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ASSOCIATION OF HEMATOCRIT LEVEL AND SEVERITY OF DENGUE FEVER IN CHILDREN

Emergency Medicine

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ABSTRACT

Increase in hemaocrit (Hct) is a marker of capillary leakage which is the primary pathophysiology leading to severe clinical manifestations in secondary dengue in children .Hematocrit varies with age and population in children and can be estimated by simple laboratory methods.**Aim :**To determine the association between hematocrit level in various age groups and varying severity of dengue illness **Methods:**.In children admitted with a diagnosis of dengue fever ,clinical parameters and hematocrit were obtained at admission . Dengue severity was classified according to WHO 2009 classification and results statistically analysed.**Results**: 369 children were admitted with a diagnosis of dengue, warning signs at presentation were seen in 73(39.25%) between 6- 10 years . 8(32%) between 3&6 yrs of age .None below 1 year of age had severe dengue (P <0.03) . Hct values increased with age from infancy with a (P-<0.001) .The mean and median of Hb for severe dengue was high (P<0.001) . Median Hct was 36.7 and in severe dengue the Hct value was above 39 (P<0.001) with values greater than 40 in children above 6 yrs of age. **Conclusion:**Estimation of Hb and Hct at bedside is valuable especially in low resource settings enabling early identification of children with a potential to deteriorate .

KEYWORDS

Dengue, pediatric , hematocrit .

INTRODUCTION

Secondary dengue is a life threatening infection in neonates and children. Dengue illness is clinically classified as either dengue with or without warning signs or severe dengue (1)Increase in hemaocrit (Hct) is a marker of capillary leakage which is the primary pathophysiology leading to severe clinical manifestations .Hematocrit varies with age and population in children and can be estimated by simple laboratory methods. Rising hematocrit is a predictor of increasing severity in dengue fever in children .

Aims

To identify association between hematocrit level and severity of dengue.

To identify association between hematocrit level and age in children with dengue.

METHODS

All children between 1month and 18 years of age admitted with a diagnosis of dengue fever were included in the study. Informed consent was obtained , blood sample for hematocrit was obtained at the time of admission and was estimated using automated Pentra ES60. Hb and Hct obtained by POCT correlated with laboratory values. Details of clinical parameters , age and gender were noted . Dengue severity was classified based on WHO 2009 classification which is followed at our institute for management of dengue in children .(1) The illness severity was thereby classified as dengue fever, dengue with warning signs and dengue shock syndrome . Children who were treated for anemia or received intravenous fluids , blood products prior to admission and those with chronic illness or hematological disorders were excluded from the study .

Statistical analysis was done using statistical software STATA 11.0. Continuous variables were represented as 'Mean (SD)', and categorical variables were represented as 'Frequency (percentage)'. Chi-square test or Fisher's exact tests were used to assess differences in categorical data. Analysis of Variance was used to find the difference in means of independent data. Pearson correlation was used to find the relationship between two continuous variables. Regression analysis was used to test the correlation between the values of hematocrit and the severity of illness .The p value of < 0.05 was considered significant.

RESULTS

369 children were admitted with a diagnosis of dengue during the study period 57.18% (n=211) were males. Mean age and median age were 7.60 and 7 respectively. There were 123(33.33%) children between 6 & 10 years of age , 11(2.98%) were less than 1 year and those between 1 to 6 years and above 10 years were 96 (26.02%) and 92 (24.93%) respectively. According to severity of illness , 186 (50.40%) had warning signs 158(42.81%) had no warning signs and 25(6.77%) were severe dengue . .Warning signs at presentation were seen in 73(39.25%) between 6- 10 years and 8(32%) between 3&6 yrs of age and none below 1 year of age had severe dengue p <0.03 . The mean and median Hb % was 12 and mean and median Hct 38. .The Hct values increased with age from infancy with a (p-value<0.001*) (Fig 1)

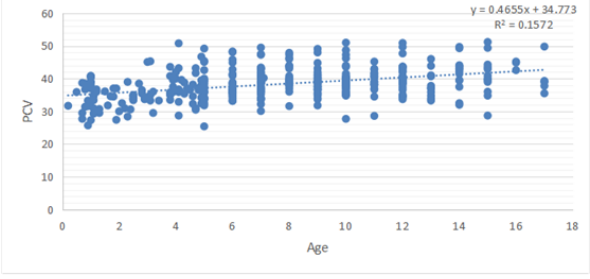

Fig 1 .
Scatterplot for Age and PCV

There is an positive correlation between the age and the PCV (r=0.3866) (p-value<0.001*)There is an significant association between the Age and PCV(R-Square =0.1572

HB Vs Outcome Table 1

HB	Outcome			
	Mean(SD)	Median	Range	P-Value
No warning signs	12.10(1.43)	12.1	8.1 to 15.8	**<0.001***
Warning Signs	13.22(1.76)	13.2	9 to 17.3	
Severe Dengue	13.42(2.88)	13.55	8.6 to 18.4	

The mean and median of Hb for severe dengue was high compared to those with and without warning signs p<0.001

Table 2 Hct Vs Severity of illness

Hct	Outcome			
	Mean(SD)	Median	Range	P-Value
No warning signs	36.55(4.86)	36.7	3.5 to 49.8	**<0.001***
Warning Signs	39.50(4.62)	39.25	27.7 to 51.2	
Severe Dengue	39.53(7.11)	39.8	27.3 to 51	

Kruskal Wallis Test

The mean and median Hct of severe dengue was high compared to other two groups.

DISCUSSION

Dengue fever is common in children in India and the main cause of mortality is shock due to capillary leak. Capillary leak causes the hematocrit to rise and is a useful parameter to titrate intravenous fluids .

The value of hematocrit that indicates the need for intravenous fluids and amount of intravenous fluids to be given is however not clear. Dengue infection is reported to be common between 5- 15 yrs of age in Asia and we observed that children between 6-10 years of age formed the predominant group in our study (2).It has been observed in various studies that infants and children older than 6 yrs of age are at a higher risk of developing severe dengue , this could also be attributed to the higher incidence of dengue infection in this age group . Capillary leak is a warning sign in dengue fever and indicates the need to start intravenous fluids . Children classified as dengue fever with warning signs in our study were mainly in the age group of 6- 10 years ($P<0.03$) and these children are at a greater risk of developing dengue shock syndrome if not identified and treated early (1) (3)In a study from Nicaragua , infants and children aged 5–7 years were at significant risk for severe dengue, whereas risk of severe illness was less in children 14 years and older .This is contrary to our findings and can vary depending on the study population, demography and serotype dengue virus (4).The relationship between leucocyte count, platelet count and hematocrit as predictors of severity of illness in dengue fever in children has been studied.. Harshpal Singh Sachdev et al concluded that the median Hb is 11.03 -16 gms/dl for boys between 1- 18 years of age and 10.97 – 12.24 gms/dl for girls ,with Hb levels increasing from infancy to adolescence .We observed that the median Hb levels increased with age and was 15gm/dl in children aged 3- 6 years with severe dengue .(5)Capillary leakage causes a rise in Hb weight per unit volume of blood .HB in our study population was 12.1gm/dl in children without severe dengue and 13.55 gm / dl in those with severe illness ($p <0.001$) .Mean Hb values of 13.12 and 14.04 among DF and DHF patients, respectively have been observed in a study from Srilanka (6)Rising hematocrit ,a surrogate marker of capillary leak in dengue fever is used as a guide for intravenous fluid therapy which is the treatment in dengue fever . Hematocrit varies with age and is also influenced by other factors such as underlying illness or administration of intravenous fluids , blood transfusion and medications. Serial hematocrit values and its association with severity of illness has also been studied in children with dengue (7) The baseline hematocrit is not known in almost all children seen in the emergency , hence determining hemoconcentration based on WHO dengue guideline of 20% increase above baseline for classifying severity is not uniformly feasible . A critical hematocrit value that would serve as a redflag related to severity of illness will be helpful in providing appropriate fluid therapy.

These simple tests can be performed bedside in low resource situations which helps in early intervention with intravenous fluids in children with warning signs or severe dengue .WHO standards to define anemia uses a Hct of 33 below 5 yrs of age increasing to 39 in children > 14 years of age . The Hct values in children with dengue in our study showed a rising trend from infancy 33.65 to 40.35 adolescence ($P<0.001$) (Fig 1) Children with dengue fever have been found to have significantly higher Hb and Hct levels between day 3 and 7 of illness in comparison with febrile illness due to other causes .(8) Plasma leakage is indicated by a rising hematocrit in dengue fever thereby serial hematocrit values guide fluid therapy(9) .The retrospective study by Viroj Wiwanitkit concluded that the level of Hct at admission in children with dengue fever does not predict the potential to develop shock (10) Hct levels vary depending on the age of the child and needs to be taken into consideration because hemoconcentration is one of the makers of warning signs in dengue fever that guides intravenous fluid therapy. We observed that the median Hct was 36.7 in those without severe dengue , while a higher value of above 39 was observed in those with severe dengue ($P<0.001$) with values greater than 40 in children above 6 years of age . Hct of <34.8 in children less than 5 yrs of age and >37.5 in those above 5 yrs of age has been found to be predicitve of hemoconcentration in a study from South India .The level of Hct at admission as a predictor of outcome has been studied in children with varying results as various factors such as intravenous fluids , blood products and others were not considered. (11) .

CONCLUSION :

Estimation of Hb and Hct at bedside is valuable especially in low resource settings enabling early identification of children with warning signs who have a potential to deteriorate. Larger studies in varied demographic settings at different ages in children with clinical evidence of warning signs is essential to establish Hct levels that mandate commencement of intravenous fluids.

Conflict of interest : none declared

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Contribution:

Radhika Raman DCH ,DNB – Conception, design, analysis and interpretation of data, review at every stage and manuscript preparation and final approval

Mobil Clinton – Data Collection And Analysis, Manuscript Prepration

All authors have met the criteria for authorship .This manuscript has been read and approved by all the authors and all authors decare that the manuscript represents honest work.

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