Original Article

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Assessment of Nutrition, Anthropometry, and Electrolyte Balance in Patients with Perforation Peritonitis: A Prospective Observational Study

Biochemistry Section

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ABSTRACT

Introduction: Perforation peritonitis is a severe abdominal emergency associated with systemic inflammation, catabolism, and significant nutritional and biochemical disturbances. Early postoperative assessment is vital to guide nutritional and electrolyte correction.

Aim: To analyse changes in nutritional biomarkers (Serum total cholesterol, Serum triglyceride total protein, Serum albumin) anthropometric indices and electrolyte balance from the preoperative period to Postoperative Day 5 (POD5) in patients undergoing surgical management of perforation peritonitis.

Materials and Methods: This prospective observational study was conducted at Dr Vasantrao Pawar Medical College, Hospital and Research Centre, Nashik, Maharashtra, over five years, from May 2021 to May 2025. The study included 110 patients who underwent emergency laparotomy for perforated peritonitis. Nutritional parameters (serum cholesterol, serum Triglycerides, serum total protein, serum albumin), anthropometry {weight, Body Mass Index (BMI), mid-arm thickness, triceps skinfold}, and electrolytes (sodium, potassium) were recorded preoperatively and on POD5. Statistical analysis was done using paired t-tests. ($p<0.05$ was considered significant).

Results: A total of 110 patients (83 males and 27 females) in the age group of 25-60 years (47.1±9.10 years) were included in the present study. Serum cholesterol and serum triglycerides showed a significant postoperative decline in values, indicating altered metabolism, reduced intake, and also an acute-phase response. Serum total protein and serum albumin were found to be decreased, suggesting inflammation. Reduced nutritional intake and catabolism can be the reason for this. Electrolytes remained stable, indicating adequate postoperative fluid and electrolyte management. Anthropometric markers, mid-arm thickness ($p=0.0614$) and triceps skinfold thickness ($p=0.2903$), were not statistically significant. Reduction in weight and BMI is statistically significant (<0.0001), which indicates early postoperative nutritional deterioration.

Conclusion: Early postoperative deterioration of nutritional and anthropometric measures was evident. These findings collectively highlight the importance of early nutritional assessment and timely postoperative nutritional intervention in patients with perforation peritonitis.

Keywords: Laparotomy, Postoperative health, Serum cholesterol, Skinfold thickness, Sodium, Triglycerides

INTRODUCTION

Peritonitis caused by perforation of the gastrointestinal tract is one of the most common emergencies in surgery [1]. Over time, surgical procedures and postoperative care protocols have undergone dramatic development and management of these patients to increase the survival rate of the patients [2].

Despite developments in the field of medicine and surgery, as well as a better understanding of the different causes of diseases, gastrointestinal perforations are still one of the major causes of morbidity and mortality and continue to be a problem [1]. This is probably due to the late identification of the disease, local treatment and thus late admission to hospitals [1].

Patients with perforation peritonitis are often severely malnourished upon presentation to the hospital. Muscle wasting, pedal oedema, and restlessness are features in such patients. These patients with inadequate nutritional support compound the problems of sepsis and metabolic alterations. All these factors combine to increase the patients' risk of morbidity and mortality [3]. Nutritional support is an integral part of management of a critically ill patient. There is a strong association between poor nutritional status and poor outcome in surgical patients [4,5].

Nutritional management of these patients also reduces the risk of metabolic complications [6-8]. Management of perforation peritonitis not only requires prompt resuscitation measures and improved surgical strategies but also intensive medical care, including specific antibiotics and maintenance of proper electrolyte balance; only then will an improved outcome be achieved

Though many studies have been done, they are mainly related to serum albumin levels [9-16]. The other nutritional parameters, like serum total proteins and lipid parameters, are not done on an extensive scale. The electrolyte measurements are critical, and very few studies [17,18] are available for this. Hence, the present study was undertaken to prove the role of nutritional assessment of additional parameters in perforation peritonitis patients systematically and extensively to prevent metabolic alterations and mortality. The present study will help to monitor these parameters continuously and also to take preventive measures to maintain proper nutritional status and electrolyte balance to have positive outcomes. The objectives were to compare serum cholesterol, serum triglycerides, serum total protein, serum albumin and serum electrolytes in patients with perforation peritonitis preoperatively and on the 5th POD and to compare BMI, mid-arm thickness, and triceps skin fold thickness in patients with perforation peritonitis preoperatively and on the 5th POD.

MATERIALS AND METHODS

This prospective observational study was conducted at Dr. Vasantrao Pawar Medical College, Hospital and Research Centre, Nashik, Maharashtra. This study was conducted over five years, from May 2021 to May 2025. Institutional ethics committee approval was obtained before the conduct of the study (Dr.VPMCH & RC /

IEC/18/2021-22 dated 17/6/2021). Written informed consent for the same was obtained from the patients/relatives.

Inclusion criteria: Diagnosed patients with perforation peritonitis in the age group of 25-60 years of age, of both genders, were included. Diagnosis of perforation peritonitis (any type) was confirmed with clinical and radiological examination {sudden-onset abdominal pain, abdominal distension, guarding/rigidity, absent or diminished bowel sounds, tachycardia, pneumoperitoneum on X-ray and Computed Tomography (CT) scan etc.,}.

Exclusion criteria: Patients below the age of 25 years and above 60 years with perforation peritonitis, and those who died before the 5th POD were excluded.

Sample size: The patients coming to the tertiary care centre (as and when),diagnosed with perforation peritonitis were included, as the incidence of perforation is not very common. Hence, when the patient was diagnosed or referred to the tertiary care centre, they were included in this study. A total of 110 diagnosed patients with perforation peritonitis were included in the present study.

Study Procedure

The basic information, such as (Name, age, gender, address, and diagnosis), was recorded. A fasting blood sample (5 mL) was collected in a plain bulb before the surgical intervention. Serum was separated by centrifugation at 3000 RPM for five minutes, and it was analysed for biochemical parameters in the central clinical laboratory by kit methods on a fully automatic analyser. On the 5th postoperative day, the blood sample was again collected in a plain bulb and biochemical parameters were analysed using the serum sample. The findings were recorded.

- Serum cholesterol (Method-CHOD-PAP, normal range <200 mg%) [19], Serum triglyceride (Method-GPO-PAP, normal range <150 mg%) [19], Serum total protein (Method-Biuret, normal range-6.0-8.0 gm/dL) [20], Serum albumin (Method-BCG, normal range-3.5-5.5 gm/dL) [20], Serum electrolyte (Method-ISE, Serum sodium-135-145mEq/L Serum potassium-3.5-5mEq/L) [21], anthropometric indices (BMI, mid arm thickness, triceps skin fold thickness) were assessed preoperatively and on the 5th POD.
- Patients with perforation peritonitis are often in a negative nitrogen balance and catabolic state due to severe infection, inflammation, and surgical stress. This increases energy and protein requirements and can rapidly worsen the nutritional status. During the first few PODs, the patient's condition may be unstable due to haemodynamic changes, fluid shifts, and sepsis that can affect the accuracy of nutritional parameters. By POD 5, the acute phase is often better controlled, allowing a more meaningful assessment. Clinicians can assess whether the patient is tolerating oral, enteral, or parenteral nutrition and determine if nutritional goals are being met. Hence, POD 5 was taken to assess the parameters again.

STATISTICAL ANALYSIS

Statistical analysis was done using Statistical Package for Social Sciences (SPSS) software version 16.0. Descriptive statistics, including frequency, percentage, mean and standard deviation, were used to present the data. Data were statistically compared using a paired t-test. A p-value of <0.05 was used in determining statistical significance.

RESULTS

A total of 110 patients (83 males and 27 females) in the age group of 25-60 years (47.1± 9.10 years) were included in the present study. The mean serum cholesterol significantly decreased from 195.93± 14.12 mg/dL preoperatively to 170.18±18.49 mg/dL postoperatively. The mean serum triglyceride level reduced from 185.80±20.26 mg/dL to 167.98± 20.30 mg/dL postoperatively. Serum total protein showed a notable decrease from 6.98±0.65 g/dL to 6.53±0.55 g/dL. Serum albumin declined from 4.19±0.53 g/dL preoperatively to 3.84±0.53 g/dL postoperatively. Contrary to other parameters, serum sodium showed a slight increase postoperatively, from 140.18±4.78 mEq/L preoperatively to 141.32±4.83 mEq/L on Day 5. Mean potassium decreased marginally from 4.27±0.51 mEq/L to 4.17±0.47 mEq/L. These findings are not statistically significant [Table/Fig-1].

Parameters	Preoperative (Mean±SD)	Postoperative (Mean±SD)	p-value
Serum total cholesterol (mg/dL)	195.93± 14.12	170.18±18.49	< 0.0001*
Serum triglycerides (mg/dL)	185.80±20.26	167.98±20.30	<0.0001*
Serum total protein (g/dL)	6.98±0.65	6.53±0.55	<0.0001*
Serum albumin (g/dL)	4.19±0.53	3.84±0.53	<0.0001*
Sodium (mEq/L)	140.18±4.78	141.32±4.83	0.0658
Potassium (mEq/L)	4.27±0.51	4.17±0.47	0.1880

[Table/Fig-1]: Comparison of preoperative and postoperative (Day 5) levels of serum cholesterol, serum triglycerides, serum total protein, serum albumin, serum sodium, and serum potassium.
*p<0.0001 is extremely statistically significant.

Anthropometric measurements showed early postoperative deterioration. Mid-arm circumference decreased from 25.08±4.33 cm preoperatively to 23.95±3.85 cm at POD5 (p=0.0614, borderline significance). In contrast, body weight decreased significantly from 66.26±13.51 kg to 64.64±13.19 kg, and BMI declined from 24.52±5.81 to 23.92±5.67 kg/m² (both p<0.0001), indicating measurable loss in total body mass over the 5 days. [Table/Fig-2].

Parameters	Preoperative (Mean±SD)	Postoperative (Mean±SD)	p-value
Mid-arm circumference thickness (cm)	25.08±4.33	23.95±3.85	0.0614
Triceps skinfold thickness (mm)	14.28±3.66	13.80±3.28	0.2903
Weight (kg)	66.26±13.51	64.64±13.19	<0.0001*
BMI (kg/m²)	24.52±5.81	23.92±5.67	<0.0001*

[Table/Fig-2]: Comparison of preoperative and postoperative anthropometry.
*p<0.0001 is extremely statistically significant.

DISCUSSION

Perforation peritonitis initiates a profound systemic inflammatory response and it is a hypercatabolic state. As a result, lipid metabolism is altered; also, there is dysregulation of hepatic synthesis and lipoprotein production, and circulating cholesterol and HDL are decreased frequently during sepsis and severe infection. Management of perforation peritonitis not only requires prompt resuscitation measures and improved surgical strategies but also intensive medical care, including specific antibiotics and maintenance of proper electrolyte balance; only then will an improved outcome be achieved [6,7].

Serum cholesterol levels typically decrease significantly in the postoperative phase of perforation peritonitis compared to the preoperative phase. This drop is part of the body's systemic response to severe infection and inflammation (sepsis) and serves as an indicator of disease severity and prognosis. The current study findings support this statement. But the study carried out by Singh RK et al., showed no significant association with cholesterol levels [8]. Similar metabolic disturbance and the utility of lipid levels in patients with peritonitis have been reported by Du Toit A [6].

Protein-energy depletion is a well-recognised outcome of severe intra-abdominal infection. The fall in serum total protein and albumin observed by day 5 postoperation in the current study population shows exactly how the negative protein balance follows inflammatory catabolism and reduced intake. Hypoalbuminemia in these patients

is repeatedly associated with affected postoperative wound healing, increased complications and prolonged hospitalisation; correction of nutrition support is therefore a key management target [2,9].

The present study findings state the use of serum albumin and total protein as useful biomarkers to identify patients at nutritional risk in the perioperative period. These results are comparable with the findings in previous studies [10-16]. Singh S et al., showed that complications were encountered more among patients having serum albumin 3.5 g and these results were found statistically significant (<0.001) [10]. Das PG et al., concluded that the mean length of postoperative hospital stay was prolonged for patients with serum albumin ≤3.5 gm/dL, p-value was 0.002 significant [11]. Khunt PM and Shah J et al., stated that preoperative hypoalbuminemia is inversely associated with postoperative rate of complication, length of hospital stay and mortality [12]. Riyaz M et al., stated that patients with hypoalbuminemia demonstrated significantly higher rates of wound complications compared to those with normal albumin levels (67.9% vs 13.6%, p<0.001) [13]. Bhagvat VM et al., found that the majority of patients had serum albumin < 2.5 gm/dL and more complications were seen with serum albumin < 3.5 gm/dL which was statistically significant (p-value 0.01) [14]. Serum albumin is a good prognostic indicator because of its ability to detect protein-energy malnutrition. Sharma L et al., observed that the rate of complications was higher when serum albumin level was <3.0 gm/dL, which is statistically significant [15]. Rathod S et al., in the review, stated that preoperative serum albumin analysis has emerged as a cheap and easy means to assess patients' nutritional status and helps in predicting postoperative morbidity and mortality [16].

Electrolyte homeostasis in the present study patients remained relatively within the normal range by POD 5, although minor fluctuations in sodium and potassium were seen in some patients. This reflects that intra- and postoperative fluid and electrolyte management was actively done. The emphasis placed on the importance of close monitoring and prompt correction of electrolyte derangements in perforation peritonitis has been seen in clinical series, as uncorrected hyponatraemia or hypokalaemia can worsen cardiorespiratory status and can interfere with recovery [1,17,18].

Anthropometric measures (mid-arm circumference, triceps skinfold), body weight and BMI showed minor but steady declines by POD 5, indicating early depletion of peripheral muscle and fat stores. These changes are clinically significant even over a short postoperative interval and indicate that catabolism and reduced intake begin immediately in the perioperative period. Early identification by using simple bedside measures can allow targeted nutritional interventions. Many prospective studies in intestinal perforation/peritonitis patients have demonstrated that Early Enteral Nutrition (EEN), when feasible, certainly improves nitrogen balance, reduces septic complications and shortens hospital stay compared with more conservative feeding strategies [3,5,14,19,22]. In view of these data, our observed recovery in biochemical trends and anthropometric losses supports implementation of early nutritional rehabilitation- preferably via enteral routes once the patient is haemodynamically stable- to mitigate catabolism and accelerate recovery.

The present study data and existing evidence from various studies underline three practical implications for management of perforation peritonitis: (a) routine assessment of nutritional status (simple anthropometry plus serum albumin/total protein) should be performed to identify at-risk patients; (b) serial monitoring of basic biochemical markers including lipids and electrolytes gives a useful information about metabolic recovery and the need of supportive care; and (c) where clinically appropriate, EEN support should be instituted to improve nitrogen balance and reduce morbidity [22].

Limitation(s)

The present study analysis is limited by the relatively short follow-up (Day 5) and by lack of longer-term outcome correlation (in terms of final recovery or mortality). Finally, while the current study findings are comparable with prior reports, data with larger sample sizes are needed.

CONCLUSION(S)

The observed postoperative decline in lipids and serum proteins together with early anthropometric losses emphasise the rapid onset of catabolism after perforation peritonitis. Routine and early nutritional assessment as well as prompt initiation of nutritional therapy, preferably enteral when feasible, should be an integral part of the perioperative management strategy to reduce complications and improve recovery. In future, more studies to examine deviations in biochemical parameters and to observe whether early nutrition with defined caloric/protein targets improves hard outcomes in this population should be taken up.

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