to excrete waste products. On the other hand, the drop in GFR diminishes the potential to excrete excess water, making the aged prone to overload of fluid and pulmonary edema. Aged patients become more prone to hypoosmolar states (hyponatremia) if given excess quantity of hypoosmolar fluids.

Hemodynamic changes that lead to dehydration may be muted, especially in hospitalized elderly patients, and signs of dehydration may be nonspecific (impaired cognitive dysfunction, minimal confusion, weakness, apathy, dizziness) and may be attributed to other etiologies or aging itself.

It is imperative to monitor electrolytes in elderly patients who are receiving IV fluids. Alterations in plasma sodium concentration generally indicate a deficit or an excess of water rather than changes in balance in sodium. A small change of even 1 mmol/L in plasma sodium concentration reflects a loss or gain of 280 mL of water in a 70 kg man. However, about half the amount of change in fluid can cause a similar change in sodium concentration in a 45 kg woman, and thus is more easily overloaded by injudicious use of fluids.

9.2 Role of Medications in Fluid and Electrolyte Balance

Many elderly patients take multiple medications—for a variety of comorbidities, such as those listed earlier—that may have significant interactions with each other. These drugs often interfere with fluid and electrolytes, as well. Thiazide diuretics and serotonin reuptake inhibitors, for example, have been shown to cause hyponatremia by either causing direct sodium loss, release of ADH, or potentiating of the effects of ADH. Aldosterone-blocking agents like spironolactone, angiotensin-converting enzyme inhibitors, and angiotensin receptor blockers can lead to hyperkalemia. It is prudent to check electrolytes periodically in patients taking these medications. Diuretics can cause significant dehydration. Some clinicians recommend dosing diuretics in out-of-hospital patients based on daily weight, rather than on routine basis, to avoid dehydration. (Figs. 9.1, 9.2, and 9.3).

Fig. 9.1 Fluid therapy

Fig. 9.2 Total parenteral nutrition

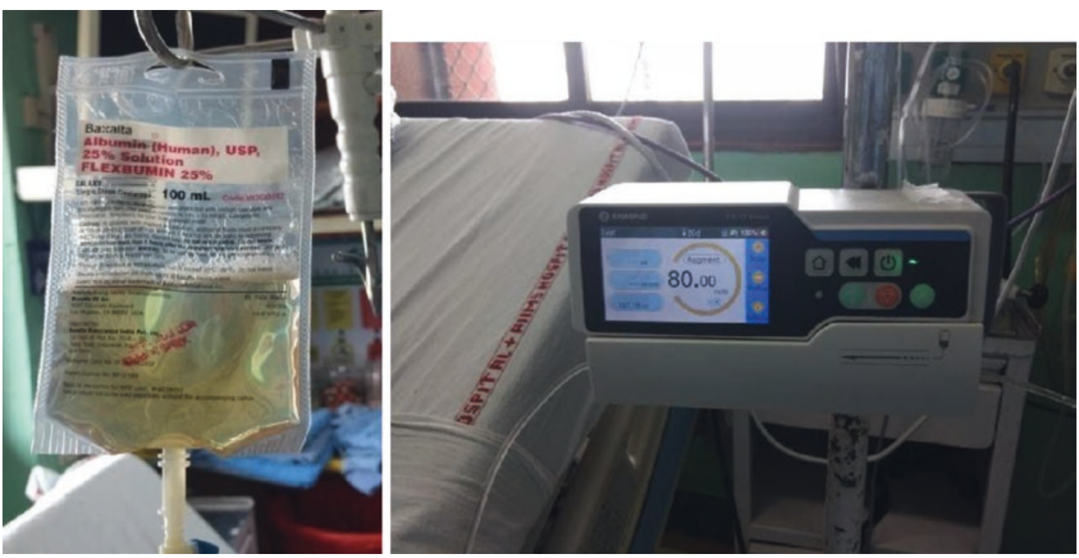

Fig. 9.3 Albumin infusion and Infusion pump

Administration of diuretics and hypertonic saline should be avoided, as it may cause rapid changes in serum sodium and water level which will lead to neuronal demyelination and fatal outcome.

9.3 Choice of Fluids in the Perioperative Period

Typical Properties of Commonly Used IV Solutions

	Sodium, mmol/L	Potassium, mmol/L	Chloride, mmol/L	Osmolarity, mOsm/L	Weight Average, MolWtkD	Plasma Volume Expansion
Type of Fluid[a]						Duration, h[b]
Plasma	136–145	3.5–5.0	98–105	280–300	–	–
5% dextrose	0	0	0	278	–	–
Dextrose 4%	30	0	30	283		
saline 0.18%						
0.9% “normal” saline	154	0	154	308	–	0.2
0.45% “half normal” saline	77	0	77	154	–	
Ringer’s lactate	130	4	109	273	–	0.2
Hartmann’s solution	131	5	111	275	–	0.2
Gelatine 4%	145	0	145	290	30,000	1–2
5% albumin	150	0	150	300	68,000	2–4
20% albumin	–	–	–	–	68,000	2–4
HES 6% 130/0.4	154	0	154	308	130,000	4–8
HES 10% 200/0.5	154	0	154	308	200,000	6–12
HES 6% 450/0.6	154	0	154	308	450,000	24–36

British Consensus Guidelines on Intravenous Fluid Therapy for Adult Surgical Patients (GIFTASUP) for fluid management recommends that “when crystalloid resuscitation or replacement is indicated balanced salt solution Ringer’s lactate/acetate or Hartmann’s solution should replace 0.9% normal saline, except in cases of hypochloremia, for example, from vomiting or gastric drainage.”

9.4 Restrictive or Liberal Fluid Therapy

Although goal-directed fluid therapy in perioperative elderly patients is not studied specifically, it is associated with improved outcomes. A primary goal of fluid therapy is to maintain optimal preload which inadvertently results in achieving adequate cardiac index/stroke volume for a particular clinical scenario. It is difficult to find accurately the fluid status in perioperative setting.

Central venous pressure or pulmonary artery wedge pressure, which are the static measures of preload, have been commonly used to guide fluid therapy. But, these are not particularly accurate[21]. Dynamic indices like systolic pressure variation (SPV) by pulse pressure variation (PPV), stroke volume variation (SVV) and pleth variability index may be better predictors of volume status[22].

Marik et al., in their meta-analysis of 29 studies involving 685 patients, showed that dynamic indices correlate better with cardiac index and stroke volume than static indices. Correlation coefficients for dynamic indices (PPV, SPV, and

SVV) were 0.78, 0.72, and 0.72, respectively; area under the curve (AUC) was 0.94 to 0.84. For static indices, AUC was 0.6 to 0.55[22]. To determine fluid status, British guidelines recommend flow-directed monitors. However, these are small studies (average, n = 23 patients) and results may not apply to elderly patients. Still, goal-directed therapy, which also requires the use of inotropes, has been recommended for intraoperative fluid management by some authorities in the United Kingdom and Europe.

9.5 Summary of British Consensus Guidelines on Intravenous Fluid Therapy for Adult Surgical Patients

	Recommendation	Level of Evidence
1.	Balanced salt solutions (e.g., Ringer's lactate/acetate or Hartmann's solution) should replace 0.9% saline, whenever crystalloid resuscitation or replacement is indicated to avoid risk of hypochloremic acidosis in practice routinely, except when there is hypochloremia (e.g., from vomiting or gastric drainage).	1b
2.	4% dextrose, 0.18% saline, and 5% dextrose are optimal sources of free water for maintenance therapy, but may result in life-threatening hyponatremia if used in excessive amounts, especially in children and elderly. These solutions are appropriate only in significant free water deficit (e.g., diabetes insipidus), but not in other conditions.	1b
3.	Adult patients need sodium 50 to 100 mmol/d, potassium 40 to 80 mmol/d in 1.5 to 2.5 L of water by the oral, enteral, or parenteral route for maintenance. Additional amount is given only to correct deficit or when there is ongoing losses. Clinical examination, regular weighing, and fluid balance charts should be done for monitoring when possible.	5
Preoperative fluid management		
4.	Fluid and electrolyte derangements can occur due to mechanical bowel preparation. Hartmann's or Ringer's lactate or acetate-type solutions are used to correct it.	5
5.	Gastric aspiration/vomiting can lead to excessive losses preoperatively and to be treated with crystalloid solution that comprises necessary potassium supplement. Hypochloremia is treated by 0.9% saline, with added potassium to avoid sodium overload. Lose of fluid from diarrhea/ Ileostomy/small bowel fistula/obstruction/ileus should be replaced with Hartmann's or Ringer's Lactate or acetate-type solutions. Excessive diuretics can lead to "saline depletion," which is better managed with a balanced electrolyte solution like Hartmann's.	5 and IIa
6.	Preoperative treatment with IV fluid and inotropes should be given in high-risk surgical patients to achieve adequate cardiac output and delivery of oxygen for improved survival.	1b
7.	Flow-based measurements should be used to diagnose preoperative or operative hypovolemia, though it is logistically difficult in many centers currently. Clinical features are also an important indicator to determine hypovolemia. Hypovolemia is clinically diagnosed by pulse rate, capillary refill, venous (JVP/CVP) pressures, peripheral perfusion, Glasgow Coma Scale, acid–base and lactate levels, when direct flow measurement is not possible. A low urine output should be always interpreted in context of patient's cardiovascular parameters.	1b

9.6 Conclusion

Renal function declines progressively in the elderly. Approximately 8% of Medicare patients have chronic kidney disease. In view of the deleterious effects of fluid and electrolyte imbalance on perioperative outcomes, administration of fluids and electrolytes should receive heightened attention in elderly patients. Clinicians must consider fluids as medications and administer them as such, and an improved understanding of the composition of fluids and their physiologic effects is critical.

In a hospitalized, inactive, afebrile, and elderly patient, there is diminution of fluid need. Dehydration in elderly patient may be due to decreased thirst response, regular diuretics usage, and limited functionality. Underhydration and overhydration are both deleterious. However, few studies in the elderly have specifically addressed the issue of fluid management in the perioperative period. More research is needed in this area.