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A PROSPECTIVE STUDY PREDICTING THE SEVERITY OF DENGUE FEVER USING INFLAMMATORY MARKERS AND ULTRASOUND ABDOMEN

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ABSTRACT

Introduction and aim: The main public health issue, particularly in the Indian subcontinent, is dengue fever. It is an arboviral infection spread by mosquitoes that causes severe morbidity and mortality. ARDS, fluid leak, haemorrhage, hepatitis, encephalopathy, and other dengue fever complications, typically appear after the fifth day of sickness. Hence this study was taken up to predict the severity of dengue fever by estimating the levels of inflammatory markers and radiographic measurements in kids with dengue fever, associated with the start of problems.**Objective:** To study the clinical profile , inflammatory markers and radiological parameters of dengue fever in pediatric age group.**Materials and methods:** A prospective observational study was conducted in Basaveshwara hospital on 100 cases of children who have had a fever for 2–7 days, presenting to OPD/IPD of pediatric department from March 2021 – May 2022 **Results:** This study has shown the mean RR and mean HR increased significantly with dengue severity. The mean SpO_2, mean SBP and mean DBP decreased significantly with dengue severity. The mean ferritin, mean CRP, and mean procalcitonin increased significantly with dengue severity. **Conclusion:** Dengue is a widespread, terrible disease spread by mosquitoes that is completely preventable. Early and prompt detection of symptoms can stop the disease's progression and reduce mortality and morbidity associated with it.

Keywords: Dengue hemorrhagic fever, complications, pediatric age group

INTRODUCTION:

The viral illness dengue, which is spread by mosquitoes, has recently spread quickly throughout all of the WHO's areas. Female mosquitoes, mostly of the species Aedes aegypti and, to a lesser degree, Aedes albopictus, spread the dengue virus. These mosquitoes can transmit the zika, yellow fever, and chikungunya viruses. The risk of contracting dengue varies locally and is affected by climatic conditions as well as social and environmental factors throughout the tropics.

The disease dengue can infect humans and be brought on by the dengue virus. According to estimates, 2.5 million people, mostly in metropolitan areas, are at danger of contracting the virus.[1] More than 2.4 billion cases of dengue were reported to WHO in 2010, and 5.2 billion cases were recorded in 2019. This is an increase of more than 8 times in the last two decades. The overall number of illnesses and reported deaths both appeared to be declining in the years 2020 and 2021. The data is not yet full, and the COVID 19 pandemic may have made it more difficult for countries to disclose cases in some of them.

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Dengue virus was previously thought to cause infections by four antigenically distinct serotypes, each of which produced a different host immunological response to the infection. In October 2013, DENV 5's fifth variation was discovered. Natural selection, genetic bottlenecks, and genetic recombination are possible causes for the formation of the new serotype.[2]

The clinical spectrum of dengue shock syndrome, which frequently results in death due to aberrant capillary permeability and plasma leakage, can can take many different forms, including asymptomatic infection, silent infection, mild dengue fever, dengue hemorrhagic fever and more. Myocardiopathy, hepatic failure, and neurological problems are other atypical manifestations of the disease. Although there is currently no specific cure for dengue, controlling vectors is the primary preventive measure.[3]

The hallmark of DHF is plasma leakage brought on by alterations in microvascular permeability. Dengue is frequently mistaken for other febrile illnesses of viral origin, which complicates clinical therapy and disease surveillance for viral transmission prevention. Early in the course of the illness, non-specific clinical symptoms predominate, making clinical care challenging.[4]

Early stages of disease can be treated using less expensive, quicker diagnostic procedures such isolation of virus or field trials using NS1-ELISA, such as RT-PCR. Simple biochemical or haematological diagnostics are urgently needed since they can aid in case management and lower death and morbidity rates.[5]

Ultrasonography is one of the radiographic procedures that can be used to diagnose hepatosplenomegaly, thickness of the gall bladder wall, peri-cholecystic fluid, minor ascites, pleural and pericardial effusion. The liver parenchyma abnormalities, which may be caused by intraparenchymal and subcapsular haemorrhages, was also discovered using ultrasonography.[6]

After the fifth day of sickness, dengue fever complications typically manifest. In addition to being the most significant public health issue in tropical developing nations, dengue consequences include fluid leak, bleeding, hepatitis, encephalopathy, ARDS, hepatitis, and encephalopathy. They also have a significant negative impact on the economy and society. In this region of the country, there are few studies on dengue in the paediatric age range. As a result, this study was undertaken to estimate the inflammatory markers and ultrasonography findings among children with dengue fever in order to predict the severity of dengue fever.

AIM: To study the clinical profile, inflammatory markers and radiological parameters of dengue fever in pediatric age group.

MATERIAL AND METHODS:

After receiving approval from the institutional ethical committee, a prospective observational study conducted among 100 children with NS1 positve or IgM/IgG positive or both. We excluded children with co infection with Malaria, Enteric fever, Rickettsia fever.

The study was conducted for 1 year from March 2021 to February 2022. Detailed history including the name, age, sex, address contact number was noted. Dengue serology was done in suspected dengue cases and reports were obtained. After gaining parental permission, dengue NS1 positive or IgM positive children were included. and given a full medical history.

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Children who meet the inclusion criteria were observed with the following signs and symptoms: fever, headache, pain behind the eyes, myalgia, arthralgia, rash development, any bleeding symptoms (including epistaxis, melena, and hematemesis), decreased urine production, and shortness of breath.

The complete blood count, serum levels of ferritin, C-reactive protein and procalcitonin was estimated on day one of admission and thereafter the children were monitored with hematocrit levels, for every 6 hours in ICU cases and every 24 hours in ward cases, ultrasound abdomen in all cases of suspected dengue fever was done to look for fluid leakage particularly septate gall bladder (honey combing)., gall bladder wall edema, ascites and pleural effusion. Monitoring was done considering heart rate, respiratory rate, blood pressure and saturation and urine output in ward and ICU cases.

All information was entered into Microsoft Excel, and SPSS version 21.0 a statistical analysis tool was employed. For continuous variables, the independent sample t-test is used and are shown as mean and standard deviation. Comparing categorical data that were presented as frequencies and percentages was done using the Chi-square test.

RESULTS

The present study was conducted on a total of 100 subjects suffering from dengue. We had majority patients aged between 6 to 10 years (50%), males (55%) and presented with fever (95%).[Table 1]

Table 1: Demographic and symptoms distribution of study participants

Variables		**Frequency**
Age	**<5 years**	5
	6 to 10 years	50
	11 to 15 years	45
	15 to 20 years	0
Gender	**Males**	55
	Females	45
Symptoms	**Fever**	95
	Headache	86
	Retro-orbital pain	23
	Myalgia	57
	Rashes	81
	Nausea/vomiting	32
	Pain abdomen	85

Table 2 shows the dengue serology and severity in our study population. We had 73% with IgG positive and 25% had mild dengue, 52% moderate dengue and 23% severe dengue.

Table 2: Dengue serology and severity distribution

Dengue	**Frequency**

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Dengue serology	**IgG**	73
	IgM	27
Dengue severity	**Mild**	25
	Moderate	52
	Severe	23

Table 3 shows the association of mean vitals and inflammatory markers and USG abdomen. We found that the mean RR and mean HR increased significantly with dengue severity. The mean SpO_2, mean SBP and mean DBP decreased significantly with dengue severity. The mean ferritin, mean CRP, and mean procalcitonin increased significantly with dengue severity.

Table 3: Comparison of inflammatory markers and USG abdomen with dengue severity

Variables		**Dengue severity**			**p-value**
		Mild	**Moderate**	**Severe**	
Mean RR (cpm)		12 ± 5	16 ± 9	20 ± 11	**0.008**
Mean SpO_2		98 ± 2	97 ± 3	96 ± 3	**0.05**
Mean HR (bpm)		63 ± 1	75 ± 3	113 ± 5	**<0.001**
Mean SBP (mmHg)		120 ± 3	112 ± 5	110 ± 5	**<0.001**
Mean DBP (mmHg)		80 ± 5	75 ± 3	69 ± 1	**<0.001**
Mean ferritin (mcg/L)		115 ± 13	215 ± 25	350 ± 15	**<0.001**
Mean CRP (mg/L)		5 ± 2	8 ± 5	10 ± 5	**0.001**
Mean Procalcitonin (ng/mL)		7 ± 3	18 ± 5	21 ± 7	**<0.001**
Complete blood count	**Normal**	5 (20%)	12 (23.1%)	3 (13%)	0.61
	Abnormal	20 (80%)	40 (76.9%)	20 (87%)	
USG abdomen	**Normal**	6 (24%)	14 (26.9%)	3 (13%)	0.416
	Abnormal	19 (76%)	38 (73.1%)	20 (87%)	

DISCUSSION

The present study was done among 100 dengue patients. We had majority aged between 6 to 10 years (50%) and were males (55%).This was comparable to studies by Kalayanarooj et al.[7], Guzmán et al.[8], Baskar et al.[9]

In our study, majority subjects were positive towards IgG antibodies (73 %) followed by 27 % IgM positive subjects. This was comparable with the past studies conducted by Surangrat Pongpana et al .[10], Ho et al et al.[11], Guzman MG et al.[12]

In our study, majority subjects had moderate disease (52 %) followed by 25 % subjects with mild disease and 23 % subjects with severe disease. This was comparable to studies by Surangrat Pongpana et al.[10], Ho et al et al.[11], Guzman MG et al.[12]

Among 25 subjects with mild disease, 20 % subjects had normal CBC and 80 % subjects had abnormal CBC values (leucopenia, increase in HCT by 20% and thrombocytopenia). Our results correlated with studies conducted by Maria G et al.[13], A. L. Rothman et al.[14], Y.Sun et al.[15]

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Majority subjects had abnormal USG reports, i.e., 77 % subjects; followed by 23 % subjects with normal USG reports. Soundravally R et al.[16], Kong YY et al.[17], Wiwanitkit V et al.[18] also reported similar results.

While a recent study indicated an elevated level of ferritin in dengue individuals, with no significant difference between mild and severe dengue cases, studies have shown a considerably incrased ferritin in disease severe dengue patients compared to mild dengue.[19-21] In comparison to mild and moderate dengue cases in the current investigation, severe dengue-infected subjects had considerably higher ferritin levels. Our reports were similar to studies by Chaiyaratana W et al.[22], R. Soundravally et al.[23], Muhammad Nadeem et al.[24]

The mean CRP values of subjects with mild disease were 5 ± 2 mg/L. The mean CRP values of subjects with moderate disease were 8 ± 5 mg/L. The mean CRP values of subjects with severe disease were 10 ± 5 mg/L. The mean procalcitonin values of subjects with mild disease were 7 ± 3 ng/L. The mean procalcitonin values of subjects with moderate disease were 18 ± 5 ng/L. The mean procalcitonin values of subjects with severe disease were 21 ± 7 ng/L. Maria G et al.[13], A. L. Rothman et al.[14], Y.Sun et al.[15] also reported similarly.

CONCLUSION

Dengue is a dangerous viral infection that can cause anything from a minor illness to significant, potentially fatal complications. For children, it is one of the most dreaded fevers. Although the disease has many different manifestations and characteristics, case fatality rates can be considerably reduced with early diagnosis and treatment. In this time of clinical uncertainty, inflammatory biomarkers and reports of abdominal ultrasounds were assessed as adjuncts for the diagnosis of dengue, which may have helped clinicians' clinical judgement and prompted early fluid resuscitation, which in turn may have helped prevent unnecessary complications. They might be useful markers for identifying severe dengue cases from less severe dengue infections. Accurately predicting the severity of a dengue infection helps in speedier diagnosis, lessening the need for needless treatments, and improving outcomes.

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- **Author contributions**: Conceptualization, KHT and SPK; Methodology, SPK; Software, NPT; Validation, KHT, SPK and NPT.; Formal Analysis, NPT.; Investigation, KHT; Resources, SPK; Data Curation, SPK.; Writing – Original Draft Preparation, KHT.; Writing – Review & Editing, SPK; Visualization, NPT; Supervision, BSP; Project Administration, BSP.
- **Conflicts of interest:** Nil
- **Competing interests**: The author(s) declare no competing interests.
- **Data availability:** The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.
- **Ethics approval:** All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of Basaveshwara Medical College and Hospital (BMCH/IEC/2022/163)

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