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Research Article

Correlation between Perioperative Serum Albumin Levels and Complications in Usage of Drugs and Alcohol on Major Abdominal Surgery

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Abstract

Background and purpose: Surgical trauma often leads to capillary leaks and inflammatory responses, which in turn cause a decrease in albumin levels. Hypoalbuminemia in patients undergoing major abdominal surgery can prolong treatment, increase the risk of complications, and elevate mortality rates. This study aims to explore the correlation between perioperative serum albumin levels and the occurrence of complications in major abdominal surgeries, particularly in the context of drug and alcohol usage.

Methods: This study is a prospective analytic research conducted with a cohort design at the Surgery Division of Dr. M Djamil Padang. The sample included 36 patients undergoing elective gastrointestinal surgery who met the inclusion criteria. Perioperative albumin levels were measured, and the data were analyzed using the chi-square method, with a significance threshold set at $P \leq 0.05$.

Results: A significant correlation was found between postoperative albumin levels, postoperative albumin depletion, and the incidence of major postoperative complications in abdominal surgery.

Conclusion: Perioperative serum albumin levels can serve as an independent indicator of successful outcomes in major abdominal surgeries, especially in patients with a history of drug and alcohol usage.

Keywords: Serum albumin; Major abdominal surgery; Outcome

Introduction

Albumin is the largest and most important plasma protein in the human body. The decrease in albumin plasma concentration and its connection to surgical trauma has been recognized since 1985 by Fleck et al. (1985) who highlighted that surgical trauma leads to capillary leakage and inflammatory responses, resulting in reduced albumin levels. Surgery, particularly invasive procedures, damages body tissues and triggers both anabolic and catabolic metabolic phases postoperatively. Patients undergoing surgery, especially those with a history of drug and alcohol usage, are at heightened risk of malnutrition due to preoperative fasting, surgical stress, and increased metabolic demands [1,2].

The role of albumin in the circulating blood of critically ill patients differs significantly from its function in healthy individuals. In critical patients, low serum albumin levels are linked to poor outcomes. However, the use of exogenous albumin to correct albumin levels has not been shown to improve patient outcomes [2,3].

Protein-energy malnutrition is prevalent among surgical patients, with incidence rates ranging from 10%-50%. Assessing the nutritional status of these patients is crucial, as malnutrition is a significant risk factor for morbidity and mortality. Albumin serves as a valuable marker in determining the prognosis of a disease. In hospitalized patients, hypoalbuminemia is associated with longer hospital stays, higher complication rates, and increased mortality. A meta-analysis revealed that for every 1.0 g/dL decrease in serum albumin, mortality increased by 137%, and morbidity by 89%. Another study found that a serum albumin concentration of less than 3.4 g/dL was linked to a 30-day mortality rate of 24.6%, which rose to 62% when serum albumin was below 2.0 g/dL [1-6].

The classification of major surgery depends on procedure-related factors such as the surgical approach, duration, blood loss, and patient-related factors like nutritional status, underlying conditions, and comorbidities. Reliable and straightforward parameters are essential for assessing and identifying patients with risk factors during perioperative

care, particularly those with a history of drug and alcohol use [5-7].

Postoperative complications are a significant concern following major abdominal surgery. These complications can range from local to systemic and may impair the function of various organ systems. Assessing the severity of surgical trauma is crucial for managing and addressing these complications. The Clavien-Dindo classification system, developed in 2004, is widely used to assess the severity of postoperative complications. This system is applicable across different centers due to its generalizability and ease of use [3,4].

Methods

This study was a prospective analytical study with a cohort study design. This study was conducted in the surgical department of Dr M DJAMIL Hospital Padang West Sumatra. The population is all patients in the hospital who will undergo elective major abdominal surgery. The inclusion criteria for this study were elective major digestive surgery, age >18 years, surgery with a laparotomy approach. Patients who refused to be included in the study, patients who died intraoperatively or died before 24 hours postoperatively, patients with comorbid factors (DM, endocrine disorders, pulmonary function disorders, history of MCI, cardiomyopathy, stroke), preoperative patients with symptoms of SIRS or sepsis, preoperative patients with unstable haemodynamics, surgery with an endo-laparoscopic approach were included in the exclusion criteria. Blood samples to assess serum albumin concentration were taken 24 hours before surgery and one day after surgery. Patients will be followed from the first postoperative day until discharge or death and assessed for postoperative outcomes categorised according to the Clavien-Dindo classification.

The collected data will be processed, analysed and presented using 2 × 2 tabulation with the chi-square method and calculation with the diagnostic test formula with confidence limit of $p<0.05$ to compare preoperative, postoperative serum albumin levels and albumin depletion with postoperative outcomes based on the Clavien-Dindo classification.

Results

In a prospective analytical study with a cohort study design of 36 research subjects who underwent major abdominal surgery at Dr M. Djamil Padang Hospital from April 2017 to June 2017, the following results were obtained. The characteristics of the research subjects can be seen in Table 1.

Table 1: Characteristics subject study

Characteristics	f	%	Information
Age	-	-	Mean: 48.75
Operating hours	-	-	Mean: 190.41
Length of treatment			
<7 days	12	33.30	Mean: 7.60
>7 days	24	66.70	
Type sex			
Woman	19	52.80	-
Man	17	47.20	
Pre-op Albumin			Mean: 3.275
Hypoalbuminemia	17	47.20	Max: 4.7
Normal albumin	19	52.80	Min: 2.5
Post-op Albumin			Mean: 2.53
Hypoalbuminemia	29	80.60	Max: 3.8
Normal albumin	7	19.40	Min: 1.1
Albumin Depletion			Mean: 0.742
High (>1 mg/dl)	10	27.80	Max: 1.7
Low (<1 mg/dl)	26	72.20	Min: 0.2
Classification clavien-dindo			
No there is complications	8	22.20	-
Minor (grade 1-2)	16	44.40	
Major (grade 3-4)	8	22.20	
Mortality (grade 5)	4	11.10	
Albumin group category			
A (Normal-D>1)	1	2.80	-
B (Normal-D<1)	6	16.70	
C (Normo–hypo-D>1)	6	16.70	
D (Normo–hypo-D<1)	6	16.70	
E (hypo–hypo-D>1)	3	8.30	
F (hypo–hypo-D<1)	14	38.90	
Colorectal	27	75.00	-
Hepatobiliary	4	11.10	
Upper GI tract	2	5.60	
Other	3	8.30	

Tables 2 and 3 illustrate the results of the chi-square statistical test with the final Yates correction values of 2.376 and 0.683 ($p>0.05$) respectively. Therefore, it can be concluded that there is no association between age and gender with the incidence of complications in major abdominal surgery.

Table 2: Relationships age with success major abdominal surgery

Age (years)	Classification Clavier–dindo				
	Minor complications		Major complications		chi-square Yates correction
	f	%	f	%	
20-50	16	80	4	20	2.376
50	8	50	8	50	p>0.05

Table 3: Relationships type sex with success major abdominal surgery

Type sex	Classification Clavier–dindo				
	Minor complications		Major complications		chi-square Yates correction
	f	%	f	%	
Man	11	57.90	8	42.10	0.683
Woman	13	76.50	4	23.50	p>0.05

The relationship between pre-operative albumin levels and the success of major abdominal surgery can be seen in Table 4 below. The table illustrates the results of the chi-square statistical test with the final result of the p value=0.892 (p>0.05). Therefore, it can be concluded that there is no relationship between pre-operative albumin levels and the incidence of complications in major abdominal surgery.

Table 4: Relationships pre-operative albumin levels with success major abdominal surgery

Preoperative albumin	Classification Clavier–dindo				
	Minor complications		Major complications		chi-square p-value
	f	%	f	%	
Hypoalbuminemia	10	58.80	7	41.10	0.892
Normal albumin	14	73.70	5	26.30	p>0.05

The relationship between post-operative albumin levels and the success of major abdominal surgery can be seen in Table 5 below. The table illustrates the results of the Fisher Exact statistical test with the final result of the fisher p value=0.041 (p<0.05). Therefore, it can be concluded that there is a relationship between postoperative albumin levels and the incidence of complications in major abdominal surgery.

Table 5: Relationships postoperative albumin levels with success major abdominal surgery

Preoperative albumin	Classification Clavier–dindo				
	Minor complications		Major complications		chi-square p-value
	f	%	f	%	
Hypoalbuminemia	17	58.60	12	41.40	0.041
Normal albumin	7	100	0	0	p<0.05

The association of albumin depletion with complications of major abdominal surgery can be seen in Table 6. The table illustrates the results of the chi-square statistical test with the final result of the Yates correction value=6.284 (p<0.05). Therefore, it can be concluded that there is an association between albumin depletion and the incidence of complications after major abdominal surgery.

Table 6: Relationships depletion with complications

Albumin depletion	Classification Clavier–dindo				
	Minor complications		Major complications		chi-square Yates correction
	f	%	f	%	
Depletion >1	3	30.00	7	70.00	6.824
Depletion <1	21	80.70	5	19.20	p<0.05

Table 7 illustrates the results of the characteristics of serum albumin levels in the study subjects with complications that occur based on grading in the Clavien-Dindo classification. From this table the highest incidence of mortality occurred in group E.

Table 7: Perioperative characteristics of albumin with success major abdominal surgery

Category	Classification Clavier–dindo							
	No there are complications		Minor complications		Major complications		Mortality	
	f	%	f	%	f	%	f	%
A	1	100.00	0	0.00	0	0.00	0	0.00
B	3	50.00	3	50.00	0	0.00	0	0.00
C	0	0.00	2	33.30	4	66.70	0	0.00
D	1	16.70	4	66.70	1	16.70	0	0.00
E	0	0.00	0	0.00	1	33.30	2	66.70
F	3	21.40	7	50.00	2	14.30	2	14.30

The relationship between pre-op albumin levels and length of treatment can be seen in Table 8 Initially, the normality test was carried out and the data was found to be normally distributed. Then proceed with the independent sample t-test to see the relationship between preoperative, postoperative, and albumin depletion levels with the length of stay in the hospital. From the results of statistical tests, it was found that there was no relationship between preoperative, postoperative, and albumin depletion levels on length of stay with a value of t=0.414, p=0.681 (p>0.05), a value of t=0.064, p=0.950 (p>0.05), a value of t=0.200, p=0.843 (p>0.05) respectively. Therefore, it can be concluded that there is no relationship between preoperative, postoperative, and albumin depletion levels with the length of treatment.

Table 8: Relationships level albumin with length of treatment

Level albumin pre-op	**Length of treatment**				**chi-square p-value**
	Average	**n**	**SD**	**t value**	
Hypoalbuminemia	7,688	13.00	3.005	0.414	0.681
Normal albumin	7,316	12.00	2.311	-	p>0.05
Level albumin post op	**Length of treatment**				**chi-square p-value**
	Average	**n**	**SD**	**t value**	
Hypoalbuminemia	7,500	28	2,887	0.064	0.95
Normal albumin	7,429	7	1.134	-	p>0.05
Level Depletion albumin	**Length of treatment**				**chi-square p-value**
	Average	**n**	**SD**	**t value**	
Depletion<1	7,538	26	2.420	0.200	0.843
Depletion>1	7.333	8	3.279	-	p>0.05

Discussion

Major abdominal surgery is closely related to adverse outcomes. This study aims to evaluate serum albumin levels as a marker of surgical trauma which is then used as a reference whether serum albumin levels can be used as a predictor of surgical success. Malnutrition is a problem that is often found in patients who will undergo major abdominal surgery, in accordance with the characteristics of the subjects of this study, where it was found that as many as 47.20% of the study subjects had serum albumin levels below 3.2 gr/dl. Albumin itself can be used as a parameter that describes the nutritional status of the patient. From this study, it can be seen the relationship between preoperative albumin levels and the incidence of postoperative complications with a p value=0.892, which statistically shows that preoperative serum albumin levels do not greatly affect the incidence of complications after major abdominal surgery, where the incidence of complications occurs almost equally in both the hypoalbumin and normo albumin groups [8-10].

This is in accordance with the results of previous research by Tadanobu Shimura et al. (2016) which states that preoperative albumin levels are not associated with the incidence of leakage in patients with colorectal anastomosis (p=0.474). However, in this study there was a mortality rate (Clavien-Dindo grade V classification) of 11.10% where the mortality rate only occurred in the preoperative hypoalbumin group while in the preoperative normoalbumin group there was no mortality rate. However, in the study of Tadanobu Shimura et al. (2016) the lowest cutt off albumin value in the study subjects was 3.2 gr/dl (median, 4.1 g/dL; range, 3.2 g/dl-4.6 g/dl) which means that none of the study subjects were in the hypoalbumin group [11-14].

The postoperative albumin value shows a decrease in the postoperative serum albumin level of the major abdomen. In accordance with the results of previous research by Smeets et al. (1994) who conducted postoperative hypoalbumin analysis explained that 70% of the decrease in serum albumin was due to increased vascular permeability which caused redistribution of albumin, 6% was due to decreased albumin synthesis function as a result of inflammatory mediators, 18% due to blood loss, and haemodilution of serum albumin due to fluid administration. Fleck et al. (1985) have also explained that TER (Transcapillary Escape Rate) increases 100% after major surgery and can increase up to 300% in patients with sepsis shock. Albumin sequestration into the third cavity is the main cause of acute albumin loss after surgery. In this study, 80.60% of the study subjects were in the hypoalbumin group and 19.40% in the normoalbumin group [15-20]. Statistically using the chi-square method there is a relationship between postoperative serum albumin levels and the occurrence of complications after major abdominal surgery with a p value=0.041. In this study, post-operative hypoalbuminemia has a higher risk of complications than the group with normal serum albumin levels. Another study by Ryan et al found a decrease in albumin on the first day after esophagotomy surgery below 2.0 gr/dl, which increases the risk of morbidity, prolongation of ICU care and high rates of reoperation. In another study by Tadanobu Shimura et al. (2016) stated that hypoalbuminemia on the first day postoperatively was associated with anastomosis leakage in colorectal patients where in the group with anastomosis leakage had serum albumin values with a median of 2.8 gr/dl and a range of 2.5 gr/dl-3.2 gr/dl, this value was lower than in the group without anastomosis leakage with a median of 3.2 with a range of 2.0 gr/dl-4.1 gr/dl (p=0.0001) [21-23].

Conclusion

Decreased postoperative serum albumin levels can be used

as an indicator of the severity of surgical trauma and can be used as a predictor for the occurrence of complications after major abdominal surgery.

Conflicting Interests

The authors declare that there is no conflict of interest in this report.

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