Original Research Article

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Usefulness of serum albumin as a prognostic factor in dengue

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ABSTRACT

Background: Dengue is a major public health problem throughout subtropical and tropical regions. In more severe or complicated dengue, patients present with a severe febrile illness characterized by abnormalities of hemostasis and increased vascular permeability, which in some instances results in a hypovolemic shock. Dengue is endemic in more than 100 countries in tropical and subtropical regions with an estimated 390 million infections occurring worldwide, among which 96 million infections are clinically apparent. The objective of this study is to assess the usefulness of serum albumin as a prognostic factor in dengue.

Method: This observational study enrolled 100 patients who were admitted in KIMS Hospital from June 2017 to June 2018 without any co morbidities as mentioned in the exclusion criteria. On day 4 of illness hemoglobin, packed cell volume, platelet and serum albumin were done, and the participants were classified into 3 groups based on clinical manifestation

Results: In this study, hemoglobin was elevated on day 4 in group 3 when compared to other groups and it was statistically significant. Hemoconcentration and low platelet values were also seen in group 3 when compared to other groups showing statistical significance.

Serum albumin was also low in group 3 when compared to other groups, which was strongly significant.

Conclusion: Hence serum albumin can be used as a prognostic factor in dengue.

Keywords: Dengue virus, Hemoconcentration, Hypoalbuminemia, Low platelet

INTRODUCTION

Dengue is a febrile illness caused by flavivirus transmitted by Aedes aegypti or Aedes albopictus mosquito during a blood meal. There are five dengue virus (DENV) types (DENV-1, DENV-2, DENV-3, DENV-4, DENV-5) all of which are capable of inducing severe disease. Dengue is endemic in more than 100 countries in tropical and subtropical regions with an estimated 390 million infections occurring worldwide ,among which 96 million infections are clinically apparent. Manifestation of severe dengue is high among individuals who are infected the second time by a another DEN type. DF is a severe flu-like infection that involves individuals of all age groups (infants, children,

adolescents, and adults).³ Infection can be asymptomatic or cause a range of severity like hemorrhagic manifestation which can even progress to shock. The involvement of liver and endothelial cells of different organ system is an important factor in pathogenesis of dengue. It depends on both viral and host specific elements. Severe liver damage affects the production of coagulation factors and albumin.⁴

The common challenge faced by physician is the early detection of patients at risk of complication . These patients usually have increased capillary permeability leading to plasma leakage into the interstitial space, which is seen around 5-7 days of fever and lasts for 48-72 hrs. which necessitates the need for proper fluid

management.⁵ The onset of critical phase can be appreciated by increasing hematocrit in resource limited clinical settings. In one study, dengue cases with plasma leakage had higher aspartate aminotransferase compared to those without leakage.⁶

Dengue fever with hemorrhagic manifestation and other complication are likely associated with low serum albumin, deranged coagulation profile due to plasma leakage and, low platelets.⁷ Hence this study is conducted to find the association between serum albumin and severity of dengue and its role as a prognostic marker.

METHODS

An observational study of "The usefulness of serum albumin as a prognostic factor in dengue" conducted in K.I.M.S Hospital, Bangalore, Karnataka, a tertiary care hospital from June 2017 to June 2018.

In this study serum albumin and complete hemogram was done on day 4 of illness in febrile phase and repeat Hb, PCV, Plt values done 2 days later were considered in NS1Ag positive patients with or without IgG or IgM Positive.

Inclusion criteria

All children less than 17 yrs with or without complication of dengue with day 3 of illness, in febrile phase.

Exclusion criteria

- Any other co morbidities like malnutrition, chronic liver disease, nephrotic syndrome was excluded
- Any other viral fever with thrombocytopenia with dengue serology being negative
- Less than 1month of age.

Sample size of 100 based on these criteria were selected. These patients were later classified into three categories based on their clinical presentation as dengue fever without warning signs (Group 1), dengue fever with warning signs (Group 2), severe dengue (Group 3).

Collection of data

- Informed and written consent was obtained from the parent/guardian of the child
- Hemoglobin (Hb), packed cell volume (PCV), Platelet count, dengue serology, serum albumin was done for all patients.
- History taken to rule out any co morbidities like nephritic syndrome, chronic live disease
- Anthropometry done to rule out malnutrition.

Results are tabulated and statistical analysis was performed using appropriate tests and functions.

Statistical analysis

The data collected was organized in MS excel work sheets. The data was analyzed using SPSSv20.

Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean±SD(Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5% level of significance. One way ANOVA test has been used to find the significance of the study parameters on continuous scale between three groups (Inter group analysis) on metric parameters.

Significant figures

- Suggestive significance (P value: 0.05<P<0.10)
- Moderately significant (P value: 0.01<P<0.05)
- Strongly significant (P value: P< 0.01)

RESULTS

A total of 100 children were enrolled in this study based on the inclusion and exclusion criteria. Statistical analysis was done.

In this study among 100 cases, 58 cases were male out of which 20 cases were dengue fever without warning signs, 24 cases were dengue fever with warning signs, 14 cases were severe dengue and 42 cases were female out of which 13 cases were dengue fever without warning signs, 19 cases were dengue fever with warning signs, 10 cases with severe dengue (Table 1).

Hemoglobin done on day 4 of illness were elevated in cases of severe dengue (mean -15.01) when compared to other groups(group 2 mean value was 13.8 and 12.83 in group 1) probably due to increased vascular permeability. Thaw maximum and minimum values observed in group 3 on day 4 of illness were 18.3 and 7.6 respectively. The p value was 0.013 which is significant proving a positive correlation (Table 2).

There is a significant correlation between high PCV and severity of dengue. Hemoconcentration is seen more in severe dengue when compared to other groups probably due to increased vascular permeability, with mean PCV of 42.16 in group 3 done on day 4 of illness(D1) and mean PCV of 40.25 and 37.22 in group 2 and group 1 respectively. Maximum and minimum PCV in group 3 done on day 4 of illness (D1) was 49 and 25.3.Repeat values were done two days later (D2) (Table 3).

There is a significant correlation between low platelets and severe dengue. Platelet values done on day 4 of illness(D1) were found to be low in group 3 with a mean value of 0.46, with a maximum and minimum values of 1.03 and 0.11 respectively. This was low when coma;red with other groups(mean values of platelet done on day 4

of illness in group 1 and group 2 were 1.47 and 1.10 respectively. This association was statistically significant

as p value was 0.0001 (Table 4).

Table 1: Sex distribution among cases.

Gender	Dengue fever without warning signs	Dengue fever with warning signs	Severe dengue fever	Total (%)
Male	20	24	14	58 (58)
Female	13	19	10	42 (42)
Total	33	43	24	100 (100)

Table 2: Correlation of hemoglobin with severity of dengue done on day 4 of illness (D1) and two days later (D3).

	Group	N	Min.	Max.	Mean	SD	Median	ANNOVA F	P value
HB D1	Group 1	33	7.7	15.6	12.83	1.38	13	4.48	0.013
	Group 2	43	9.8	17.8	13.8	1.63	13.6		
	Group 3	24	7.6	18.3	15.01	2.44	15.9		
	Total	100	7.6	18.3	13.76	1.94	13.5		
HB D2	Group 1	33	7.5	15.8	12.37	1.49	12.7	3.43	0.04
	Group 2	43	10	15.3	12.83	1.32	13.1		
	Group 3	24	8.1	16	13.44	1.86	13.8		
	Total	100	7.5	16	12.83	1.56	13		

Table 3: Correlation of PCV with severity of dengue.

	Group	N	Min.	Max.	Mean	SD	Median	ANNOVA F	P value
PCV D1	Group 1	33	27.1	42.6	37.22	3.32	37.5	9.84	0.001
	Group 2	43	29	52	40.25	4.36	40.1		
	Group 3	24	25.3	49	42.16	5.23	42.55		
	Total	100	25.3	52	39.71	4.65	39.75		
PCV D2	Group 1	33	25.9	46.7	35.13	3.88	34	0.08	0.92
	Group 2	43	31	41	35.08	2.67	34.1		
	Group 3	24	28.2	50.8	35.45	5.08	34		
	Total	100	25.9	50.8	35.18	3.73	34		

Table 4: Correlation between platelets and severity of dengue.

	Group	N	Min.	Max.	Mean	SD	Median	ANNOVA F	P value
PLT D1	Group 1	33	0.42	4.5	1.47	0.93	1.3		
	Group 2	43	0.11	3.2	1.10	0.85	0.78		
	Group 3	24	0.11	1.03	0.46	0.24	0.35	11.91	0.0001
	Total	100	0.11	4.5	1.07	0.86	0.78	11.71	0.0001
PLT1 D2	Group 1	33	0.36	4	1.99	0.81	1.99		
	Group 2	43	0.98	3.2	1.93	0.55	1.9		
	Group 3	24	0.34	2.65	1.67	0.53	1.71	_	
	Total	100	0.34	4	1.88	0.65	1.88	1.91	0.15

Table 5: Correlation between Serum albumin and severity of dengue.

	Group	N	Min.	Max.	Mean	SD	Median	ANNOVA F	P value
Sr. albumin	Group 1	33	3	4.5	3.76	0.38	3.7	87.28	0.0001
	Group 2	43	2	3.7	3.14	0.31	3.1		
	Group 3	24	1.9	3.2	2.45	0.41	2.45		
	Total	100	1.9	4.5	3.19	0.56	3.1		

The mean serum albumin levels in the group 3(severe dengue) was 2.45 with a minimum of 1.9 and maximum of 3.2, which was low when compared with other groups(those without warning signs and those with warning signs), signifying a greater risk of end organ damage in severe dengue.

In group 1 (without warning signs), the mean serum albumin is 3.76 with a minimum of 3 and maximum of 4.5.

In group 2, (those with warning signs), the mean serum albumin is 3.14 with minimum being 2 and maximum 3.7.

The P value of this association was 0.0001 proving a statistical significance.

A near normal levels of serum albumin in other groups, signifies end organ damage is less likely to occur in the early stages of the disease and becomes significant as the fluid leak progresses (Table 5).

DISCUSSION

Dengue is a major public health problem throughout subtropical and tropical regions. This acute infectious disease is characterized by biphasic fever, headache, and pain in various parts of the body, prostration, rash, lymphadenopathy, and leucopoenia. In more severe or complicated dengue, patients present with a severe febrile illness characterized by abnormalities of hemostasis and increased vascular permeability, which in some instances results in a hypovolemic shock.

In a study done by Yogananda Reddy et al, there was no significant relationship between serum albumin and severity of dengue.⁸ In a study done by Prathana et al, on 150 patinets there was a significant relationship between serum albumin and severity of dengue fever.⁹

In a study done by Brito CA et al, among 14 patients who presented with dengue hemorrhagic fever 57% presented with hemoconcentration of 20% or more. Hypoalbuminemia in 71%.Serum albumin increased the detection of permeability abnormalities in 43% in which hemoconcentration was less than 20% and hence suggested that use of serum albumin quantification increased the sensitivity of dengue hemorrhagic complication. ¹⁰

This study done retrospectively included 100 patients out of which 58 were male and 42 were female. In this study, hemoglobin was elevated on day 4 in-group 3 when compared to other groups and it was statistically significant. Haemoconcentration and low platelet values

were also seen in-group 3 when compared to other groups showing statistical significance.

Serum albumin was also low in group 3 when compared to another group which was strongly significant. Hence serum albumin and HB, PCV, Plt can be used as a prognostic factor of severe dengue.

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Institutional Ethics Committee

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