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PREOPERATIVE SERUM ALBUMIN AS A PREDICTOR OF POST OPERATIVE MORBIDITY AND MORTALITY IN PATIENTS OF PERFORATION PERITONITIS

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ABSTRACT

Background: Perforation peritonitis is the most common surgical emergency encountered in India. Due to late presentation, perforations lead to diffuse peritonitis, resulting in high morbidity and mortality.Assessment of nutritional status of these patients can help in reducing the adverse outcomes.Serum albumin level is a readily available clinical parameter that gives an insight to patients' nutritional status. In this study, we used pre-operative serum albumin level to assess post-operative outcomes in patients of perforation peritonitis who underwent emergency laparotomy.

Methodology: This prospective observational study was conducted in the Department of General Surgery at Sri Guru Ram Das Institute of Medical Sciences and Research, Vallah, Amritsar. 70 patients were included in the study. Pre-operative serum albumin levels were obtained and correlation was drawn with the post-operative outcomes in terms of delayed wound healing, wound dehiscence, surgical site infection and 30 day mortality.

Results: In our study, out of 70 patient, 87.1% had hypoalbuminemia. The mean serum albumin of patients with normal wound healing was statistically more than that of patients with delayed wound healing. As per Southampton Grading System, statistically significant SSI were encountered among patients with hypoalbuminemia. Statistically significant number of patients with hypoalbuminemia had wound dehiscence according to WUWHS-SWD wound grading system. Additionally, statistically significant mortality was observed in patients having pre-operative hypoalbuminemia.

Conclusion: Pre-operative serum albumin levels can be used as a clinical parameter to predict post-operative outcomes in patients undergoing emergency laparotomy for perforation peritonitis.

Keywords: Laparotomy, perforation peritonitis, wound dehiscence, surgical site infection, hypoalbuminemia.

INTRODUCTION

The peritoneum is a glistening and slippery transparent layer of serous membranes. It lines the abdominopelvic cavity and invests the viscera .Perforation peritonitis is a condition that results from inflammation of peritoneum as a result of perforation of viscera in the abdominopelvic cavity. Perforation peritonitis is the most frequently encountered surgical emergency in India. Majority of them constitute gastrointestinal perforations[1-2]. Due to late presentation, gastrointestinal perforations usually cause diffuse peritonitis leading to high morbidity and mortality. The mainstay of treatment involves resuscitation of the patient followed by surgical intervention to treat the underlying cause.

Although, surgical advancements have led to significant improvement in postoperative mortality of patients, but post-operative morbidity still remains high[3].

Assessment of nutritional status of these patients and early identification of patients

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with nutritional deficiencies can help in reducing the postoperative morbidity[4-6]. Many factors (age, serum lactate levels, serum acidosis, base excess) and scores (APACHE score, MOF score) have been used to identify patients with nutritional deficiencies but till date, there is no consensus on single best method for assessing nutritional status of patients. Serum albumin level is the most readily available clinical parameter that gives an insight to patients' nutritional status.

Albumin is a major plasma protein and it constitutes approximately 60% of the total plasma proteins. Normal serum concentration of albumin is 3.5–5.0 g/dl. A serum level of less than 3.4 g/dl is considered hypoalbuminemia. Plasma albumin has three primary functions:

- To maintain osmotic pressure
- Transportation
- Nutrition

In acute conditions like perforation peritonitis, inflammatory processes lead to capillary leakage into interstitial spaces ultimately causing hypoalbuminemia. Other contributing factors include reduced synthesis of plasma proteins, dilution of blood due to fluid administration, renal and intestinal losses due to congestion, and increased catabolism[7-9]

Studies have shown that hypoalbuminemia contributes negatively to the process of wound healing14. It has also been linked to mortality and postoperative complications such as surgical site infections (SSI), reoperations and long hospital stays[10,11]. Furthermore, previous studies have also suggested the positive role of preoperative serum albumin in predicting surgical outcomes in elective gastrointestinal surgeries as well as many other surgeries except cardiac surgeries.[12,13]

Therefore, there are many tools to assess patient's nutritional status pre operatively. Decreased serum albumin is a good and easy predictor of surgical threat and has been used as quantitative measure of a patients' nutritional status because of its easy availability and less cost.

Although there are many studies that have looked into various factors, risk scores that predict adverse outcomes, but still, there exists a paucity of studies determining the role of preoperative serum albumin level as an independent factor in determining post-operative outcomes after emergency abdominal surgeries.

Hence, this study was conducted to study the role of pre-operative serum albumin levels in predicting post-operative outcomes in patients of perforation peritonitis in terms of morbidity and mortality.

METHODS: This study was conducted at the Department of General Surgery, Sri Guru Ram Das Institute of Medical Sciences and Research, Vallah, Amritsar after obtaining approval from the Institutional Ethics Committee and Scientific Committee. A total of 70 diagnosed cases of perforation peritonitis who fulfilled the inclusion and exclusion criteria were included in the study. Informed and written consent was obtained from all the patients.

STUDY DESIGN: Prospective Observational Study

INCLUSION CRITERIA:

1. Age 12 years or above.
2. Patients undergoing laparotomy for perforation peritonitis.
3. Written and informed consent.

EXCLUSION CRITERIA:

1. Age less than 12 years
2. Patients with kidney disease
3. Patients with liver disease with bilirubin >5mg/dl

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4. Patients on steroids
5. Patients undergoing chemotherapy.
6. Patients with severe anaemia <7gm/dl
7. Patients with diabetes mellitus.

Diagnosis of perforation peritonitis was established on the basis of thorough history and clinical examination supported by ultrasound and x-ray pictures. Besides routine investigations like CBC, PTI, renal function test, liver function test, random blood sugar and ECG were done. All patients also underwent estimation of total serum proteins pre operatively. Informed and written consent was signed by the patient before enrolling for study.

Details of the patient were noted on proforma .These included:

1. Name
2. Age
3. Education
4. Chief complaints
5. Past history
6. Family history
7. Local examination
8. Preoperative serum albumin levels.

TYPE OF OUTCOME MEASURED

In the post-operative period, patients were carefully watched for development of any complications within 30 days post operatively. The outcomes were studied on following parameters:

1. Surgical Site Infection as per Southampton Grading System
2. Delayed wound healing
3. Wound Dehiscence (WUWHS SWD Grading System)
4. Mortality

SOUTHAMPTON GRADING OF SSI[14]

GRADE	APPEARANCE
0	Normal healing
1	Normal healing with mild bruising and erythema
1a	Some bruising
1b	Considerable bruising
1c	Mild erythema
2	Erythema with other signs
2a	At single point/stitch
2b	Around multiple sutures
2c	Along entire stitch line
3	Clear or haemoserous discharge
3a	At single point (<2cm)
3b	At multiple stitches (>2cm)
3c	Large volume
4	Pus discharge
4a	At single point (<2cm)
4b	Along stitch line (>2cm)
5	Deep wound infection with or without tissue breakdown ; haematoma requiring aspiration

WORLD UNION OF WOUND HEALING SOCIETIES - SURGICAL WOUND DEHISCENCE GRADING [15]

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GRADE	DESCRIPTION
1	Epidermis involved No visible subcutaneous tissue
1a	Grade 1 plus clinical signs and symptoms of infection
2	Subcutaneous layer exposed Fascia not visible
2a	Grade 2 plus clinical signs and symptoms of infection
3	Subcutaneous layer and fascia exposed
3a	Grade 3 plus clinical signs and symptoms of infection
4	Fascial dehisecnce with exposure of underlying organ or viscera
4a	Grade 4 plus clinical signs and symptoms of infection

STATISTICAL ANALYSIS:

Data was analysed and appropriate statistical tests were applied .The post-operative outcome were supervised by the senior fraternity from department and results were drawn. Significance was considered at 95% confidence interval and p-value < 0.05.

RESULTS

In the present study, patients of perforation peritonitis were evaluated for their pre-operative serum albumin levels and subsequent post-operative outcome was studied in terms of SSI, delayed wound healing, wound dehiscence and mortality. This study included 70 diagnosed cases of perforation peritonitis who presented to Sri Guru Ram Das Institute of Medical Sciences and Research, Vallah, Amritsar.

Table 1:Age Distribution

Age group	**No. of cases**	**%age**
<20	4	5.7
21-30	21	30.0
31-40	10	14.3

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41-50	16	22.9
51-60	11	15.7
>60	8	11.4
Total	70	100.0
Mean age	40.510±16.001	

In the present study, the mean age of patients was 40.510±16.001, out of this 4 patients (5.7%) were <20 years, 21 patients (30%) were 21-30 years age, 10 patients (14.3%) were 31-40 years of age, 16 patients (22.9%) were 41-50 years age, 11 patients (15.7%) were 51-60 years age and 8 patients (11.4%) were >60 years of age.

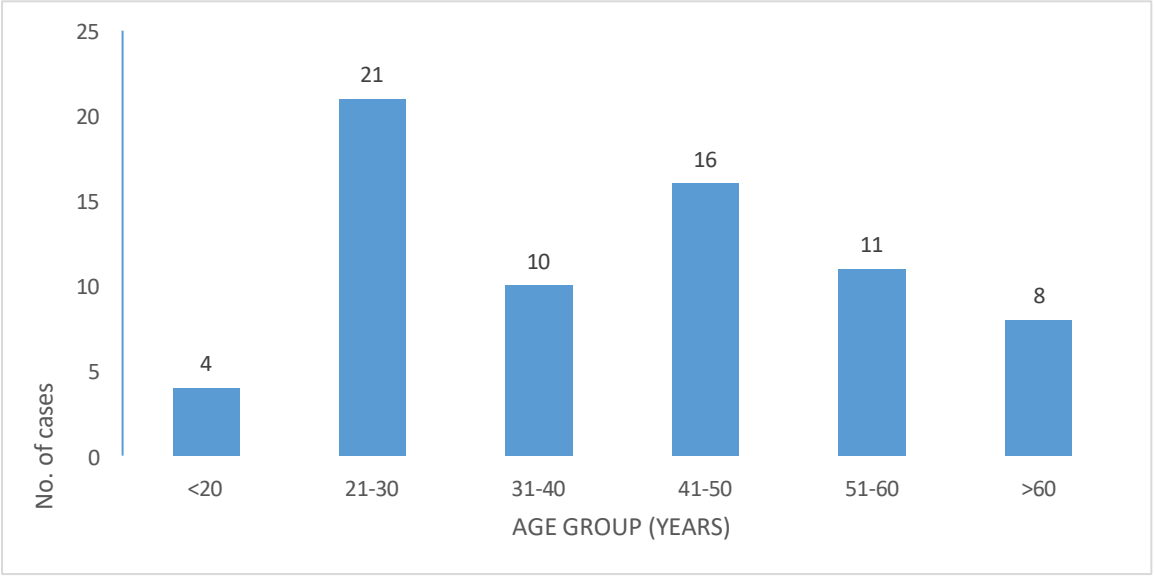

FIGURE 1: Age Distribution

TABLE 2: SERUM ALBUMIN AND SURGICAL SITE INFECTION

SSI	Serum albumin				Total	
	<3.5		>3.5			
	No.	%age	No.	%age	No.	%age
Normal healing	5	7.14	7	10.00	12	17.14
Normal healing with mild bruising, erythema	1	1.43	1	1.43	2	2.86
• 1A (Some bruising)	1	1.43	1	1.43	2	2.86
• 1C (Mild erythema)	5	7.14	0	0.00	5	7.14
Erythema plus other signs		0.00		0.00	0	0.00
• 2A (at one point)	4	5.71	0	0.00	4	5.71
• 2B (around sutures)	1	1.43	0	0.00	1	1.43
• 2C (along wound)	1	1.43	0	0.00	1	1.43
Clear or haemoserous discharge		0.00		0.00	0	0.00
• 3A (at one point only, <2 cm)	10	14.29	0	0.00	10	14.29
• 3B (along wound, >2 cm)	7	10.00	0	0.00	7	10.00
• 3C (large volume)	1	1.43	0	0.00	1	1.43
Pus		0.00		0.00	0	0.00
• 4A (at one point only, <2 cm)	10	14.29	0	0.00	10	14.29
• 4B (along wound, >2 cm)	9	12.86	0	0.00	9	12.86

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Deep or severe wound infection with or without tissue breakdown, hematoma requiring aspiration	6	8.57	0	0.00	6	8.57
Total	61	87.14	9	12.86	70	100.00

As per Southampton wound healing grading system, following observations were made. Out of 70 patients, 12 patients (17.14%) had normal wound healing (grade 1). Out of these 12 patients, 7 patients (10%) had serum albumin >3.5g% and 5 patients (7.14%) had serum albumin <3.5g%.

Out of 70 patients, 9 patients (12.86%) had normal healing with mild bruising and erythema (grade 2). Out of these 9 patients 7 patients (10%) had serum albumin levels <3.5g and 2 patients (2.86%) had serum albumin >3.5g.

Out of 70 patients, 6 patients (8.57%) had erythema (grade 3) and all 6 patients had serum albumin <3.5g pre operatively.

Out of 70 patients, 18 patients (25.72%) had clear or haemoserous discharge from stitch line and it was observed that all 18 patients had serum albumin <3.5g.

Out of 70 patients, 19 patients (27.15%) had pus discharge from stitch line and all of these patients had serum albumin <3.5g.

Out of 70 patients, 6 patients (8.57%) had deep or severe wound infection and all of them had serum albumin <3.5g%.

It was observed that among all stages of surgical site infection, complications were encountered more among patients having serum albumin <3.5g and were comparatively less among patients who had serum albumin >3.5g and these results were found statistically significant (<0.001).

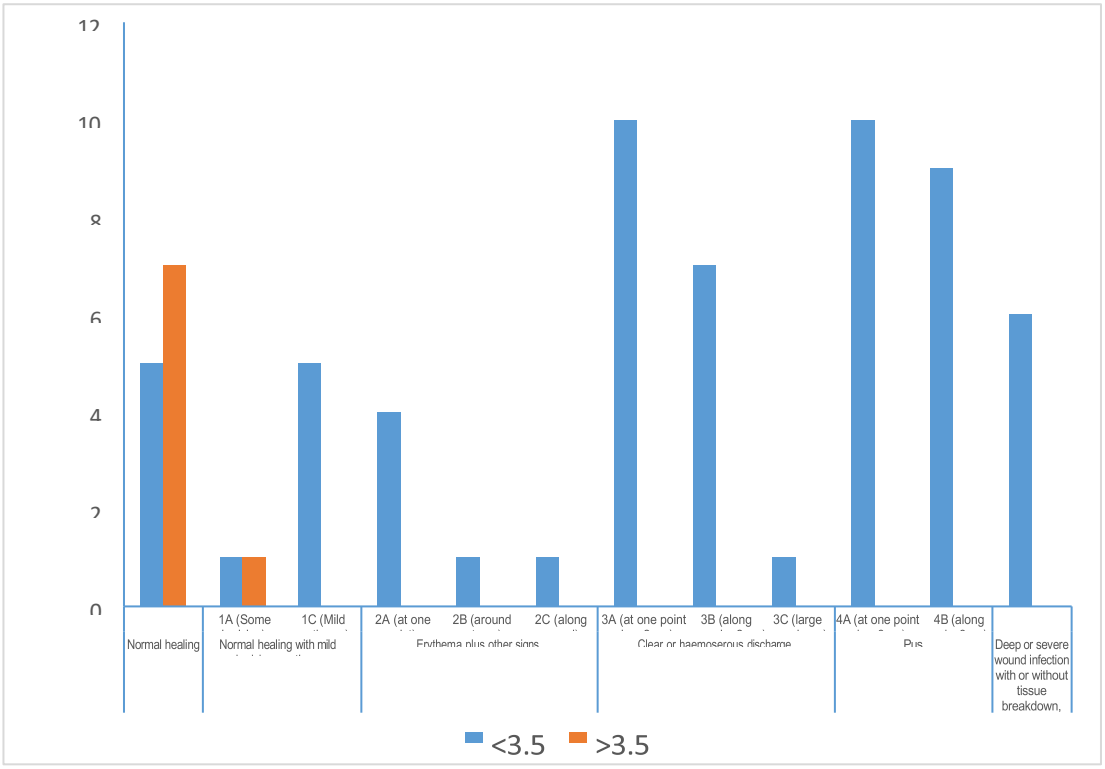

FIGURE 2: SERUM ALBUMIN AND SURGICAL SITE INFECTION

TABLE 3: SERUM ALBUMIN AND DELAYED WOUND HEALING

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Serum albumin	Delayed wound healing				Total	
	No		Yes			
	No.	%age	No.	%age	No.	%age
<3.5	26	37.14	35	50.00	61	87.14
>3.5	9	12.86	0	0.00	9	12.86
Total	35	50.00	35	50.00	70	100.00
Mean serum albumin	2.266±0.422		3.183±0.470		1.130±0.337	
p-value	0.001					

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It was observed that the mean serum albumin of 35 patients who had normal wound healing was 3.183±0.470 and the mean serum albumin of patients who had delayed wound healing was 2.266±0.422.

It was further observed that out of 35 patients who had normal wound healing 26 patients had serum albumin less than 3.5 g and only 9 patients had serum albumin more than 3.5g ,whereas all 35 patients who had delayed wound healing had a serum albumin level of <3.5.

These results were found statistically significant (p value <0.001).

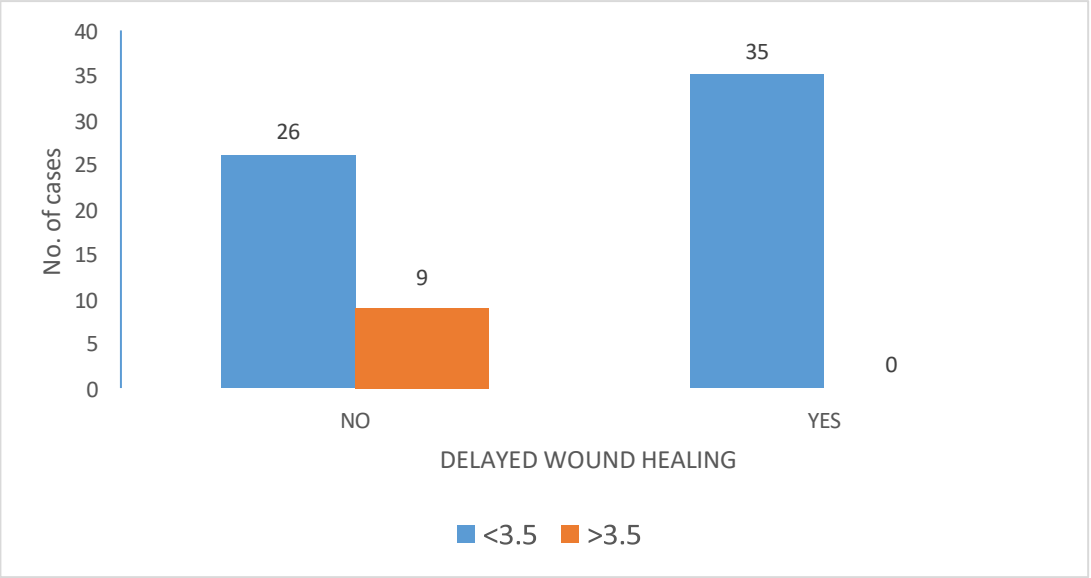

FIGURE 3: SERUM ALBUMIN AND DELAYED WOUND HEALING

TABLE 4: SERUM ALBUMIN AND WOUND DEHISCENCE

Wound dehiscence		Serum albumin			
		<3.5		>3.5	
		No.	%age	No.	%age
0	No wound dehiscence	14	22.95	9	100.00
1	Epidermis involved Non visible subcutaneous tissue	4	6.56	0	0.00
1a	Grade 1 plus clinical signs and symptoms of infection	0	0.00	0	0.00
2	Subcutaneous layer exposed Fascia not visible	20	32.79	0	0.00
2A	Grade 2 plus clinical signs and symptoms of infection	7	11.48	0	0.00
3	Subcutaneous layer and fascia exposed	6	9.84	0	0.00
3A	Grade 3 plus clinical signs and symptoms of infection	4	6.56	0	0.00
4	Fascial dehiscence with exposure of underlying organ or viscera	0	0.00	0	0.00
4A	Grade 4 plus clinical signs and symptoms of infection	6	9.84	0	0.00
Total		61	100.00	9	100.00

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out of 61 patients with hypoalbuminemia, it was observed that 14 patients (22.95%) had no wound dehiscence, 4 patients (6.56%) had grade 1 wound dehiscence, 20 patients (32.79%) had grade 2 wound dehiscence, 7 patients (11.48%) had grade 2A wound dehiscence, 6 patients (9.84%) had grade 3 wound dehiscence, 4 patients (6.56%) had grade 3A wound dehiscence and 6 patients (9.84%) had grade 4A wound dehiscence.

On the other hand, out of 9 patients with normoal buminemia, no patient had wound dehiscence. These results were found statistically significant.

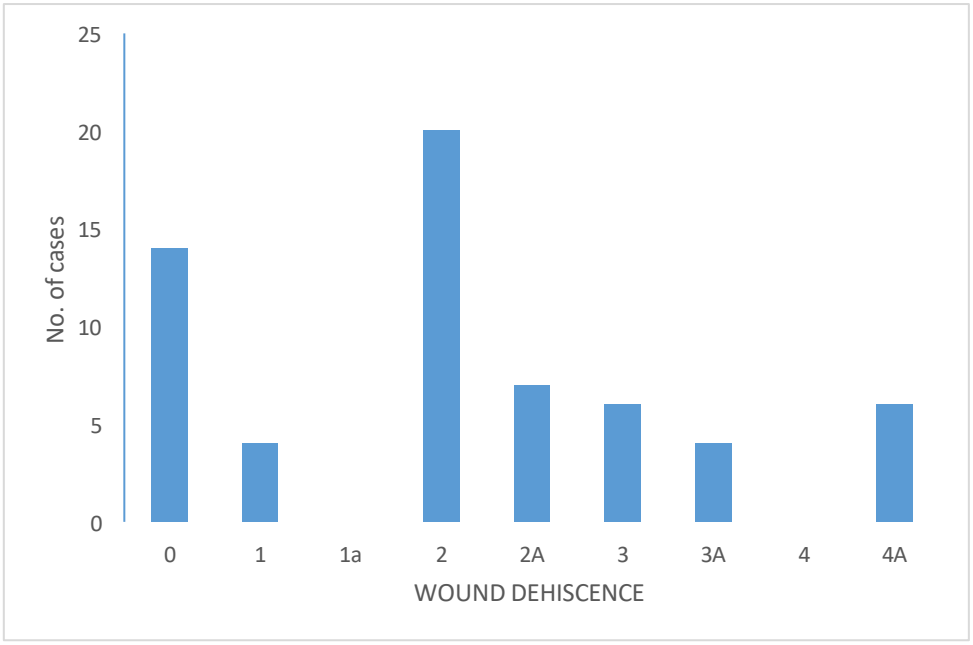

FIGURE 4 SERUM ALBUMIN AND WOUND DEHISCENCE IN PATIENTS WITH HYPOALBUMINEMIA

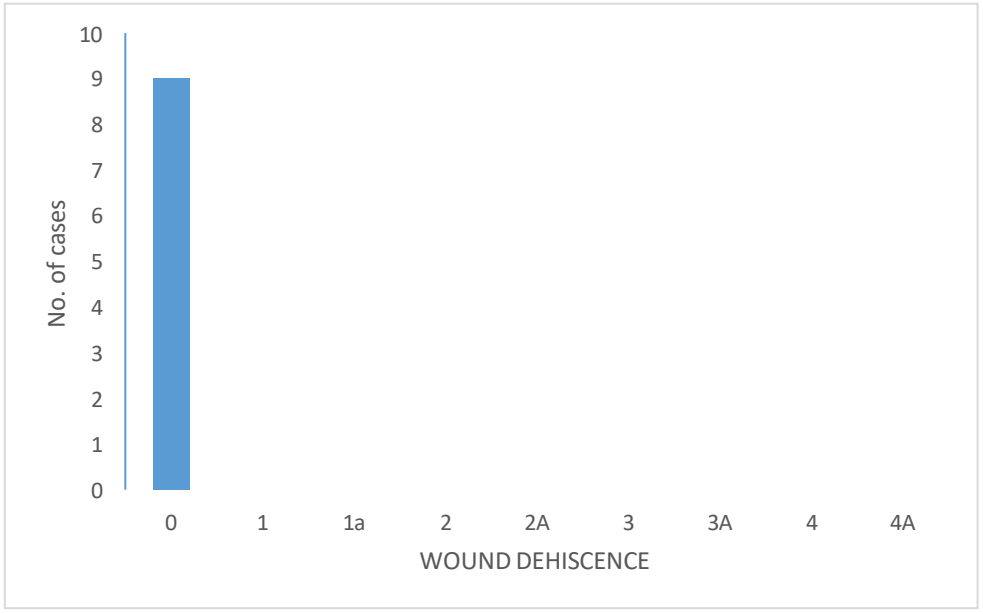

TABLE 5: WOUND DEHISCENCE IN PATIENTS WITH NORMAL SERUM ALBUMIN LEVEL

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TABLE 5: SERUM ALBUMIN AND MORTALITY

Serum albumin	Mortality				Total	
	No		Yes			
	No.	%age	No.	%age	No.	%age
<3.5	59	84.29	2	2.86	61	87.14
>3.5	9	12.86	0	0.00	9	12.86
Total	68	97.14	2	2.86	70	100.00
Mean serum albumin	1.400±0.423		2.763±0.605		1.130±0.337	
p-value	0.001					

Out of 70 patients, 68 patients (97.14%) survived and 2 patients (2.86%) underwent mortality. It was observed that both patients had serum albumin <3.5g. These results were found to be statistically significant (<0.001).

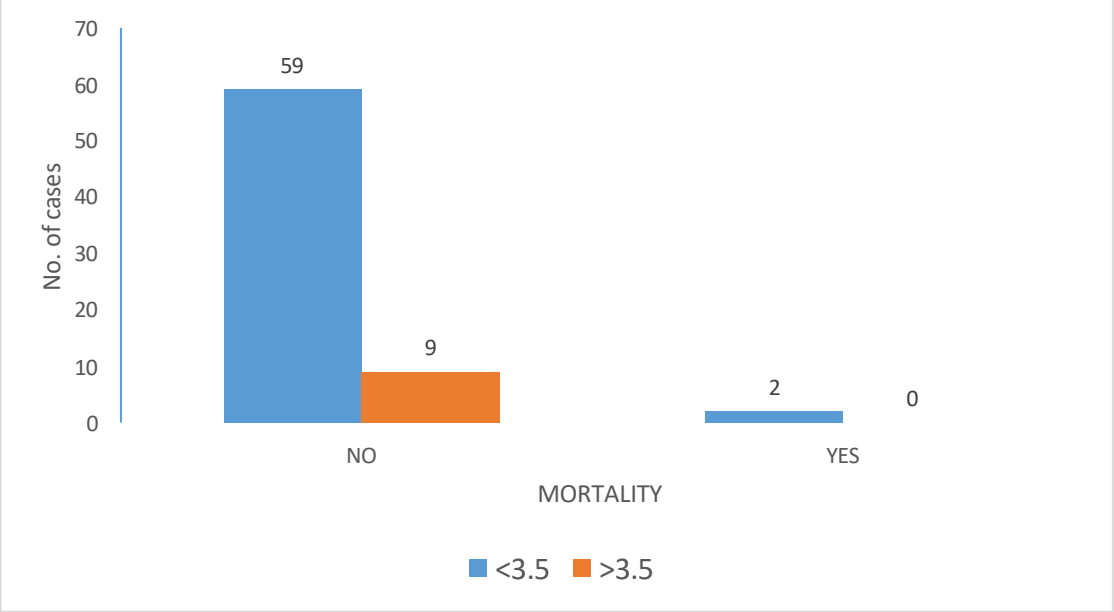

FIGURE 6: SERUM ALBUMIN AND MORTALITY

DISCUSSION

The present study was a prospective observational study conducted in the Department of General Surgery at Sri Guru Ram Das Institute of Medical Sciences and Research, Vallah. Total 70 patients were included in the study after fulfilling the inclusion and exclusion criteria.

The objectives of the study were to study the pre-operative serum albumin levels in diagnosed cases of perforation peritonitis and to study post-operative morbidity and mortality in diagnosed cases of perforation peritonitis in terms of surgical site infection, wound dehiscence, delayed wound healing and mortality. The aim was to evaluate the correlation between preoperative serum albumin levels and postoperative morbidity and mortality in patients of perforation peritonitis.

In the present study, the mean age of patients was 40.510±16.001, out of this 4 patients (5.7%) were <20 years, 21 patients (30%) were 21-30 years age, 10 patients (14.3%)

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were 31-40 years of age, 16 patients (22.9%) were 41-50 years age, 11 patients (15.7%) were 51-60 years age and 8 patients (11.4%) were >60 years of age.

It was observed that majority of patients were 21-30 years of age constituting 30% of total patients included in study and only 8 patients (11.4%) were >60 years age.

However, in a study conducted by Gibbs et al[10] (1999) in which pre-operative serum albumin levels were used to predict post-operative morbidity and mortality, mean age of patients was 61 years.

This difference of mean age found in our study could be due to the exclusion criteria, where we excluded all patients having co morbidities like liver disease, diabetes, hypertension; which are more common in elderly as compared to young age group. Also, another contributing factor for maximum number of patients being in younger age group could be drug abuse which is a common etiology behind perforation.

The outcomes of our study were drawn on the basis of delayed wound healing, wound dehiscence (WUWHS SWD), surgical site infection (Southampton Grading System[14]) and mortality.

Out of 70 patients in our study, 35 patients had normal wound healing and 35 patients had delayed wound healing. It was observed that mean serum albumin of 35 patients who had normal wound healing was 3.183±0.470 and the mean serum albumin of patients who had delayed wound healing was 2.266±0.422. It was further observed that all 35 patients who had delayed wound healing had a serum albumin level of <3.5.Out of 35 patients who had normal wound healing 26 patients had serum albumin less than 3.5 g and only 9 patients had serum albumin more than 3.5g.These results were found statistically significant (p value <0.001).

The surgical site infection was graded using Southampton grading system and following observations were made:

Out of 70 patients, 12 patients(17.14%) had normal wound healing (grade 1) and out of these 12 patients, 7 patients (10%) had serum albumin >3.5g% and 5 patients (7.14%) had serum albumin <3.5g%.

Out of 70 patients, 9 patients (12.86%) had normal healing with mild bruising and erythema (grade 2). Out of these 9 patients 7 patients (10%) had serum albumin levels <3.5g and 2 patients (2.86%) had serum albumin >3.5g.

Out of 70 patients, 6 patients (8.57%) had erythema (grade 3) all 6 patients had serum albumin <3.5g pre operatively. Out of 70 patients, 18 patients (25.72%) had clear or haemoserous discharge from stitch line. It was observed that all 18 patients had serum albumin <3.5g.

Out of 70 patients, 19 patients (27.15%) had pus discharge from stitch line and all of these patients had serum albumin <3.5g.

Out of 70 patients, 6 patients (8.57%) had deep or severe wound infection and all of them had serum albumin <3.5g%.

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It was observed that among all stages of surgical site infection, complications were encountered more among patients having serum albumin <3.5g and were comparatively less among patients who had serum albumin >3.5g and these results were found statistically significant (<0.001).

Similar results were observed in a study conducted by Kumar et al[16], where the incidence of surgical site infections was 59.1% in patients with preoperative hypoalbuminemia, which was also statistically significant.

Out of 70 patients, 23 patients (32.9%) had no wound dehiscence, 4 patients (5.7%) had grade 1 wound dehiscence, 20 patients (28.6%) had grade 2 wound dehiscence, 7 patients (10%) had Grade 2A wound dehiscence, 6 patients (8.6%) had grade 3 wound dehiscence, 4 patients (5.7%) had grade 3 A wound dehiscence, 6 patients (8.6%) had grade 4 wound dehiscence.

out of 61 patients with hypoalbuminemia, it was observed that 14 patients (22.95%) had no wound dehiscence, 4 patients (6.56%) had grade 1 wound dehiscence, 20 patients (32.79%) had grade 2 wound dehiscence, 7 patients (11.48%) had grade 2A wound dehiscence, 6 patients (9.84%) had grade 3 wound dehiscence, 4 patients (6.56%) had grade 3A wound dehiscence and 6 patients (9.84%) had grade 4A wound dehiscence.
On the other hand, out of 9 patients with normoalbuminemia, no patient had wound dehiscence. These results were found statistically significant.
Similar results were found in a study conducted by Sharath Kumar et al,[16]where the incidence of deep wound space infections was 3.2% in patients with hypoalbuminemia. In another study conducted by Gibbs et al,[17] the incidence of deep wound infection and wound dehiscence was 5.9% and 2% respectively, in patients who had preoperative hypoalbuminemia, with statistically significant p values of <0.001.
Out of 70 patients, 68 patients (97.14%) survived and 2 patients (2.86%) underwent mortality. It was observed that both patients had serum albumin <3.5g. These results were found to be statistically significant (<0.001).
CONCLUSION

The present prospective observational study was conducted in the department of General Surgery at Sri Guru Ram Das Institute of Medical Sciences and Research, Vallah, Amritsar.

The aim of the study was to find correlation between pre-operative serum albumin levels and post-operative outcomes in patients of perforation peritonitis. The outcomes were studied on the basis of delayed wound healing, wound dehiscence, surgical site infection and mortality.

Total 70 patients, who fulfilled the inclusion and exclusion criteria were enrolled in the study. Written and informed consent was taken. Pre-operative serum albumin levels were evaluated in these patients and post-operative outcomes were studied.

Following results were obtained:

- In the present study, the mean age of patients was 40.510±16.001.
- Out of 70 patients, 23 were females (32.9%) and 47 were males (67.1%).

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- Out of 70 patients, serum albumin of 61 patients (87.1%) was <3.5g preoperatively and only 9 patients (12.9%) had a serum albumin levels of >3.5g.
- It was observed that the mean serum albumin of 35 patients who had normal wound healing was 3.183±0.470 and the mean serum albumin of patients who had delayed wound healing was 2.266±0.422.
- All 35 patients who had delayed wound healing had a serum albumin level of <3.5.
- It was observed that among all stages of surgical site infection, complications were encountered more among patients having serum albumin <3.5g and were comparatively less among patients who had serum albumin >3.5g.
- Out of 9 patients with normal albuminemia, no patient had wound dehiscence.
- Out of 70 patients, 68 patients (97.14%) survived and 2 patients (2.86%) underwent mortality and both patients had serum albumin <3.5g.

Thus, we conclude that in our study pre-operative serum albumin levels served as an important predictor of post-operative outcomes. Low serum albumin levels correlated with adverse outcomes like delayed wound healing, wound dehiscence, surgical site infection and mortality. Thus, serum albumin levels can be used as a simple and cost effective predictor of post-operative outcomes. However, certain limitations of this study provide a scope for further studies to be conducted to solidify the findings of this study.

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