

Hypoalbuminemia in COVID-19 Patients: A Predictor of Disease Severity and Guarded Outcome

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ABSTRACT

Background: Pandemic of COVID-19 is spreading in all continents. There have been lots of article published on different aspects of this infection. Finding low Albumin levels in the patients of COVID-19 disease regardless of their degree of severity of infection has surprised us from the beginning.

Aim: To review the hypoalbuminemia and its extent in local population presented with COVID-19 and to determine the relationship of degree of hypoalbuminemia with the severity of infection.

Place and duration of study: Bahria International Hospital Lahore and Services Institute of Medical Sciences, Lahore from 1st May 2021 to 30th September 2021.

Methodology: Medical records 400 COVID-19 patient's related symptoms such as cough, flu, fever, headache, tiredness, distress in breathing were included. Serum Albumin, AST and ALT as clinical bioindicators in COVID-19 patients were reviewed.

Results: A significant decrease in serum albumin levels with the means and standard deviation (2.692±0.302), ($\chi^2=344.69$, $df=16$, $p<0.001$) was recorded. Whereas, a significant increase AST (U/L) and ALT (U/L) with the means and standard deviations (45.130±31.138), ($\chi^2=214.30$, $df=72$, $p<0.001$) was also noted. Analysis between survivors and non-survivors shows the level of albumin and AST/ALT was inversely proportional.

Conclusion: Low albumin is associated with disease severity and poor outcomes in terms of prolonged admissions and worse respiratory failure due to alveolar endothelial damage in COVID-19.

Keywords: COVID-19, Albumin, Transaminases, ALT, AST, Alveolar endothelial damage

INTRODUCTION

The infection of coronavirus-2 a new variant of SARS-Cov-2 (severe acute respiratory syndrome), popularly called as COVID-19 (Coronavirus-2019) was spread in Wuhan, a city of China in December 2019¹. After that COVID-19 has infected in all the regions of the world and thousands of peoples killed by this infection.² Coronavirus not only damage the lungs of the patients but also affect other parts of the body such as liver, male reproductive system and heart^{3,4}.

Albumin in the serum of human has inflammatory markers with the characteristic of antioxidant that under the normal physiological state gives freely available thiol groups that are reactive oxidants⁵. Albumin is a serum protein which is mainly used in clinical evaluation to measure the prediction and causes of the low level of serum albumin concentration⁶.

As low level of serum albumin is measured a clinical practice to identify symptoms of patients that maybe due to the production of some active cytokines with the flow of blood⁷. These cytokines increase the pores of blood vessels that allow the leakage of albumin to the extracellular areas⁸.

In clinical reports of COVID-19 patients also show liver disfunctions of enzymes such as aspartate aminotransferase (AST) or alanine aminotransferase (ALT)⁹. AST/ALT levels mostly rise in patients suffering from COVID-19 and in very serious situations liver injury and malfunctioning are seen to be more critical.¹⁰ It has been illustrated from previous works that the elevation of AST/ALT in COVID-19 patients reported one-third and risk of liver failure in very few patients were also analyzed¹¹.

In our analysis there were patients of COVID-19 with decrease level of serum albumin as well as high levels of ALT/AST. The effects of hypoalbuminemia in COVID-19 patients show significant difference with the normal value.

MATERIALS AND METHODS

A sample of four hundred COVID-19 patients (350 males and 50 females) with different symptoms such as cough, flu, fever,

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headache, tiredness, distress in breathing with clinical reports (albumin, ALT, AST) is collected using convenient sampling design from Bahria International Hospital Lahore and Services Institute of Medical Sciences, Punjab, Pakistan from 1st May 2021 to 30th September 2021. Data is analyzed by applying statistical techniques, i.e. Univariate analysis (tables and graphs), bivariate analysis (test of association, i.e. Chi-square test) and means and standard deviation were also measured to check the specified parameters. All parameters are represented as distribution of a sample in a population by frequency curve. The statistical software PASW V-21 is used for data analysis. Results are described as significant or insignificant if they are linked with a value $p<0.05$. Permission was granted by hospital ethical committee.

RESULTS

The clinical reports of COVID-19 affected are potted in Table 1. A significant decrease in the level of serum albumin in the patients of COVID-19 with the mean and standard deviation (2.692±0.302), ($\chi^2=344.69$, $df=16$, $p<0.001$), (Table 1), represents frequency distribution curve of a sample in a population ($n=400$) (Fig. 1) with larger the value of chi-square and the less data fit. Hence, our null hypothesis is rejected and alternative hypothesis accepted. Hence in this way a significant increase the levels of AST (U/L) and ALT (U/L) with the means and standard deviations (45.130±31.138), ($\chi^2=214.30$, $df=72$, $p<0.001$), (56.58±51.83), ($\chi^2=159.26$, $df=77$, $p<0.001$) respectively (Table 1). The values of chi-square for both AST/ALT were higher with less data fit. Hence, our null hypothesis is rejected for both AST/ALT. The frequency distribution curve of a sample ($n=400$) AST/ALT (Figs. 2-3).

Eighty (20 %) patients were shifted in intensive care unit (ICU) and stay there for seven days. From which 55(68.7%) were survived and other 25(31.3%) were expired. There were also shifted 120 (30 %) patients in high dependency unit (HDU) and stay there at about eight days. All patients in HDU were recovered with the increase of albumin in blood plasma and decrease level of AST and ALT significantly. Similarly, 200 (50 %) patients were also

shifted in isolated area (IA) and all were recovered quickly within four days (Table 2).

Table 1: Clinical characteristics of COVID-19 patients (n=400)

Variable	Mean±SD	χ^2	df	p-value
Albumin (g/L)	2.692±0.302	344.69	16	<0.001
AST (U/L)	45.130±31.138	214.30	72	<0.001
ALT (U/L)	56.58±51.83	159.26	77	<0.001

Table 2: Percentage of Survivors and Non-survivors between different groups of COVID-19 patients

Variables	Total	Survivors	Non-survivors
ICU (%)	N= 80 (20)	55 (68.7)	25 (31.3)
HDU (%)	N= 120 (30)	120 (100)	-----
IA (%)	N= 200 (50)	200 (100)	-----

Fig. 1: Frequency distribution analysis of lower level of serum albumin (g/L) in patients of COVID-19, ($p<0.001$)

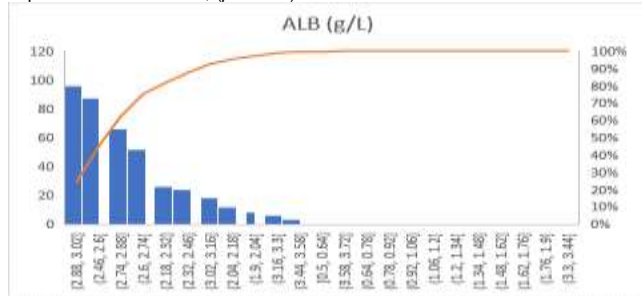


Fig. 2: Frequency distribution analysis of higher level of AST (U/L) in patients of COVID-19, ($p<0.001$)

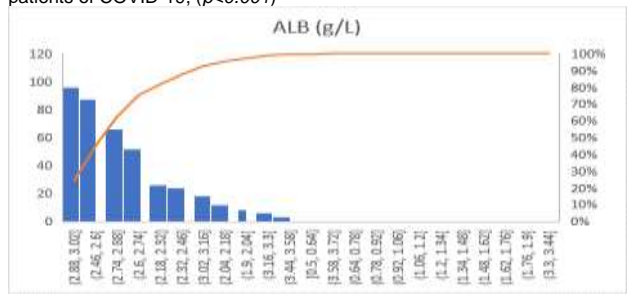
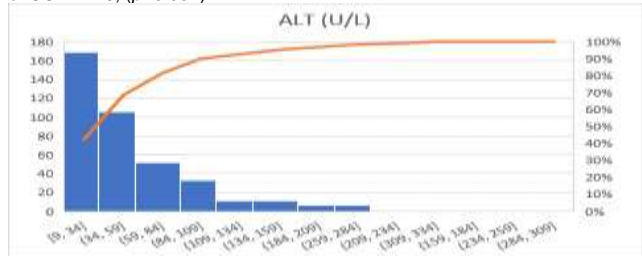


Fig. 3: Frequency distribution analysis of higher level of ALT (U/L) in patients of COVID-19, ($p<0.001$)



DISCUSSION

In our study there was significantly decrease in the level of serum albumin in patients of COVID-19 within the group with the mean and standard deviation (2.692±0.302, $\chi^2=344.69$, $df=16$, $p<0.001$). Assessment through clinical reports of COVID-19 patients by several markers such as albumin, CRP and ESR by using quantitative analysis. Analysis of these biological markers play substantial role in the identification of diseases.¹² In renal patients at chronic level the amount of serum albumen becomes low (≥ 4 g/dL) after the dialysis practices, even those who are unaffected. Human serum albumen commonly used as an indicator in clinical analysis for the patient check-up as hypoalbuminemia is prevailing and autonomous forecaster of death¹³.

Low serum albumin is thought to be threatening biochemical analysis in COVID-19 infections that may be considered due to the production of more cytokines in blood vascular system⁷. The release of cytokines causes permeation in the walls of blood vessels, that helps the diffusion of serum albumin between the extracellular spaces⁸.

Hypoalbuminemia is due to the liver dysfunctions, may also cause by the adverse effects of drugs and liver inflammation in sever patients of COVID-19. However, different studies have indicated that hypoalbuminemia may assess critical conditions of COVID-19 patients².

In our results there were significantly increase the levels of AST (U/L) and ALT (U/L) in the patients of COVID-19 within the group with the means and standard deviations (45.130±31.138, $\chi^2=214.30$, $df=72$, $p<0.001$), and (56.58±51.83, ($\chi^2=159.26$, $df=77$, $p<0.001$) respectively (Table 1).

On a large-scale analysis, the mutual rate estimation of liver dysfunctions in China was recorded as: AST 15% and ALT 15%.¹⁴ Although, few reports from America indicated high-rate oscillating among 40-50.6% from 116 to 2780 COVID-19 patients.¹⁵ Another study in China showed that different drugs (OR 1.94, $p=0.006$) was freely linked with the elevation of AST/ALT. During a large-scale study in Hong Kong elevation of AST/ALT in patients of COVID-19 was found and critical liver damaging are freely linked with hostile clinical results with the use of aggressive automatic ventilation in the emergency wards and finally death in coronavirus-19 patients¹⁶.

CONCLUSION

Low Albumin is a common finding in COVID-19 along with raised transaminases. Low Albumin is associated with disease severity and poor outcomes in terms of prolonged admissions and worse respiratory failure due to alveolar endothelial damage in COVID-19.

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