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Research Article

DENGUE SCORING SYSTEM AS A PREDICTOR OF MORBIDITY AND MORTALITY IN PAEDIATRIC DENGUE CASES

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ABSTRACT
Background: There are several limitations in diagnosing plasma leakage using the World Health Organization (WHO) guidelines of dengue hemorrhagic fever.
The present was conducted using dengue scoring system developed by Suhendro *et al.*, (2016) to predict pleural effusion and/or ascites using routine laboratory parameters in pediatric age group.
Materials and Methods: A prospective observational study was carried out at tertiary care hospital in Karnataka. Dengue cases of Pediatric age group during the period of November 2017 to October 2019 satisfying the inclusion criteria will be included in the study.
Results: A total of 205 dengue-infected patients were enrolled in the study. Of the 205 patients, 0.6% and 94.4% of dengue with warning signs and severe dengue developed pleural effusion and 17.2 % and 97.2% of patient with dengue with warning signs and severe dengue developed ascites respectively .At a cut off of ≥ 2, the Dengue Score predicted pleural effusion and/or ascites diagnosis with Specificity of 82.99, PPV of 25.0% and NPV of 100% in predicting mortality or outcome.
Conclusions: This Dengue Score can be used to identify pleural effusion and/or ascites and also useful to stratify dengue-infected patients at risk for developing severe dengue in resource limited areas were USG is not available. This study includes blood investigation such as hematocrit, Platelet count, albumin level, SGOT levels which can be used to detect the risk of developing plasma leakage

Keywords*: Dengue, Scoring System*

INTRODUCTION
Dengue viral infection is a major cause of disease in tropical and subtropical areas, with an estimated 50 million infections occurring each year and more than 2.5 billion people being at risk of infection (Guha-Sapir and Schimmer, 2005). Infection with any of the DENV serotypes may be asymptomatic in the majority of cases or may result in a wide spectrum of clinical symptoms (Harris *et al.,* 2000), ranging from a mild flu-like syndrome (known as dengue fever [DF]) to the most severe forms of the disease, which are characterized by coagulopathy, increased vascular fragility, and permeability (dengue haemorrhagic fever [DHF]). The latter may progress to hypovolemic shock [dengue shock syndrome (DSS)].
Suhendro *et al.*, (2016) conducted a study to develop a dengue scoring system in adults to predict pleural effusion and/or ascites using routine laboratory parameters predictors were scored based on the following calculations: hemoconcentration≥15.1 % had a score of 1, lowest albumin concentration at critical phase≤3.49 mg/dL had a score 1, lowest platelet count ≤49,500/μL had a score of 1, and elevated ratio of AST ≥2.51 had a score of 1. At a cut off of ≥ 2, the Dengue Score predicted pleural effusion and/or ascites, similarly the present study aimed to study dengue scoring in paediatric age group.
Thus, Dengue Score can be used to identify pleural effusions and/or ascites, which are better indicators of plasma leakage, to stratify dengue-infected patients at risk of developing severe dengue.

MATERIALS AND METHODS
Method of collection of Data:
Dengue cases of Paediatric age group during the period of November 2017 to October 2019 satisfying the inclusion criteria will be included in the study.

Table 1: Symptoms distribution comparison among those with and without Fluid Accumulation

SYMPTOMS		Fluid Accumulation			P value
		Group A	Group B	Total	
		%	%	%	
Abdominal pain	No	4.7%	2.5%	3.4%	0.407
	Yes	95.3%	97.5%	96.6%	
Persistent vomiting	No	7.0%	44.5%	28.8%	<0.001*
	Yes	93.0%	55.5%	71.2%	
Clinical fluid accumulation	No	0.0%	100.0%	58.0%	<0.001*
	Yes	100.0%	0.0%	42.0%	
Mucosal bleeding	No	80.2%	100.0%	91.7%	<0.001*
	Yes	19.8%	0.0%	8.3%	
Lethargy	No	93.0%	100.0%	97.1%	0.003*
	Yes	7.0%	0.0%	2.9%	

In the study there was significant difference in Persistent vomiting, Clinical fluid accumulation, Mucosal bleeding and Lethargy between two groups.

Table 2: USG findings distribution with respect to dengue diagnosis

		Diagnosis		P value
		DWS	SD	
		%	%	
Ascites	Present	17.2%	97.2%	<0.001*
	Absent	82.8%	2.8%	
Pleural Effusion	Present	0.6%	94.4%	<0.001*
	Absent	99.4%	5.6%	
Gall Bladder Oedema	Present	17.2%	97.2%	<0.001*
	Absent	82.8%	2.8%	
Hepatomegaly	Present	0.6%	38.9%	<0.001*
	Absent	99.4%	61.1%	
Ascites + Pleural Effusion + Gall Bladder Oedema + Hepatomegaly	Present	0.6%	38.9%	<0.001*
	Absent	99.4%	61.1%	

In the study there was significant difference in Ascites, pleural effusion, Gall bladder oedema and hepatomegaly and Ascites + Pleural Effusion + Gall Bladder Oedema + Hepatomegaly between Dengue Warning signs and Severe dengue fever.

Table 3: Score distribution among subjects

		Count	%
Score	1	140	68.29%
	2	21	10.2%
	3	15	7.3%
	4	29	14.1%

In the study 68.29% had Score- 1, 10.2% had Score -2, 7.3% had Score- 3 and 14.1% had score- 4.

Table 4: Score among those with Group A and Group B

		Fluid Accumulation					
		Group A		Group B		Total	
		Count	%	Count	%	Count	%
Score	1	45	52.3%	95	79.8%	140	68.3%
	2	7	8.1%	14	11.8%	21	10.2%
	3	9	10.5%	6	5.0%	15	7.3%
	4	25	29.1%	4	3.4%	29	14.1%

*χ 2 =36.58, df =4, p <0.001**

In the study there was significant difference in Dengue score between the two groups. Those with Fluid accumulation, score was high and those without fluid accumulation, score was low.

Criterion values and coordinates of the ROC curve

Criterion	Sensitivity	95% CI	Specificity	95% CI	+LR	-LR	+PV	-PV
≥1	100.00	71.5 - 100.0	0.00	0.0 - 1.9	1.00		5.4	
>2	100.00	71.5 - 100.0	82.99	76.9 - 88.0	5.88	0.00	25.0	100.0
>3	81.82	48.2 - 97.7	89.69	84.5 - 93.6	7.94	0.20	31.0	98.9
>4	0.00	0.0 - 28.5	100.00	98.1 - 100.0		1.00		94.6

Dengue score of >2 had sensitivity of 100%, Specificity of 82.99, PPV of 25.0% and NPV of 100% in predicting mortality or outcome.

DISCUSSION

Dengue fever has a wide spectrum of presentation; it can range from subclinical to full blown shock. Early detection is required due to its remarkable progression to severity (WHO, 2009).

There are no studies to predict the severity of dengue fever based on cut-off point of the lowest platelet count and elevated ratio of transaminase levels at the critical phase for diagnosing pleural effusion and/or ascites in paediatric age group.

This study was under taken to study dengue scoring system to predict the morbidity and mortality in paediatriccases. The study was conducted over a period of two years from November 2017 to August 2019 on 205 confirmed Dengue cases of Paediatric age group up to 18 years.

In this study, 43.9 % of dengue cases were aged between 6 to 10 years with male predominance (58%). Kamalakara babu *et al.,* (2018), Jakribettu *et al.,* (2015) and Gurdeep *et al.,* (2008)studies also has same age distribution with male predominance. In this study 100 % of the patients were Ns1Ag positive.

In this present study, patients were admitted within 5 days of illness, more patients with Ns1Ag positive were observed. Study conducted by Kulkarni *et al.,* (2010), Saurabh. *et al.,* (2016) and Metri and Jyothi (2015) showed Ns1Ag positivity of 30%, 29% and 62.6% respectively.

The positivity with NS1 is higher than other test because NS1 appears to be highly specific and reliable for diagnosis of dengue infection from the first days of fever. Libraty *et al.,* (2002), in their study showed a very high concentration of NS1 antigen during early phase of illness in patients with severe dengue infection and used as an early diagnostic marker for severe dengue infection.In this study there is no significant different in sex distribution with respect to dengue with warning sign and severe dengue which is similar to study conducted by Ratageri *et al.,* (2005); the common clinical features noted were fever (100%) vomiting (71.2%), pain abdomen (96.6%), lethargy (2.9%), mucosal bleed (8.3%) and hepatomegaly (39.5%), which is more common in severe dengue.

Scoring

Suwarto *et al.*, (2016) study			Present study		
Score	**sensitivity**	**Specificity**	**Score**	**Sensitivity**	**Specificity**
>1	98.97%	40.85%	>1	100%	0.00%
>2	82.47%	70.42%	>2	100%	69.33%
>3	65.98%	88.73%	>3	81.82%	78.67%
>4	26.80%	97.10%	>4	0.00%	100%

The sensitivity of the study conducted by Suwarto *et al.,* (2016) for score >1, >2, >3, >4 is 98.97%, 82.47%, 65.98%, 26.80% respectively whereas the specificity of the study for score >1, >2, >3, >4 is 40.85%, 70.42%, 88.73%, 97.10%respectively. Similarly, in the present study we have obtained the sensitivity of 100%, 100%, 81.82% and 0% for the score of >1, >2, >3, >4 respectively whereas specificity being 0%, 69.33%, 78.67% and 100% for the score of >1, >2, >3, >4 respectively. This correlates with Suwarto et al[3] that score cut off of ≥ 2, the dengue Score predicted pleural effusion and/or ascites.

Dengue score <2 are mildest form, score >2 predicted complication of severe dengue like pleural effusion and ascites, this patient should be monitored for early signs of plasma leakage, haemoconcentration, coagulopathy,thrombocytopenia and signs of shock.

Mortality rates in studies done by Rangaswamaiah *et al.,* (2017), Narayanan (2002), Dhooria *et al.,* (2008), Aggarwal *et al.,* (1998) was 0.53%, 0.8%, 3.7% and 6% respectively with all cases belonging to severe dengue group. Most deaths from dengue occur in patients with profound shock, particularly if the situation is complicated by fluid overload. In present study, mortality rate of 5.4 % was observed and mortality was associated with admission 12 – 24 hours after developing critical phase. These cases also received higher volume of fluid and had fluid overload.

Present study suggests that timely picking up cases with set of warning signs given by WHO in critical phase of illness followed by stepwise protocol-based fluid therapy can reduce case fatality.

CONCLUSION

- Since the progression of dengue fever is unpredictable ,This Dengue Score can be used to identify pleural effusion and/or ascites and also useful to stratify dengue-infected patients at risk for developing severe dengue
- Although pleural effusions and/or ascites visualized by ultrasonography (USG) are highly sensitive andspecific for determining plasma leakage . However, USG is not widely available in resource limited areas. This study includes blood investigation such as hematocrit, Platelet count, albumin level, SGOT levels which can be used to detect the risk of developing plasma leakage.
- Application of this scoring system into routine patient care can reduce the morbidity and mortality.

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