Correlation of hematological parameters with right-sided pleural effusion in pediatric dengue cases – A cross-sectional study

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ABSTRACT

Background: Capillary leak in dengue presents as ascites, pleural effusion (PE), and pericardial effusion. **Objectives:** The objectives of the study were to correlate the hematological parameters with radiological findings in cases with right-sided PE. **Materials and Methods:** This was a cross-sectional study conducted at the tertiary care teaching hospital. A total of 138 cases were included in the study. Investigations included complete hemogram on the day of admission, day of diagnosis of PE and at discharge. Radiological investigations included chest X-ray, ultra-sonogram of abdomen, and chest which were correlated with hematocrit and platelet count. **Results:** Out of 138 cases, 71 (51%) had PE; out of which, 46 cases (64.78%) had bilateral effusions with right side more than left. About 21 (15.2%) cases had only right-sided PE. The mean platelet count and hematocrit were 67,640/µL and 31.8%, respectively, on the day of PE. **Conclusion:** In cases of dengue, right-sided PE is more common in cases with platelet count ranging between 20,000 and 50,000/µL.

Key words: *Dengue, Radiological findings, Right-sided pleural effusion, Thrombocytopenia*

Dengue fever is a tropical viral disease caused by the dengue virus (DENV), transmitted by *Aedes aegypti* mosquito. DENV has four serotypes – DENV 1, 2, 3, and 4. A fifth serotype, DENV5 has been reported in Malaysia, but exact characterization of virus has not been done [1]. In year 2017, a total of 188,401 cases were reported in India and the state of Telangana recorded 5369 cases during that period [2].

WHO has classified the cases of dengue according to severity as probable dengue, dengue with warning signs and severe dengue [3]. On exposure to the DENV for the 1st time, fever is caused, but the second infection with different serotype leads to dengue with warning signs and severe dengue due to increased capillary permeability causing fluid loses in third spaces, intravascular fluid depletion, and shock.

The immune complex of antibody and virus affects the macrophages leading to antibody dependent enhancement and release of cytokines cascading capillary leak [4]. Dengue infection might cause a disturbance in the endothelial glycocalyx layer leading to capillary leaks and bleeding manifestations [5]. Pleural effusion (PE) usually develops on day 4–6 of illness [6]. Radiological investigations such as chest X-ray, ultra-sonogram, and computed tomography chest have been used in diagnosing PE [7-9]. Hence, this study was conducted to correlate hematological parameters with the radiological finding of right-sided PE.

MATERIALS AND METHODS

This cross-sectional study was conducted during the period July 2018–November 2018, in children admitted with fever, rash, and other warning signs of dengue in pediatric ward and intensive care unit at the medical college of Telangana. All children had complete hemogram and dengue serology done at admission. Cases positive with nonstructural protein 1 antigen and immunoglobulin (IgM)/IgG antibody were included in the study. Cases having capillary leak with third spaces loses, respiratory distress and clinically diagnosed with PE were subjected to chest X-ray and/or ultra-sonogram. Complete hemogram was repeated on the day of radiological diagnosis of PE. These were correlated with hematocrit and platelet count.

Cases were divided into five groups according to their platelet count. Group 1 consisted of cases with platelet count >150,000 µL, Group 2 with platelet count 100,000–150,000/µL, group 3 with platelet count 50,000–100,000/µL, and Group 4 with platelet count 20,000–50,000/µL and platelet count <20,000/µL as Group 5.

Children with existing congenital cardiac disorders, underlying pulmonary diseases, and renal disorders were excluded from the study. A total of 138 cases were included in the study. All the data was entered into Microsoft Excel sheet and it was analyzed using SPSS ver. 21 (Statistical Package for the Social Sciences, Version 21).

RESULTS

Out of 138 cases included in the study, 76 (55.07%) were males, and 62 (44.92%) were females. Twenty (14.49%) cases were aged <1 year, 27 (19.5%) were between 1 and 5 years, 49 (35.50%)

were between 5 and 10 years, 33 (23.91%) were between 10 and 15 years, and 9 (6.52%) cases were between 15 and 18 years. A total of 31 (22.4%) cases were diagnosed as probable dengue, 88 (63.7%) cases were as dengue with warning signs, and 19 (13.7%) cases were severe dengue.

A total of 71 (51%) cases developed PE; of these, 46 (64.78%) cases had bilateral PE on ultrasound sonography and chest X-ray (right >left), 21 (29.57%) cases had only right-sided PE, 3 (4.2%) cases had PE on left side, and 1 (1.4%) case had bilateral equal PE. The mean day at which PE developed was 4th day. The mean platelet count on the day of radiological diagnosis of PE was 67,640/μL. Cases had higher platelet count at admission and discharge compared to that on the day of PE. Table 1 shows the mean platelet levels and hematocrit values in the study population.

The mean platelet and hematocrit values for PE cases are tabulated in Table 2.

PE was more common with platelet counts between 20,000 and 50,000/μL, i.e., in Group 4 with 33 (46.47%), followed by 25 (35.2%) cases in Group 3, 5 (7%) cases each in Group 2, and Groups 5 and 3 (4.2%) cases in Group 1 had among those cases with PE (Table 3).

Right-sided PE had higher incidence in Group 4 thrombocytopenia, i.e., with platelet count between 20,000 and 50,000/μL (p=0.282).

DISCUSSION

Dengue begins abruptly after an intrinsic incubation period of 3–10 days [10]. The host immune response plays an important role in the pathogenesis of dengue fever. The cases are defined and classified into three groups based on the severity of the clinical manifestations as probable dengue, dengue with warning signs, and severe dengue [3]. In our study of 138 cases, 22.4% were probable dengue, 63.7% were dengue with warning signs, and 13.7% were severe dengue cases. In a similar study conducted by Kabilan *et al*. [11], 65% had dengue fever, 11.2% had dengue hemorrhagic fever, and 34 (23.8%) had dengue shock syndrome.

Table 1: Platelet and hematocrit values in the study population

Day	Admission	Day of pleural effusion	Discharge
Mean platelet (×10³/μL)	76.46	67.64	124.36
Mean hematocrit (%)	32.41	31.8	30.68

Table 2: Mean platelet and hematocrit values for PE cases

PE site	Mean platelet (×10³/μL)	Mean hematocrit (%)
Bilateral	85	24.90
Bilateral R>L	51.67	31.51
Right side	62.8	34.03
Left side	62.33	28.50
No. effusion	80.08	31.55

PE: Pleural effusion

Table 3: PE site versus platelet count

PE site	Bilateral	Bilateral R>L	Right	Left
Platelet >150,000/μL (3)	0	2	1	0
Platelet 100,000–150,000/μL (5)	0	3	1	1
Platelet 50,000–100,000/μL (25)	1	14	10	0
Platelet 20,000–50,000/μL (33)	0	23	8	2
Platelet <20,000/μL (5)	0	4	1	0
Total	1	46	21	3

p=0.282. PE: Pleural effusion

In this study, 20 (14.4%) cases were infants, 27 (19.5%) cases aged between 1 year and 5 years, and 82 (59.4%) cases were aged between 5 years and 15 years. These results were comparable with the study done by Kabilan *et al*. [11], where out of 143 cases, 29 (20%) were infants, 41 (28.7%) were between 1 year and 5 years, and 95 (51%) were between 5 and 15 years. In both the studies, the incidence of dengue was more in the age group of 5–15 years.

In this study, 64.78 cases had bilateral PE (right >left), while 15.2% of cases had only right side PE, and 4.2% cases had left side PE. PE is considered as one of the manifestations of dengue. In a study conducted by Venkata Sai *et al*. and Santhosh *et al*., the incidence of bilateral and right side PE was higher than the left side [8,12]. The effusion was detected between 5th and 7th day, while the mean day of detection of PE in our study was 4th day. In study conducted by Shabbir *et al*., left side PE was more common [13].

Thrombocytopenia occurs due to the destruction of platelets by the autoantibodies, disseminated intravascular coagulation, bone marrow suppression during early phase of the disease, and peripheral sequestration of platelets. In this study, thrombocytopenia was found to be correlated with PE, and the mean platelet count in cases of bilateral PE was least when compared to the other sites. In a study conducted by Santhosh *et al*. [12], PE was correlated with platelet count, and they have found that effusion was more common in cases with platelet count <40,000/μL. In our study, 46.47% of the cases with PE had platelet count between 20,000 and 50,000/μL, i.e., Group 4 thrombocytopenia. There were a few limitations to this study. As radiological investigation was not performed in all the cases, cases with minimal PE might have been missed.

CONCLUSION

PE is more common on the right side detected by radiological investigation on day 4 of illness in cases with thrombocytopenia with platelet count 20,000–50,000/μL.

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