European Journal of Molecular & Clinical Medicine (EJMCM)
ISSN: 2515-8260 Volume 07, Issue 08, 2020

Original research article

An observational study to analyse the patterns and prevalence of different ABO blood groups in dengue and to find an association between ABO blood groups and severity of dengue

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Abstract

Aim: to analyse patterns and prevalence of different ABO blood groups in dengue and to find an association between ABO blood groups and severity of dengue.

Material and methods: This prospective observational study was done the Upgraded Department of Paediatrics, Patna Medical College & Hospital, Patna, Bihar, India, for 1 year. Children between 0-18 years of age were included. All patients with serological confirmation of Dengue (NS1, IgM/IgG positivity) by Rapid Card methods with hematology data were included. Blood groups (by Forward Blood grouping -Slide method with Anti-A, Anti-B sera from Tulip diagnostics) were also recorded. The severity of dengue was graded according to World Health Organization guidelines.

Results: Of the 400 cases, 230 were blood group O, 65 were blood group A, 88 were blood group B and 17 were blood group AB. The control group for blood group distribution was determined by assessment of blood groups of 200 random patient's blood sample. Of the 214 patients who presented with dengue fever without warning signs, 134 (62.62 %), 38(17.76%), 36 (16.82%) and 6 (2.81%) had blood groups O, A, B, AB respectively. When compared with general population, this was statistically significant ($\varkappa 2$=55.65, degrees of freedom=3, p=9.19x10-11). Blood group O presented with milder forms of dengue as compared to distribution in general population (39%). Of the 70 patients with dengue fever with warning signs, 33 (47.14%), 11 (15.71%), 22 (31.43%) and 4 (5.71%) had blood groups O, A, B, AB respectively, which was statistically significant ($\varkappa 2$=31.47, degrees of freedom=3, p=1.19x10-6).

Conclusion: Dengue infection is prevalent in most parts of India with severe forms having high mortality. This study concludes that although the incidence of dengue fever is higher in children with blood group O, AB blood group is associated with severe forms of dengue, especially in secondary infections.

Keywords: AB blood group, Blood group, Dengue, Severity

Introduction

Dengue is an arboviral infection (DENV 1-4) transmitted by the Aedes mosquito. It has a wide clinical spectrum from asymptomatic to undifferentiated fever and Dengue hemorrhagic fever.[1] Also being categorized as Non severe Dengue with or without warning signs and Severe Dengue (WHO 2009).[2] It has been estimated that globally around 50-100 million individuals get infected by dengue annually, with 2-5 lakh cases being that of Dengue Hemorrhagic Fever/Dengue Shock Syndrome.[3] Dengue fever is self-limiting but severe dengue may be lethal if not treated promptly. As currently there is no specific treatment or vaccine for dengue, early

and rapid diagnosis is crucial for patient management and this is dependent on clinical features and laboratory tests which not only aid in the diagnosis but in the prognosis of the disease as well.[1-6] Factors which could serve as prediction for severe dengue include age, genetics, nutritional status, viral strain, secondary infections and certain laboratory tests.[3,7] Genetic factors include HLA and ABO blood group. Individuals with different ABO blood groups differ in their susceptibility or resistance to viral, bacterial infections and other diseases. Kaipainen and Vuorinin in 1960 first hypothesized the relationship between blood groups and diseases.[3] Many reports have suggested an association of blood groups with cardiovascular diseases, cancers and infectious diseases. 8 In 1917, the association of blood group with tuberculosis was published. 8 Since then various studies have linked blood groups with various bacterial, parasitic and viral diseases like malaria, cholera, E. coli and H. pylori infections.[9,10] Some studies have linked the severity of infection to the blood group.[3,7,8,10,11] A few studies have focused on association of Dengue infection and blood groups, while some have reported increased prevalence of certain blood groups in dengue, others have noted an association of certain blood group with severity of Dengue. [3,7,9,12-14] However, reports are varied among the different studies, none of which have correlated the blood group with each of the hematological parameters which are affected in dengue. Our study focuses on the association of blood group and dengue, its prevalence and severity as knowledge of risk factors can prove to be vital for prevention and management. The aim of our study was to analyse patterns and prevalence of different ABO blood groups in dengue and to find an association between ABO blood groups and severity of dengue.

Material and methods

This prospective observational study was done the Upgraded Department of Paediatrics, Patna Medical College & Hospital, Patna, Bihar, India, for 1 year, after taking the approval of the protocol review committee and institutional ethics committee. Children between 0-18 years of age were included.

All patients with serological confirmation of Dengue (NS1, IgM/IgG positivity) by Rapid Card Method (Standard Diagnostics-BiolineAlera) with hematology data (obtained by hematology automated analyzer Sysmex 1800c) were included. Blood groups (by Forward Blood grouping -Slide method with Anti-A, Anti-B sera from Tulip diagnostics) were also recorded. The severity of dengue was graded according to World Health Organization guidelines.

200 samples of random patients admitted in our hospital were tested for blood group and this was taken as control group for blood group distribution in the particular area.

Results

Of the 400 cases, 230 were blood group O, 65 were blood group A, 88 were blood group B and 17 were blood group AB (Table 1).

Table 1: Frequency of ABO blood group among dengue cases and controls).

Blood group	Cases	Controls
O	230	78
A	65	42
B	88	64
AB	17	16
Total	400	200

Table 2: Distribution of blood group among controls

Blood group	O	A	B	AB	Total
Distribution	78(39%)	42 (21%)	64 (32%)	16 (8%)	200

Table 3: Distribution of blood groups in primary dengue cases

Dengue severity	O	A	B	AB	Total
Dengue fever without warning signs	134	38	36	6	214
Dengue fever with warning signs	33	11	22	4	70
Severe dengue	11	4	14	2	31
Total	178	53	72	12	315

The control group for blood group distribution was determined by assessment of blood groups of 200 random patient's blood sample (Table 2).

In patients with primary infection, it was observed that the distribution of blood groups between dengue infection cases and general population were statistically significant ($\varkappa 2=38.24$, degrees of freedom=5, p=0.0000021). Of the 214 patients who presented with dengue fever without warning signs, 134 (62.62 %), 38(17.76%), 36 (16.82%) and 6 (2.81%) had blood groups O, A, B, AB respectively (Table 3). When compared with general population, this was statistically significant ($\varkappa 2=55.65$, degrees of freedom=3, p=9.19x10-11).

Blood group O presented with milder forms of dengue as compared to distribution in general population (39%). Of the 70 patients with dengue fever with warning signs, 33 (47.14%), 11 (15.71%), 22 (31.43%) and 4 (5.71%) had blood groups O, A, B, AB respectively, which was statistically significant ($\varkappa 2=31.47$, degrees of freedom=3, p=1.19x10-6). Among the 31 patients with Severe dengue, 11 (35.48%), 4 (12.90%), 14(45.16%) and 2 (6.45%) had blood groups O, A, B and AB respectively ($\varkappa 2=28.12$, degrees of freedom=3, p=5.97x10-6). This showed that a higher percentage of AB blood group presented as severe forms of dengue as compared with general population (8%). In our study, it was found that the distribution of blood groups between dengue infection cases and general population was statistically significant ($\varkappa 2=24.65$, degrees of freedom=6, p=0.00055) even in secondary cases of dengue. Of the 38 patients who presented with dengue fever without warning signs, 29 (76.32%), 4 (13.79%), 5 (17.24%) and 0 (0%) had blood groups O, A, B, AB respectively (Table 4).

Table 4: Distribution of blood groups in secondary dengue cases

Dengue severity	O	A	B	AB	Total
Dengue fever without warning signs	29	4	5	0	38
Dengue fever with warning signs	20	6	8	3	37
Severe dengue	3	3	3	2	11
Total	52	12	16	5	85

When compared with general population, this was statistically significant ($\varkappa 2=29.54$, degrees of freedom=3, p=2.48 x 10^{-6}). It was observed that no cases of AB blood group presenting as with secondary dengue had mild symptoms and always presented with warning signs (0% incidence).

Of the 37 patients with dengue fever with warning signs, 20 (54.05%), 6 (16.22%), 8 (21.62%) and 3 (8.11%) had blood groups O, A, B, AB respectively, which was statistically significant ($\varkappa 2$=12.45, degrees of freedom =3, p=0.013). Among the 11 patients with Severe dengue, 3 (27.27%), 3 (27.27%), 3 (27.27%) and 2 (18.18%) had blood groups O, A, B and AB respectively ($\varkappa 2$=10.22, degrees of freedom =3, p=0.022). 18.18% of this was blood group AB as compared with 7.32% of AB blood group in general population. This also indicated that AB blood group predisposes to severe dengue.

Discussion

In our study, an analysis of blood group patterns, in dengue, has been studied. It was observed that although blood group distribution was in concordance with that of control, blood group O was associated in higher percentages with incidence of dengue disease. This was in agreement with a study by Khode et al, which suggested that blood group O is possibly a risk factor predisposing for dengue disease.[3] The present study suggests that blood group AB is associated with severe dengue disease when compared to the control group and was statistically significant, which supported the results of the study by Kalayanarooj et al., which stated that AB blood group, was probably a risk factor predisposing to severe dengue disease.[12] Furthermore, this association for noticed more with secondary infections, where majority of patients progressed to severe dengue. The human innate immune system, consisting of mast cells, NK cells, dendritic cells, macrophages, antibody producing B cells, the complement system, and the host genetic factors-clearly plays a role in the immunity against viral infections.[15]Among these factors, the genetic factors play a significant role in determining the predisposition of an individual to be susceptible or resistant to certain phenotypes of an infection and also the magnitude of their clinical manifestations.[16] Two genetic factors namely HLA and ABO blood groups have been shown to play a crucial role in resistance to infectious diseases.[16] The blood group antigens are biochemically carbohydrates The A blood group has N-acetyl-dgalactosamine as its immunodominant sugar while the B antigen is d-galactose. Galactosyl transferases is the common enzyme involved in the synthesis of both these determinants.[16] These antigens stimulate an IgM response.[17] The glycosylated dengue viral protein produces an immune response which also consists of IgM antibodies which probably cross-react with the blood group antigen. Although a correlation between HLA typing and dengue disease has been previously researched, a specific polymorphism which affects the severity has not been identified yet. 8 This study does not study the severity amongst the different serotypes of dengue infection (DENV 1, DENV 2, DENV 3, DENV 4) and forms a limitation of the study.

Conclusion

The prevalence of dengue infection is high all over India. Most cases are asymptomatic or mild but severe cases have high fatality. Hence an understanding of investigations that help predicting progress to severity is crucial. This study concludes that although the incidence of dengue fever is higher in children with blood group O, AB blood group is associated with severe forms of dengue. Moreover, AB blood groups when associated with secondary infection more commonly progress to severe forms of dengue. Further studies are needed to determine whether HLA, and ABO are independent variables and whether some blood subgroups are associated with a particularly high risk of DENV infection itself.

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Received :12-06-2020 Revised: 06-07-2020. Accepted:29-07-2020