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PREVALENCE AND RISK FACTORS OF HYPOALBUMINEMIA IN PATIENTS ADMITTED TO SURGICAL INTENSIVE CARE UNIT IN ZAGAZIG UNIVERSITY HOSPITALS

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ABSTRACT

Background: Hypoalbuminemia is a common complication in people suffering from acute and chronic illnesses. 20% of severely ill patients have hypoalbuminemia at the time of admission to the hospital. The aim of this study was to determine the prevalence of hypoalbuminemia in the Surgical Intensive Care Unit and to assess the risk factors for hypoalbuminemia in order to improve the outcomes of patients admitted to the unit. **Patients and methods:** this study included 200 patients were hospitalised to Zagazig University Hospitals' surgical Intensive Care Unit, Anesthesia and Intensive Care Department. Complete blood count, liver function tests, renal function tests, random blood sugar, and prothrombin time were all performed on all of the patients. Serum albumin was measured on day one and day six. **Results:** The majority of individuals with hypoalbuminemia were over 60 years old. Tumors, diabetes, hypertension, renal illnesses, and hepatic disorders were the most prevalent risk factors. The greater the danger, the greater the chance of hypoalbuminemia. Oncology patients had the lowest albumin levels. In compared to the mean albumin level on day one and day six, the risk of hypoalbuminemia increases as the length of stay in the hospital increases. **Conclusion:** In surgical intensive care units, careful monitoring of serum albumin levels is required, especially in older patients, because the risk of hypoalbuminemia increases dramatically as the duration of stay increases, and the prevalence of hypoalbuminemia increases in patients with greater risk factors.

Keyword: Hypoalbuminemia; Surgical Intensive Care unit; Serum albumin

INTRODUCTION:

Hypoalbuminemia is defined by a serum albumin <35 g/L, although clinically significant hypoalbuminemia is probably identified by levels <25 g/L. Hypoalbuminemia is commonly observed in elderly patients, especially those who are institutionalized and/or hospitalized, and in patients with malnutrition or advanced-stage chronic diseases **(1)**, the reported frequency of hypoalbuminemia, defined as a serum albumin concentration of less than 34 g/L, was 21% at the time of admission in adult hospitalized patients **(2).**

hypoalbuminemia may develop within hours in acute disease or after trauma and resuscitation in previously well-nourished individuals and is also present in chronic inflammatory diseases. There is actually a poor correlation between the level of nutrition intake and the serum albumin level **(3).**

The association between hypoalbuminemia and poor outcomes has long motivated clinicians in administering exogenous albumin to hypo-albuminemic patients, and hypoalbuminemia is a licensed indication for human albumin in the United States and other countries. However, the appropriateness of this practice has been challenged on the basis of insufficient evidence to support its efficacy **(4).**

The aim of this study was to determine the prevalence of hypoalbuminemia in the Surgical Intensive Care Unit and to assess the risk factors for hypoalbuminemia in order to improve the outcomes of patients admitted to the unit.

Patients and Method:

This cross-sectional study included patients admitted to a surgical intensive care unit for at least 6 days. Using Open Epi, the sample size was calculated using the following assumptions: the total number of patients admitted to the surgical Intensive Care Unit in Zagazig University Hospitals was 320 per year, and the frequency of hypoalbuminemia was 21%, so the sample size was calculated to be 143 patients with a confidence interval of 95% **(2)**. So, we included 200 patients to this study.

Inclusion Criteria:

Patients of both genders at 18 years old or older who had been admitted to a surgical intensive care unit for at least 6 days.

Exclusion Criteria:

Patient's length of stay less than six days in surgical intensive care unit.

Operational Design:

Immediate blood sample collection before starting any medication for albumin estimation and any other investigations necessary for management after taking a complete history and full examination (complete blood count, liver function tests, kidney function tests, random blood sugar, prothrombin time, arterial blood gases). Then, in the first and sixth days, serum albumin levels are measured.

All patients' age, gender, reason for admission, hospital diagnosis, ICU admission and discharge dates, and hemodynamic data (blood pressure, pulse rate, respiratory rate, and oxygen saturation) were recorded.

Statistical analysis:

The data analyses using statistical package for the social sciences (SPSS) version 26 was used to code and enter the data (IBM Corp., Armonk, NY, USA). For quantitative variables, mean and standard deviation were used, while for categorical variables, frequencies (number of cases) and relative frequencies (percentages) were used. In normally distributed quantitative variables, comparisons between groups were made using unpaired t test or analysis of variance (ANOVA) with multiple comparisons post hoc test, while non-parametric Kruskal-Wallis test and Mann-Whitney test were used for non-normally distributed quantitative variables.For comparing categorical data, Chi square ($\chi 2$) test was performed. Exact test was used instead when the expected frequency is less than 5. P-values less than 0.05 were considered as statistically significant **(5).**

Results:

Total 200 patients were included in our study with age ranging from 19 to 94 years and with mean age 56.83 ± 17.84 years; 51.5% of them were males and 48.5% were females. They were tested for serum albumin level. From the 200 patients who admitted to surgical intensive care unit, 120 (60%) had albumin values lower than normal (Albumin < 3.5 gm/dl); 62 were males (31%) and 58 were females (29%). Eighty patients (40%) had normal albumin values; 41 were males (20.5%) and 39 were females (19.5%). The measurement of the average plasma levels of albumin showed no significant difference between males and females **(Figure 1)**.

The age of patient admitted to the ICU ranged from (19- 94) years. They were classified into three groups; group (1) with age ranged from (18 to 40) with mean albumin level on admission (3.95 ± 0.76), group (2) with age range from (>40 to 60) with mean albumin level (3.54 ± 0.62) and group (3) with age >60 years with mean albumin level (2.94 ± 0.63). There is highly significant increase of hypoalbuminemia in patients with age >60 **(Figure 2)**.

Representation of the plasma albumin levels in different patients according to their age. The mean of albumin level was 2.94 ± 0.63in patients with an age ≥ 60 years; there is highly significance decrease in albumin level in patients > 60 years.Patients were divided in two group according to cause of admission; post-operative included 134 (67%) patients 110 of them had hypoalbuminemia on admission and trauma group included 66 (33%) patients 10 of them had hypoalbuminemia on admission. Prevalence of hypoalbuminemia was significantly higher in post-operative patients ($p \geq 0.0001$ vs. trauma patients' group).Tumors, diabetes, hypertension, renal diseases, hepatic disease were considered risk factors. Some patients were presented with no risk factors while other were presented with one risk factor or several risk factors **(Figure 3)**.

Most of patients who have four of these risk factors suffered from hypoalbuminemia (plasma albumin < 3.5 g/dl). The increase in the number of presented risk factors will lead to an increase in the possibility of hypoalbuminemia Most of Patients with one risk factor didn't show a significant low

albumin level. Mean level of albumin in hypertensive patients were (3.54± 0.76), in diabetic patients was (3.78± 0.25), in chronic liver disease patients was (3.30 ± 0.76) and in oncology patients mean albumin level was (3.13± 0.66). While the mean albumin level in chronic kidney disease patients as a single risk factor is not applicable. There was significant decrease in albumin level in oncology patients when compared with patients with no risk factors (P<0.05) **(Figure 4)**.

We found that by the sixth day of ICU admission the number of hypoalbuminemic patients increased to 81% (n= 162) and only 19% (n=38) had normal albumin levels; forty two patients had gained hypoalbuminemia in the sixth day of admission **(Figure 5)**.

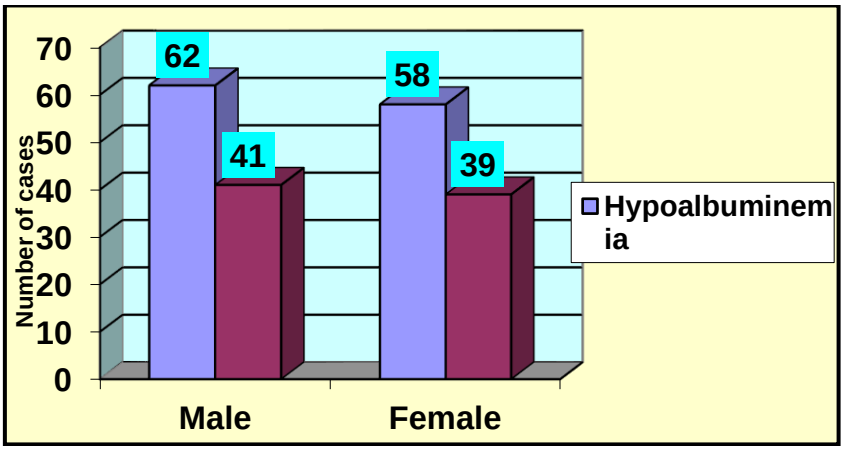

Figure (1): Prevalence of hypoalbuminemia in both sexs.

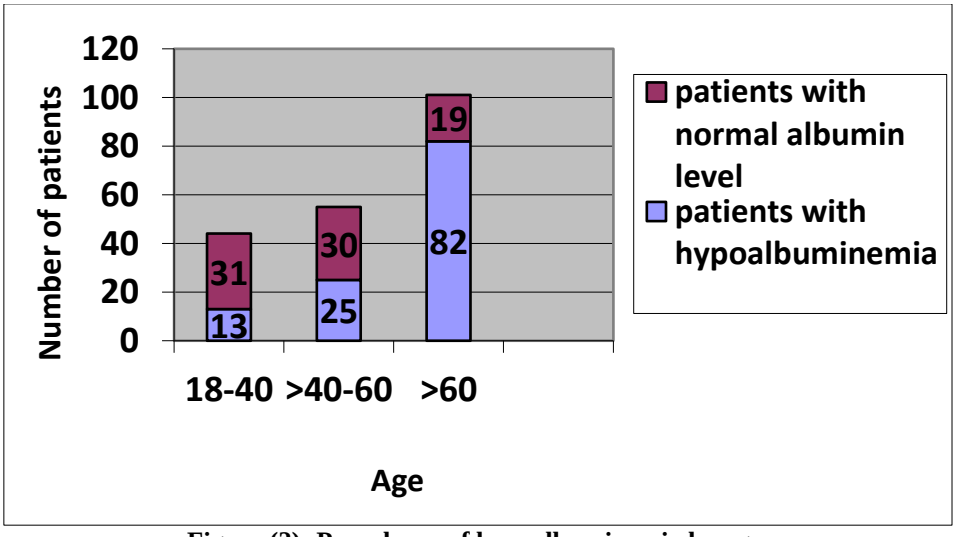

Figure (2): Prevalence of hypoalbuminemia by age.

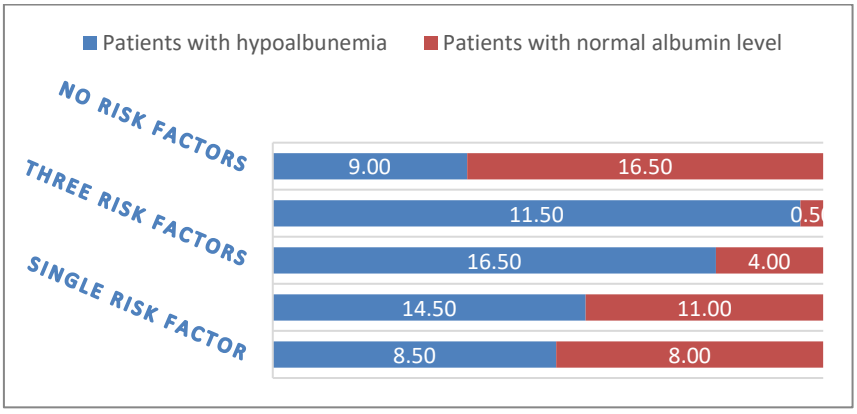

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Fig. (3): The prevalence of hypoalbuminemia in pateints presented with possible risk factors.

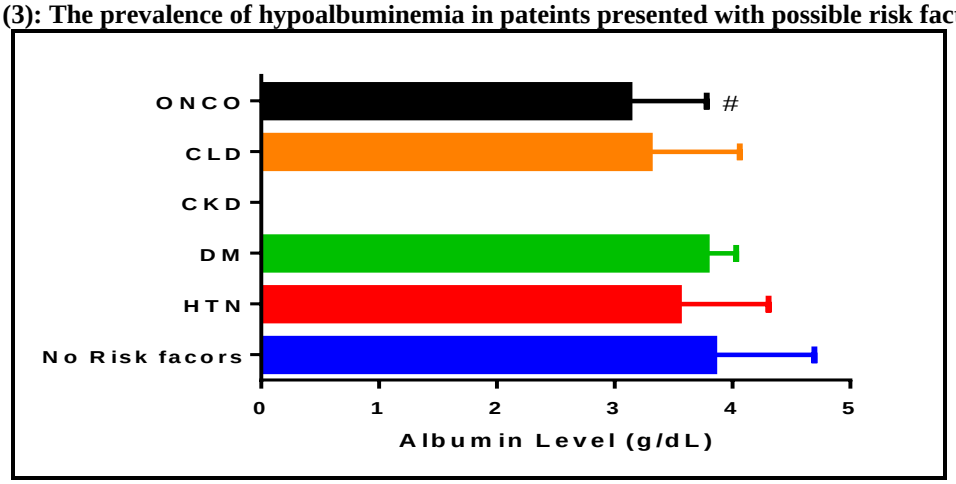

Fig. (4): Albumin plasma levels in patients presented with one risk factor.

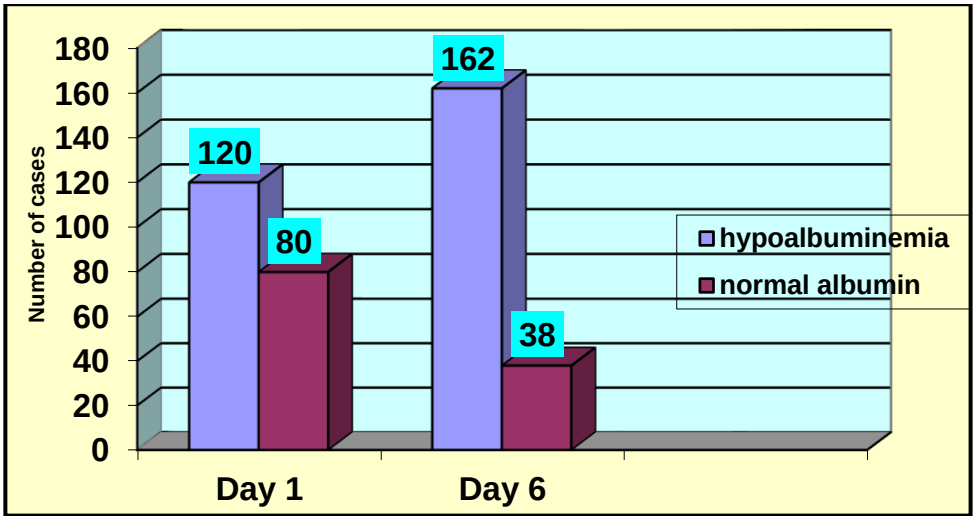

Fig. (5): Change in numbers of patients with Hypoalbuminemia.

On admission, mean serum albumin level was 3.47 gm/dl, by the six day declined to 3.1 gm/dl, with percentage change of -7.64% in the sixth day compared to the first day. There was a negative correlation between albumin level and length of hospitalization; Lowering in albumin levels were observed by the six day. Among 200 patients who admitted to ICU 79.5% discharged and 20.5% died. With more risk factors the prognosis was poor. Most of patients with no risk factors (22%) or with less than three risk factors (36.5%) were survived **(Figure 6)**.

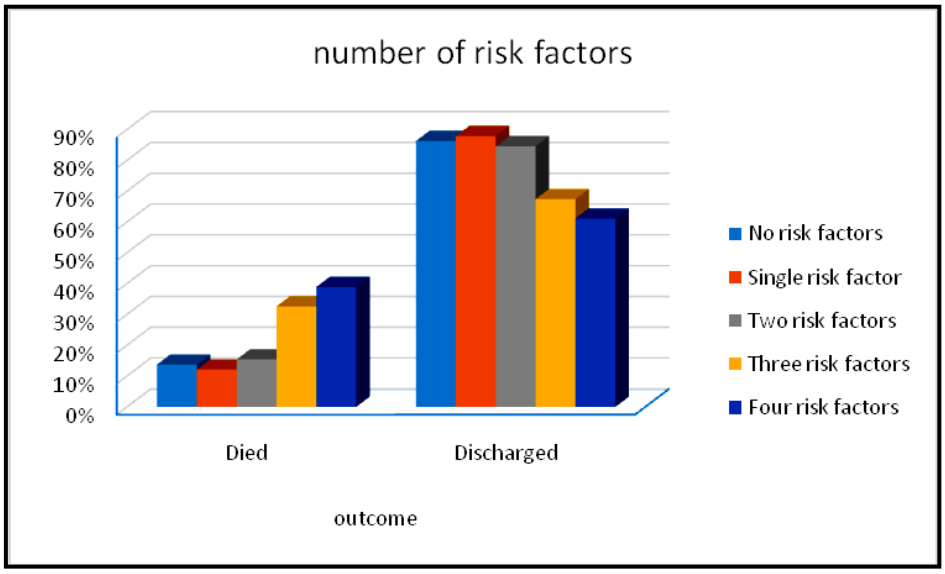

Fig. (6): Outcome of the patients regarding number of risk factors.

Discussion:

The processes which are responsible for maintaining serum albumin levels are the rate at which it is synthesized, the amount secreted by hepatocyte, it's body fluid distribution, and the level at which it undergoes degradation **(6).**

A study conducted by **Singh et al. (7**) showed that Serum albumin level found low in 840 patients from 944 included in their study and 104 found within normal range. In anthor study conducted by **Sabiullah et al. (6)** Showed that among the 1071 patients whose serum protein and serum albumin were measured, only 165 patients had hypoproteinemia and hypoalbuminemia. Also study conducted by **Namendys-Silva et al. (8)** agree with our results. This study included 200 patients. A total of 164 (82%) patients had a serum albumin concentration below 35 g/L, of which 91 (55.5%) patients had levels of albumin 20 g/L. And a study conducted by **(9**) done on 200 elderly patients**.** The average albumin level was 2.9± 0.5g/dL, in 87% (n=173) of the patients a diagnosis of hypoalbuminemia was found and 13% (n=27) had serum albumin levels considered to be in the normal range.

Total of 893 patients were enrolled and analyzed in a study conducted by **Pondeenana et al. (10).** The normal value of albumin was found in 106 (11.9%) patients. The hypoalbuminemia at admission in SICU was 787 (88.1%) patients.

According to cause of admission our study showed that 134 patients (67%) were post-operative and 66 patients (33%) were traumatic. Among the 120 with low serum albumin there was 55% (110) postoperative patients and 5% (10) traumatic patients.

In a study conducted by **Sabiullah et al. (6)** he divided 165 patients 44.8% (74 patients) were admitted with burn, 20.1% (34 patients) were post-operative and 34% (57 patients) were had a medical problems. The Mean ±SD of serum albumin level was same in patients with burns and medical problems while post-operative patients was lower.There is a 30% reduction in albumin with major surgery when the total circulating and exchangeable albumin pools were measured, this is consistent with sequestration of albumin into non-exchangeable sites such as wounds, the intestine and extra abdominalsites.

Hypoalbuminemia can result partly due to alteration in vascular permeability and due to the effect of dilution caused by saline and glucose infusion during and after surgery**(11).**

In this study we tried to highlight the possible risk factors that could be the possible causes of hypoalbuminemia in patient admitted in Surgical Intensive Care Unit. Tumors, diabetes, hypertension, renal diseases, hepatic disease were most common risk factors we discussed in this study. Most of patients who have four of these risk factors suffered from hypoalbuminemia. The increase in the number of presented risk factors will lead to an increase in the possibility of hypoalbuminemia.

We found that the average plasma level of albumin in diabetic or hypertensive patients as a single factor was within the normal range. However, the plasma level of albumin was not significantly different in patients with no risk factors if compared with other patients with single risk factor except

for oncology patients who showed the worst level of albumin as a single risk factor and albumin level in Patients with chronic kidney diseases as a single risk factors is not applicable.

Our study showed that by the sixth day of admission in intensive care unit the number of hypoalbuminemic patients increased to162 patients (81%). The patients presented worsening in serum albumin levels when compared the first and the sixth day of hospitalization in different age group. The average of albumin level in the sixth day 3.1± 0.56 g/dL.

This means that the length of hospitalization may increase the risk of hypoalbuminemia.

The results of our study were in agreement also with the study done by **Brock et al. (9);** the prevalence of hypoalbuminemia in elders at the sixth day of hospitalization was 90% (n=110) and only 10% (n=12) had normal albumin levels, a statistically significant difference for both classifications, the average of albumin level in the sixth day was 2.7± 0.5g/dL. The patients presented worsening serum albumin levels by the sixth day of hospitalization.

The serum albumin is a good prognostic marker correlating with morbidity and mortality in hospitalized patients. It is possibly this rationale for lowered levels of albumin which leads to increased mortality and prolonged duration of stay in intensive care unit **(**6**.**

Our study showed that among 200 patients who admitted to ICU 79.5% survived and 20.5% died. With more risk factors the prognosis was poor. Among the 55 patients who received albumin 14% died.

Singh et al. (7) had found thathypoalbuminemia associated with adverse outcomes in kidney disease, chronic heart failure, wound repair, and acute coronary syndromes.

Conclusion:

In surgical intensive care units, careful monitoring of serum albumin levels is required, especially in older patients, because the risk of hypoalbuminemia increases dramatically as the duration of stay increases, and the prevalence of hypoalbuminemia increases in patients with greater risk factors.

Conflict of Interest: No conflict of interest.

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