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Original Article

Clinical Study of Perioperative Nutritional Status and Post-operative Fluid Management Related Complications in Gastrointestinal Surgeries at a Tertiary Hospital in Thiruvananthapuram

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Abstract

Introduction: Gastrointestinal surgery patients are at risk of nutritional depletion from inadequate nutritional intake, surgical stress, and dehydration. Reasonable selection of proportion and infusion order of crystalloid and colloid is necessary in fluid and nutrition support. In this study, we evaluated perioperative nutritional status of patients and post-operative fluid management related complications in gastrointestinal surgery.

Aims of the Study: (1) To assess the perioperative nutritional status of the patients undergoing gastrointestinal surgery, (2) to correlate nutritional status and the incidence of fluid management related complications postoperatively, (3) post-operative fluid management, the role of colloids and crystalloids.

Materials and Methods: Source of data: This study was a prospective analysis conducted on 51 patients who underwent gastrointestinal and biliary surgery in the Department of Surgery, Medical College, Thiruvananthapuram, during the period 2003-2004.

Results: In emergency surgeries, of 29 bowel perforation surgeries, 13 patients postoperatively developed pulmonary edema and hypotension. In elective surgeries, most of the cases were malignancies with chronic starvation, weight loss, and dehydration showed low blood parameters and had a higher incidence of complications. In long duration surgeries, patients having duration of surgery >4 h had more complications compared to a shorter duration. 7 of 8 carcinoma stomach and all pancreas carcinoma patients developed post-operative complications. Malnourishment and low albumin levels affected the post-operative outcome. Mortality rate in emergency cases (12) was more than the elective ones (7).

Conclusions: Complications were more in emergency and long duration surgeries than in elective and short duration surgeries. Malnourishment and low albumin levels affected the post-operative outcome. Pre-operative nutritional assessment is highly valuable in determining the type and amount of fluid to be administered for a particular patient to prevent complications. Reducing duration of surgery and correction of blood parameters with titrated fluids can reduce the post-operative complications.

Key words: Complications, Fluid, Nutritional status, Perioperative, Post-operative

INTRODUCTION

Pre-operative nutritional status of the patient and subsequent preoptimization before gastrointestinal surgery significantly affects the post-operative morbidity and mortality. The aim of all treatment during the pre-operative period is to prepare the patient to withstand the stresses of surgery and to minimize the risk of surgical procedure. Factors such as the chronological and physiological age of the patient, the degree of physiological derangement and nutritional deficits, the presence of organ system failure or insufficiency, the presence of obesity and the stage of the primary disease must be considered in the decision of when, how, and why to perform an operative procedure. Months of chronic under nutrition cannot be corrected in

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a matter of hours, but anemia, dehydration and electrolyte abnormalities can be ameliorated with early initiation of intensive intravenous support and appropriate laboratory monitor.

Perioperative fluid therapy remains a highly debated topic. Its purpose is to maintain or restore effective circulating blood volume during the immediate perioperative period. Maintaining effective circulating blood volume and pressure are key components of assuring adequate organ perfusion while avoiding the risks associated with either organ hypo- or hyperperfusion.

The post-operative management of patients with an acute abdominal catastrophe remains a major challenge for surgeons, anesthetists, and intensivists. One important aspect of gastrointestinal surgery is fluid management either pre-operative, perioperative or post-operative. Intravenous volume replacement given before, during, and after surgery has significantly reduced the mortality. Pre-operative fluid management is normally a hallmark of preparation for urgent or emergency operation, in which one needs to replenish existing fluid or electrolyte deficits and ongoing abnormal losses resulting from the patient's disease or therapy. The goal of nutritional support during malnutrition is to replete protein deficits and lean body mass and attains positive nitrogen balance and weight gain.[1] The strategy in the metabolic support of the critically ill is to limit nitrogen and nutrient losses with the aim of preserving organ structure and function.

The nutritional history and physical examination provide only a gross qualitative picture of nutritional status that is limited by the patients recall and by the accuracy of hospital records, which often neglect the potential effect of malabsorption or lifestyle.

Lab investigations such as serum albumin and serum transferrin levels give a rough index of nutritional status.

Pre-operative Nutritional Support

Pre-operative nutritional support for 7-10 days before surgery considered in:

1. Patients with weight loss more than 15%
2. Serum albumin <3 g/dl
3. Nutritional risk index <83.5
4. More than 5 days starvation.

Post-operative Nutritional Support

Post-operative nutritional support has been advocated in following patients:

1. Those who are not going to eat for more than 7 days after surgery
2. Patients with weight loss >15% in the pre-operative period, particularly if there is physiological dysfunction
3. Patients who have experienced severe sepsis and trauma and whether have increased metabolic requirement
4. Patients with enterocutaneous fistula particularly of the high output variant.

All the above indices were based on serum albumin levels and it is important in all quantitative measurements of nutritional status. Along with that total protein and hemoglobin levels of the patient give a fairly good idea about the nutritional status.

However, many important issues still remain unresolved in terms of fluid resuscitation. Fluid therapy controversies often arise from a common misconception; the failure to diagnose deficient plasma volume clinically in the presence of excessive interstitial water.

Frequently post-operative shock patients have maldistributed flow with contracted plasma volume but increased interstitial water. Therapy should be aimed at improving circulatory function by restoring plasma volume, not overloading an already expanded interstitial space. Restoration of blood volume is the most important correctable therapeutic problem in acute circulatory shock.

Effect of Crystalloids in Fluid Resuscitation

Fluid retention in critically ill patients may be partly due to the administration of saline or carbohydrate as the sole caloric intake, particularly in those who are chronically depleted. Intravenous glucose administration produces acute fluid retention in fasting but otherwise healthy young man by reducing sodium excretion. The effect is increased when sodium chloride is given simultaneously.

Because an expanded extracellular water may contribute to respiratory failure in critically ill patients, the routine administration of 5% glucose and electrolyte solutions should be replaced with adequate parenteral nutrition mainly composed of amino acids, fat, vitamins, minerals, and carbohydrates in quantities that maintain the blood glucose between 100 and 200 mg/dl.

Advantage of Colloids

Comparison of hemodynamics and oxygen transport responses to colloid and crystalloid solutions in early adult respiratory distress syndrome (ARDS)/pulmonary edema in which the physiological effects of 1000 ml of crystalloid solutions were compared with those of 100 ml of 25% albumin in 23 patients who developed ARDS showed that 100 ml of 25% albumin solution increased the plasma volume by 450 ml by dragging 350 ml of interstitial

water into the intravascular space. By contrast, 1000 ml of Ringer lactate given to the same patients expanded blood volume by <200 ml at the end of infusion. Crystalloids and colloids should be given in a ratio 3:1 to produce the same volume expansion.

Furthermore, any restoration of blood volume produced by colloids will be nullified by over administration of crystalloids. The successful outcome of surgery depends on comprehensive pre-operative evaluation, patient preparation, skilled surgical technique, and meticulous post-operative care. A better understanding of the natural history of disease allows for improved pre-operative and post-operative management. Although perioperative fluid management remains a highly debated subject, data suggests that goal-directed fluid therapy with the objective of hemodynamic optimization can reduce complications after major surgery. Hence, fluids should be treated as any other intravenous drug therapy, and thus, careful consideration of its timing and dose is mandatory.

In this study, we evaluated the perioperative nutritional status of patients and post-operative fluid management related complications in gastrointestinal surgery.

Aims of the Study

1. To assess the perioperative nutritional status of the patients undergoing gastrointestinal surgery based on serum albumin, hemoglobin, and total protein levels and their post-operative outcome
2. To study the incidence of fluid management related complications postoperatively in elective and emergency surgeries
3. Post-operative fluid management, the role of colloids and crystalloids.

MATERIALS AND METHODS

Source of Data

This study was a prospective analysis done on 51 patients who underwent gastrointestinal and biliary surgery in the Department of Surgery, Medical College, Thiruvananthapuram, during the period 2003-2004.

Period

12 months.

Inclusion Criteria

Patients who underwent gastrointestinal surgery, both elective and emergency surgery, with:

- Serum albumin <3.5 g/dl.
- Serum total protein <6 g/dl
- Blood hemoglobin <10 g/dl.

Exclusion Criteria

Patients with cardiac diseases, renal dysfunction, and respiratory diseases were excluded from the study.

Pre-operative assessment of hemodynamic variables and nutritional status was done, which included routine blood and urine tests, renal function test, serum electrolytes, serum albumin, and total protein.

Preoperatively the type of anesthesia, duration of surgery, use of hypotensive anesthetic drugs was observed. As per the blood loss, the type and the quantity of fluids given by the anesthetist were noted, and the final input and output were assessed.

Post-operative management of these patients was done in the surgical intensive care unit and critical unit. Re-estimation of blood parameters was done.

These patients were monitored based on variables such as central venous pressure, arterial blood gas, urine output, and blood pressure.

Incidence of fluid management related complications such as hypotension and pulmonary edema were assessed. Patients were followed up to the final outcome.

OBSERVATIONS AND RESULTS

Complications in Emergency Surgeries (Table 1 and Figure 1)

Among 10 duodenal ulcer perforations, 4 developed pulmonary edema and hypotension. Among 11 gastric ulcer perforations, 3 developed pulmonary edema and hypotension (Table 1).

In 2 patients with gall bladder perforation, 1 patient developed pulmonary edema. 1 patient with jejunal perforation developed pulmonary edema and hypotension. 1 patient who underwent emergency cholecystectomy developed pulmonary edema and hypotension.

About 2 patients with sigmoid growth perforation developed pulmonary edema and 1 had associated hypotension. 2 patients with obstructed inguinal hernia perforation developed pulmonary edema and hypotension.

Complications in Elective Surgery (Table 1 and Figure 1)

Most of these cases were malignancies. They all had a history of chronic starvation, weight loss, and dehydration. Their blood parameters were low and had a higher incidence of complications.

Emergency versus Elective Laparotomy (Table 2 and Figure 2)

Emergency cases showed more complications than elective since the urgency of surgical intervention limited the length

Table 1: Post-operative complications in emergency and elective surgeries

Cases	Total number	Pulmonary edema	Hypotension	Anastomotic leak	Wound dehiscence	Deep vein thrombosis
DU perforation	10	4	4			
GU perforation	11	3	3			1
Sigmoid growth perforation	2	2	1			
GB perforation	2	1	1		1	
Obstructed inguinal hernia perforation	2	2	2			
Carcinoma pancreas	2	2				
Multiple resection	4			4	3	
APR	4	2	2			
Right hemicolectomy	3					
Cholecystectomy and common bile duct exploration	1	1	1			
Carcinoma stomach	8	3	3		1	
Jejunal perforation	1	1	1			
Appendicular perforation	1			1	1	

DU: Duodenal ulcer, GU: Gastric ulcer, GB: Gall bladder, APR: Abdominoperineal resection

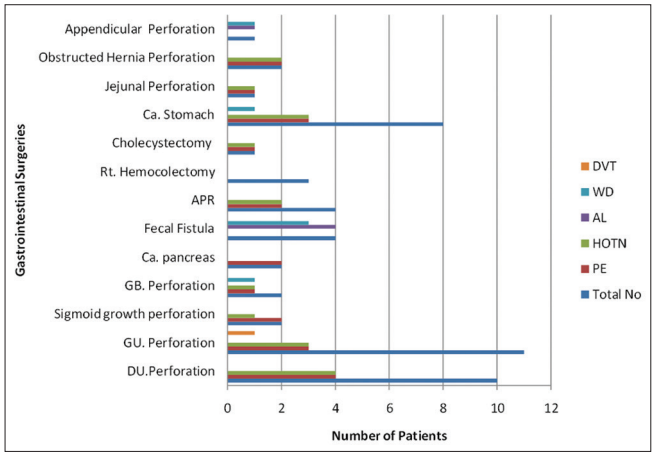

Figure 1: Complications (DVT: Deep vein thrombosis, PE: Pulmonary embolism, HOTN: Hypotension, AL: Anastomotic leak, WD: Wound dehiscence)

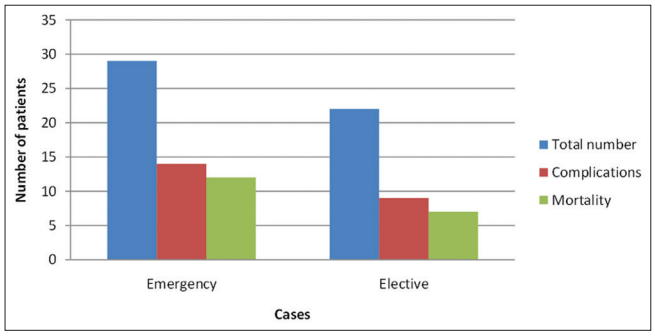

Figure 2: Emergency versus elective

of pre-operative preparation and the time for correcting pre-existing abnormalities. In 23 patients who developed fluid overload related complications, 14 were emergency 9 were elective.

Albumin Level and Complications (Table 3 and Figure 3)

1. Among the 51 patients, 22 patients had severe malnutrition, 21 of them developed complications, only 5 recovered (Table 3)

Table 2: Emergency versus elective

Cases	Total number	Complications	Mortality
Emergency	29	14	12
Elective	22	9	7

Table 3: Albumin levels and complications

Albumin	Total number	Complications	Recovered	Mortality
<2.5	22	21	5	17
2.5-3	15	2	13	2
3-3.5	14	0	14	0

2. Among the 15 patients who were moderately malnourished, 2 patients developed complications and later expired
3. No complications were seen in the mildly malnourished group.

In those patients who had low albumin levels in the perioperative period developed more complications than others.

Duration of Surgery

Duration of surgery was <2 h in 14 patients and post-operative period was relatively uneventful.

Mortality and Recovery (Table 4 and Figure 4)

Out of 51 patients, mortality was 19. Cause of death in 15 patients was respiratory failure. The 32 patients who recovered from complications were duly managed by titrated fluid correction, adequate nutritional correction with nutritional supplements, fresh frozen plasma, albumin, and blood transfusion. 2 needed ventilatory support for recovery (Table 5 and Figure 5).

In this study, it was found that the complications were less and recovery was better in patients who were given both

crystalloids and colloids in adequate proportion with due importance to colloids wherever required.

DISCUSSION

Modern resuscitation of the acutely ill began during the conflicts which occurred in the early and middle parts of the 20th century. Walter. B. Canon, professor of physiology at Harvard introduced the term "homeostasis" to describe the "coordinated physiological processes" that maintain a steady state for most systems. He could well be called "the father of critical care."

Francis D. Moore (1913-2001) defined objectives of metabolism in surgical patients and in 1959 published his widely quoted book "Metabolic Care of Surgical Patients." In 1960, Jonathan. E. Rhoads (1907-2002) in collaboration with colleagues Hars Vars and Stan Dudrick described the technique of total parenteral nutrition, which has become an important lifesaving treatment in the management of the critically ill patients who cannot tolerate standard enteral feedings. As in studies about the total parenteral nutrition of Veterans Affairs 1991[2] evidence to support pre-operative nutrition support is limited but suggests that if malnourished individuals are adequately fed for at least 7-10 days preoperatively, then the surgical outcome can be improved.

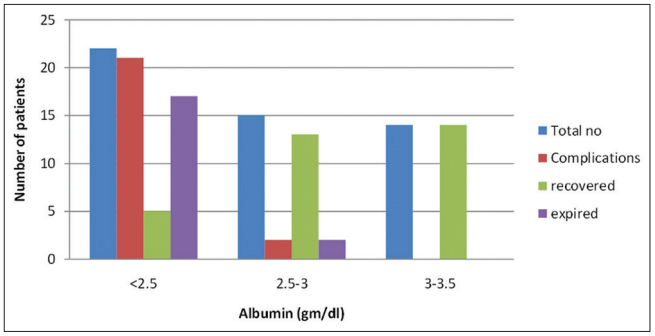

Figure 3: Albumin level and complications

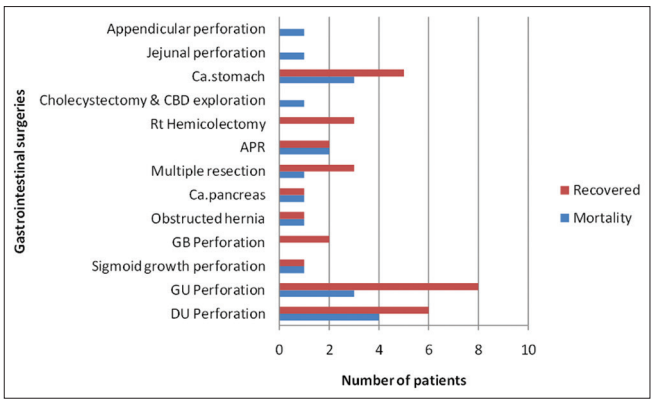

Figure 4: Post-operative outcome

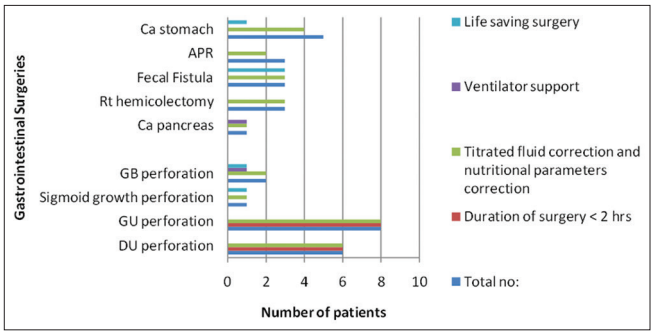

Figure 5: Management of recovered patients

Table 4: Post-operative outcome

Cases	Mortality	Recovered
DU perforation	4	6
GU perforation	3	8
Sigmoid growth perforation	1	1
GB perforation		2
Obstructed hernia	1	1
Carcinoma pancreas	1	1
Multiple resection	1	3
APR	2	2
Right hemicolectomy		3
Cholecystectomy and CBD exploration	1	
Carcinoma stomach	3	5
Jejunal perforation	1	
Appendicular perforation	1	

DU: Duodenal ulcer, GU: Gastric ulcer, GB: Gall bladder, APR: Abdominoperineal resection

Table 5: Management of recovered patients

Cases	Total number	Duration of surgery<2 h	Titrated fluid correction and nutritional parameters correction	Ventilator support	Life-saving surgery
DU perforation	6	6	6		
GU perforation	8	8	8		
Sigmoid growth perforation	1		1		1
GB perforation	2		2	1	1
Carcinoma pancreas	1		1	1	
Right hemicolectomy	3		3		
Fecal fistula	3		3		3
APR	3		2		
Carcinoma stomach	5		4		1

DU: Duodenal ulcer, GU: Gastric ulcer, GB: Gall bladder, APR: Abdominoperineal resection

Surgeons have been at the forefront in practically all the major developments in nutritional support down through the ages. In 1970 John Hunter first described the use of a tube to feed a patient enterally and almost a century later, the first successfully performed surgical gastrostomy was reported in 1876 (Gauderer and Stellato). Fleming and Remington in 1981 described the concept of intestinal failure, which is defined as a reduction in functioning gut mass below the minimum necessary for the adequate digestion and absorption of nutrients.

In this study, 62.7% patients recovered from complications postoperatively and 32.3% mortality was present.

Pre-operative assessment of hemodynamic variables and nutritional status was done, which included routine blood and urine tests, renal function test, serum electrolytes, serum albumin, and total protein. With respect to albumin levels it was found that 95% patients with albumin levels <2.5 g/dl had complications; 13.3% patients with albumin levels between 2.5 and 3 g/dl had complications. These findings are in consistent with the studies of Gibbs *et al.*[3] in which they quote albumin also have been found to predict post-operative mortality and morbidity for patients undergoing elective surgery and post-operative morbidity for those undergoing gastrointestinal tract surgery. Also in studies by Rich *et al.*[4] and group it's said that increased complications and prolonged hospital stay are in elderly cardiac surgical patients with low serum albumin.

In our study, it was found that 48.27% of patients undergoing emergency surgeries had complications when compared to 40.9% of patients undergoing elective surgeries. This is in consistent with studies conducted by Kumar *et al.*[1] where they quote that compared with the elective patients, the emergency patients had a higher rate of morbidity and mortality.

Post-operative fluid management related complications were mainly hypotension (35.29%) and pulmonary edema (41.17%). 2 patients needed ventilatory support. Rest of the patients recovered from complications with titrated fluid correction and correction of nutritional parameters. This is in consistent with studies of Brandstrup *et al.*[5] where hypotension and cardiopulmonary complications postoperatively were managed by restricted fluid therapy.[6] In this study it was found that the complications were less and recovery was better in patients who were given both crystalloids and colloids[7-9] in adequate proportion with due importance to colloids wherever required. According to studies by Choi *et al.,*[10] there is no apparent difference in pulmonary edema, mortality, or length of stay between isotonic crystalloid and colloid resuscitation which was different from our observations.

Out of 32 patients recovered 14 underwent surgery for <2 h duration that is about 43.75%. Prolonged surgeries show more complications than surgeries of short duration. According to studies by Qaseem *et al.,*[11] patients with prolonged surgeries show higher risk of post-operative pulmonary complications which was in consistent with our studies.

CONCLUSION

1. Perioperative nutritional status of the patients undergoing gastrointestinal surgery did affect the outcome. In patients with poor albumin levels, complications were more
2. Prolonged surgeries had more complications than surgeries of shorter duration
3. Fluid management related complications postoperatively in emergency surgeries were more than elective due to lack of time for adequate correction of blood parameters and nutritional status
4. Pre-, per-, and post-operative fluid management complications such as hypotension and pulmonary edema were duly corrected with titrated fluid correction and correction of nutritional parameters
5. In this study, it was found that the complications were less and recovery was better in patients who were given both crystalloids and colloids in adequate proportion with due importance to colloids wherever required.

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