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RESEARCH PAPER

EVALUATION OF PULSE PRESSURE AS A MONITORING TOOL IN DENGUE INFECTED PATIENTS

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ABSTRACT

INTRODUCTION: Dengue is one of the most important viral diseases especially in the tropicalregions, with four serotypes that belongs to the genus flavivirus of the family Flaviviridae.

AIM OF THE STUDY: 1.To evaluate the pulse pressure as a monitoring tool in dengue infected patients.

MATERIALS ND METHODS: This is a prospective study done on 76 patients with dengue positive serology in hematology section of SNijalingappa medical college & HSK Hospital, Bagalkot over a period of 3 months from november 2018 to january 2019.Pulse pressure and hematocrit values recorded from patients starting from day of admission as day-0 to day-3.

RESULTS: Patients were diagnosed as DF,DHF,DSS based on clinical and lab parameters .Pulse pressure and haematocrit values were recorded from day of admission as day-0 to day-3.we found that pulse pressure was decreasing significantly from day -0 to day-3, more in DSS < DHF < DF.

CONCLUSION: Like haematocrit, pulse pressure is a highly effective, simple, and prognostic tool in anticipating the complications of dengue infected patients if utilized correctly. It also gives therapeutic guidance by aiding inappropriate selection of fluids.

KEY WORDS : DF(Dengue fever), DHF (Dengue hemorrhagic fever), DSS(Dengue shock syndrome)

INTRODUCTION:

Dengue is one of the most important viral diseases in the tropical regions. According to the WHO almost 50 million people get dengue infection annually and WHO estimates almost half of the world's population lives in countries having endemicity for dengue infection[1]

It is a well-known fact that genus Aedes aegypti mosquitoes transmit dengue infection. Dengue has a variety of clinical presentations, where the patients can be completely asymptomatic to mild clinical features to high grade fever with viral syndrome or in the severest forms as dengue haemorrhagic fever (DHF) which can even be fatal[2]. Dengue virus infection has existed in India since a long time[3].

Most common clinical presentation of Dengue fever (DF) is of an acute febrile viral disease with headaches, bone, joint and muscular pains, rash and leucopenia. Due to the severe bone pains, dengue fever is also known as break bone fever [4].

Dengue hemorrhagic fever (DHF) is characterized by four major clinical manifestations: high grade fever, hemorrhagic phenomena, often with hepatomegaly and, in severe cases, signs of circulatory failure. Severe plasma leakage in these patients can lead to hypovolemic shock and circulatory failure . This is called dengue shock syndrome (DSS) which can lead to death[5].

AIM OF THE STUDY:

To evaluate the pulse pressure as a monitoring tool in dengue infected patients.

MATERIALS AND METHODS:

This is a prospective study done on 76 patients with dengue positive serology in hematology section of S Nijalingappa medical college & HSK Hospital, Bagalkot over a period of 3 months from november 2018 to january2019.

Pulse pressure and hematocrit values recorded from patients starting from day of admission as day-0 to day-3.

Inclusion criteria:

- Patients attending the SNMC medical college with dengue serology positive with age >16 years.
- Both genders.

Exclusion criteria:

- Age <16 years
- Pregnancy
- Patients with ITP, anemia, bleeding diathesis are excluded.
- Patients who are having mixed infections like Dengue fever and malaria and where diagnosis is not confirmed will be excluded from study.

Statistical analysis:

Data was entered in Microsoft excel and analysed using SPSS software. Percentages and proportions for qualitative data and mean +_SD for quantitative data was used. Chi square test, student t test applied for the data.other appropriate statistical tests was applied $p < 0.05$ considered as statistically significant.

RESULTS:

In a total of 76 dengue serology positive cases analysed, the age of patients ranged from >16 years of age.

Table-1

NS1Ag positive patients	Day -0	Day-1	Day-2	Day-3
Mean Pulse pressure	36.25	31.54	29.96	29.29
Mean Haematocrit	36.77	41.47	42.57	41.63

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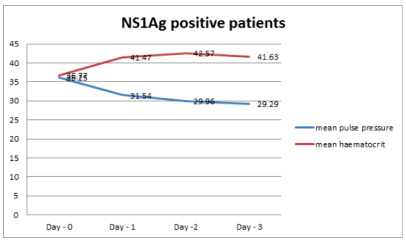
Graph-1



In table-1and graph-1,we can find that there is decrease in pulse pressure from day-0 to day-3 and increase in haematocrit value from day-0 to day-3.

Among 76 patients, 48 patients were NS1AG positive and 28 were NS1AG negative.

On day 0 mean pulse pressure among NS1AG positive cases was 36.25 with a standard deviation of 9.367, mean hematocrit among NS1AG positive cases was 36.775 with a standard deviation of 6.4981.On day 0 mean pulse pressure among NS1AG negative cases was 38.71 with a standard deviation of 14.404, mean hematocrit among NS1AG negative cases was 36.457 with a standard deviation of 9.6440.

On day 1 mean pulse pressure among NS1AG positive cases was 31.54 with a standard deviation of 11.443, mean hematocrit among NS1AG positive cases was 41.475 with a standard deviation of 8.7081.On day 1 mean pulse pressure among NS1AG negative cases was 33.43 with a standard deviation of 11.364, mean hematocrit among NS1AG negative cases was 39.943 with a standard deviation of 10.4751.

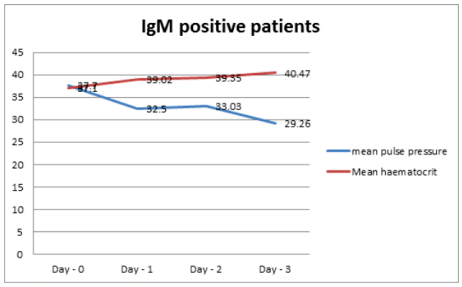
On day 2 mean pulse pressure among NS1AG positive cases was 29.96 with a standard deviation of 10.778, mean hematocrit among NS1AG positive cases was 42.571 with a standard deviation of 10.7708.On day 2 mean pulse pressure among NS1AG negative cases was 34.29 with a standard deviation of 10.438, mean hematocrit among NS1AG negative cases was 38.068 with a standard deviation of 9.9206.

On day 3 mean pulse pressure among NS1AG positive cases was 29.29 with a standard deviation of 10.833, mean hematocrit among NS1AG positive cases was 41.638 with a standard deviation of 11.5853.On day 3 mean pulse pressure among NS1AG negative cases was 31.50with a standard deviation of 9.264, mean hematocrit among NS1AG negative cases was 37.111 with a standard deviation of 7.2575

Table-2

IgM positive patients	Day-0	Day-1	Day-2	Day-3
Mean Pulse pressure	37.7	32.5	33.03	29.26
Mean Haematocrit	37.1	39.02	39.35	40.47

Graph-2



In table-2 and graph-2 we can find decrease in pulse pressure and significant raise in haematocrit from day-0 to day-3.

Among 76 patients, 35 patients were IgM positive cases and 41 were IgM negative cases.
On day 0, mean pulse pressure among IgM positive cases was 37.71 with a standard deviation of 12.641, mean hematocrit among IgM positive cases was 37.186 with a standard deviation of 8.7334.On day 0, mean pulse pressure among IgM negative cases was 36.68 with a standard deviation of 10.748, mean hematocrit among IgM negative cases was 36.207 with a standard deviation of 6.8670.

On day 1, mean pulse pressure among IgM positive cases was 32.51 with a standard deviation of 11.286, mean hematocrit among IgM positive cases was 39.200 with a standard deviation of 9.6581.On day 1, mean pulse pressure among IgM negative cases was 32.00 with a standard deviation of 11.584, mean hematocrit among IgM negative cases was 42.371 with a standard deviation of 8.9539.

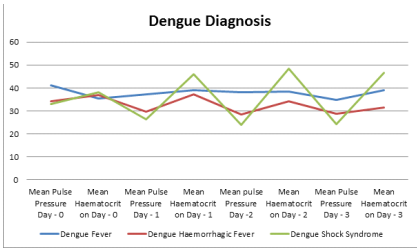
On day 2, mean pulse pressure among IgM positive cases was 33.03 with a standard deviation of 10.237, mean hematocrit among IgM positive cases was 39.351 with a standard deviation of 10.9104.On day 2, mean pulse pressure among IgM negative cases was 30.29 with a standard deviation of 11.212, mean hematocrit among IgM negative cases was 42.244 with a standard deviation of 10.3237.

On day 3, mean pulse pressure among IgM positive cases was 29.26 with a standard deviation of 11.105, mean hematocrit among IgM positive cases was 40.474 with a standard deviation of 11.6784.On day 3, mean pulse pressure among IgM negative cases was 30.83 with a standard deviation of 9.591, mean hematocrit among IgM negative cases was 39.539 with a standard deviation of 9.2724.

Table-3

Diagnosis	Mean Pulse Pressure Day-0	Mean Haematocrit On Day-0	Mean Pulse Pressure Day-1	Mean Haematocrit On Day-1	Mean Pulse Pressure Day-2	Mean Haematocrit On Day-2	Mean Pulse Pressure Day-3	Mean Haematocrit On Day-3
Dengue Fever	41.22	35.547	37.39	38.969	38.22	38.531	34.78	38.972
Dengue Haemorrhagic Fever	34.27	36.840	29.73	37.327	28.40	34.187	28.80	31.373
Dengue Shock Syndrome	33.04	38.148	26.32	45.856	23.84	48.376	24.16	46.564

Graph-3



Among 76 patients, 15 patients were diagnosed with DHF, 36 patients with Dengue fever and 25 patients with DSS.

On day 0, mean pulse pressure in DHF patients was 34.27 with standard deviation of 13.068 and mean hematocrit was 36.840 with standard deviation of 9.1544 .On day 0, mean pulse pressure in Dengue fever was 41.22 with standard deviation of 8.353 and mean hematocrit was 35.547 with standard deviation of 5.7359.On day 0, mean pulse pressure in DSS was 33.04 with standard deviation of 13.065 and mean hematocrit was 38.148 with standard deviation of 9.2924

On day 1, mean pulse pressure in DHF patients was 29.73 with standard deviation of 8.137 and mean hematocrit was 37.327 with standard deviation of 8.3770. On day 1, mean pulse pressure in Dengue fever patients was 37.39 with standard deviation of 9.342 and mean hematocrit was 38.97 with standard deviation of 6.593. On day 1, mean pulse pressure in DSS patients was 34.27 with standard deviation of 13.068 and mean hematocrit was 36.840 with standard deviation of 9.1544

On day 2, mean pulse pressure in DHF patients was 28.40 with standard deviation of 10.669 and mean hematocrit was 34.187 with standard deviation of 10.5656. On day 2, mean pulse pressure in Dengue fever patients was 38.22 with standard deviation of 7.403 and mean hematocrit was 38.531 with standard deviation of 5.8397. On day 2, mean pulse pressure in DSS patients was 23.84 with standard deviation of 9.091 and mean hematocrit was 48.376 with standard deviation of 11.9662

On day 3, mean pulse pressure in DHF patients was 28.80 with standard deviation of 11.534 and mean hematocrit was 31.373 with standard deviation of 7.4719. On day 3, mean pulse pressure in Dengue fever patients was 34.78 with standard deviation of 8.146 and mean hematocrit was 38.972 with standard deviation of 6.1933. On day 3, mean pulse pressure in DSS patients was 24.16 with standard deviation of 9.218 and mean hematocrit was 46.564 with standard deviation of 12.4787

DISCUSSION:

The concentration of erythrocytes in the blood has a strong influence on blood viscosity. At a hematocrit of 40-45%, blood viscosity is approximately 3 times the value for plasma and approximately 5 times that of water. Blood viscosity shows a curvilinear relation with the hematocrit and it increases sharply when the hematocrit is raised much beyond the normal range.

The increase in hematocrit in dengue is due to hemoconcentration attributed to plasma leakage induced by cytokine-mediated increase in vascular permeability and damage to vascular endothelium.[6]

Cytokines are produced by DENV infected monocytes, B lymphocytes, and mast cells.[7,8] Endothelial cell dysfunction by virus also leads to increased capillary permeability.[9] This phase of plasma leakage is the critical phase, the onset of which (marked by circulatory and perfusion changes leading to shock can be predicted with the rise of hematocrit 10–15% above the baseline value. This is considered a significant predictor of severe disease.[10,11,12]

A few studies have noted that there is a higher proportion of cases with increased hematocrit in severe than nonsevere dengue[13,14] and also the mean hematocrit values are higher in severe compared to non-severe dengue.[15]

The relationship between blood pressure and viscosity is such that, given a constant systolic blood pressure, if blood viscosity increases, then the total peripheral resistance (TPR) will necessarily increase, thereby reducing blood flow. Conversely, when viscosity decreases, blood flow and perfusion will increase. Because of the dependence of systemic arterial BP on cardiac output and TPR, if blood viscosity and TPR rise, systolic BP must then increase for cardiac output to be maintained. Consequently, blood viscosity has been established as a major determinant of the work of the heart and tissue perfusion. Since increased viscosity requires a higher BP to ensure the same circulating volume of blood, both the burden on the heart and the forces acting on the vessel wall are directly modulated by changes in blood viscosity. As the blood viscosity increases there will be increase in the diastolic blood pressure. This leads to narrowing of pulse pressure.

The key issue in the management of dengue lies in the identification of onset of critical phase[16] by continuous monitoring of hematocrit to check for the rise in hematocrit above baseline/reference values. Similarly based on narrowing of pulse pressure, we will be able to identify the onset of critical phase.

CONCLUSION:

Like haematocrit, pulse pressure is a highly effective, simple ,non invasive prognostic tool in anticipating the complications of dengue infected patients if utilized correctly. It also gives therapeutic guidance by aiding inappropriate selection of fluids.
However, proper guidelines need to be enforced with regard to timing, frequency and threshold values to prevent overdiagnosis of non-severe and underdiagnosis of severe cases which could impact morbidity and mortality in dengue.

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