Clinical Case Study of ABO Hemolin Different Ethnic Groups, Blood Types and Parity

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Abstract: ABO hemolytic disease of newborn (ABO-HDN) is an allogeneic passive immune disease caused by maternal fetal blood group incompatibility. It is caused by the combination of maternal blood group antibody and blood group antigen on the surface of fetal or neonatal red blood cells, resulting in the destruction of fetal or neonatal red blood cells, Therefore, this disease is also known as neonatal mother child blood group incompatible hemolytic disease(Simmons, Savage 2015). In this study, we collected relevant clinical data by summarizing the clinical characteristics of full-term ABO-HDN, using a retrospective study of term infants who met the diagnostic criteria for ABO-HDN, and compared the differences in the minimum hemoglobin, age at onset (h), and incidence of anemia between different genders, ethnic groups, blood groups, and parity of ABO-HDN.Through the analysis, it was found that there were no significant differences in the lowest hemoglobin, age at onset (h) and incidence of anemia of full-term ABO-HDN in the People's Hospital of Baise ($P > 0.05$), which provided a reference for further improving the clinical management of full-term ABO-HDN.

1 INTRODUCTION

Hemolytic disease of newborn (HDN) is a kind of isoimmune hemolytic anemia(Chen, Ling 1994), which is caused by inconsistent blood groups between mothers and infants. Immune hemolytic anemia caused by blood group antibodies is one of the common causes of unconstrained hyperbilirubinemia of newborn(Jeon, Calhoun, Pothiawala, et al 2000)

The clinical symptoms of ABO-HDN are related to the degree of hemolysis of newborns. Usually, ABO-HDN reaction will appear one to two days after birth, showing hemolysis. The main clinical symptoms are premature jaundice, rapid increase of indicators, increase of abnormal destruction of red blood cells and other symptoms(Sun, Zhang 2007).

In general, ABO-HDN is usually a relatively slow and mild hemolysis process. The degree of hemolysis is considered to be mild to moderate. Severe hemolysis and fetal edema rarely occur, but there are also reports of death cases(Kim, Kim, Park, et al 2020). Severe hemolysis and anemia require blood exchange, leading to bilirubin encephalopathy, affecting the intelligence level of newborns, hand and foot movement or death. Through the retrospective analysis of the clinical data of 127 full-term children with ABO-HDN who met the diagnosis and treatment criteria, this study had a more comprehensive understanding of the occurrence and treatment of full-term ABO-HDN in this region, so as to provide reference for clinical judgment of the disease and formulation of treatment plan, and provide clinical data for the related research of full-term ABO-HDN.

2 SUBJECTS AND METHODS

Subjects 127 full-term newborns who met the diagnostic criteria of ABO-HDN were selected. SPSS statistics 16.0 software was used for statistical analysis. The counting data were described by the number of cases and percentage (n,%). The measurement data were described by mean±standard deviation ($\overline{X} \pm S$). The differences between groups were compared by independent sample t-test, analysis of variance and chi square test. $P<0.05$ was statistically significant.

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3 CLINICAL DATA ANALYSIS

A total of 127 children with full-term ABO-HDN were selected in this study. Among them, 72 (56.7%) were male children and 55 (43.3%) were female children; 52 (40.9%) children with blood type A ABO-HDN and 75 (59.1%) children with blood type B ABO-HDN; 69 (54.3%) were cisgender and 58 (45.7%) were cesarean delivery; Twenty two patients (17.3%) had a 1st parity, 34 patients (26.8%) had a 2nd, and 71 patients (55.9%) had more than a 3rd parity (including the 3rd).

3.1 Differential Comparison of Term ABO-HDN in Different Gender Groups

They were divided into male and female groups according to gender, and the differences in the lowest hemoglobin, age at onset (h), and incidence of anemia were compared between groups using independent samples t-test, and chi square test. As can be seen from table 1, there was no statistical difference between males and females in the lowest hemoglobin, age at onset (h), and incidence of anemia ($P > 0.05$).

Table 1: Comparison of the incidence of lowest hemoglobin, age at onset (h) and anemia among different sexes.

class (n)	Minimum Hb (g/L) $\overline{x} \pm s$ 1	Age at disease onset (h) $\overline{x} \pm s$ 1	Anemia incidence2（%）
Male (n=72)	136.44±22.45	24.30±16.09	62.5%
Female (n=55)	141.13±19.13	24.51±17.09	50.9%
t value/χ2value	-1.24	-0.07	1.71*
P value	0.22	0.94	0.19

Notes: * chi square test was used; 1x refers to mean and s refers to standard deviation; 2 the denominator for the incidence of anemia was the 127 full-term abo-hdn cases enrolled.

3.2 Comparison of Differences in Term ABO-HDN among Ethnic Groups

Based on the ethnic distribution, they were divided into three groups: Han group, non Han group (Zhuang and other minorities), and the independent samples t-test was used to compare the differences in the lowest hemoglobin, age at onset (h), and chi square test to compare the differences in the incidence of anemia. As can be seen from table 2, there were no statistical differences among different ethnic groups in the lowest hemoglobin, age at onset (h), and incidence of anemia ($P > 0.05$).

Table 2: Comparison of the incidence of minimum hemoglobin, age at onset (h) and anemia among different ethnic groups.

class (n)	Minimum Hb (g / L) $\overline{x} \pm s$ 1	Age at disease onset (h) $\overline{x} \pm s$ 1	Anemia incidence2（%）
Han nationality (n=53)	140.40±20.94	23.30±11.49	56.6%
Non-Han nationality group (n=74)	137.09±21.29	25.18±19.29	58.1%
t value /χ2value	0.87	-0.63	0.03*
P value	0.39	0.53	0.87

Notes: * chi square test was used; 1x refers to mean and s refers to standard deviation; 2 the denominator for the incidence of anemia was the 127 full-term abo-hdn cases enrolled.

3.3 Differential Comparison of Term ABO-HDN in Different Blood Group

Different blood groups were divided into A blood group and B blood group. Independent sample t-test was used to compare the differences of minimum hemoglobin and age at onset (h), and chi square test was used to compare the differences of anemia incidence. It can be seen from table 3 that there was no difference in minimum hemoglobin, age at onset (h) and incidence of anemia among different blood groups, and the results were not statistically significant ($P > 0.05$).

Table 3: Comparison of the incidence of different blood types in the lowest hemoglobin, age (h) and anemia of different blood types.

class (n)	Minimum Hb (g / L) $\overline{x} \pm s$ 1	Age at disease onset (h) $\overline{x} \pm s$ 1	Anemia incidence2（%）
Blood Type A (52)	138.58±20.39	24.53±14.85	51.9%
Blood Type B (75)	138.40±21.76	24.30±17.59	61.3%
t value /χ2value	0.05	0.08	1.11*
P value	0.96	0.94	0.29

Notes: * chi square test was used; 1x refers to mean and s refers to standard deviation; 2 the denominator for the incidence of anemia was the 127 full-term abo-hdn cases enrolled.

3.4 Differential Comparison of Term ABO-HDN in Different Parity Groups

According to different parity groups, they were divided into the first parity group, the second parity group and the third and above parity groups. The differences of minimum hemoglobin and age at onset (h) were compared by analysis of variance, and the difference of anemia incidence was compared by chi square test. It can be seen from table 4 that there was no significant difference in the lowest hemoglobin, age at onset (h) and incidence of anemia among different parity ($P > 0.05$).

Table 4: Comparison of lowest hemoglobin, age at onset (h) and incidence of anemia among different parity.

class (n)	Minimum Hb (g / L) $\overline{x} \pm s$ 1	Age at disease onset (h) $\overline{x} \pm s$ 1	Anemia incidence2（%）
First parity (n=22)	140.05±17.61	24.55±12.24	54.5%
Second child time (n=34)	140.12±22.77	28.96±24.32	55.9%
Third and above births (n=71)	137.20±21.50	22.15±12.20	59.2%
F value/χ2value	0.29	2.00	0.20*
P value	0.75	0.14	0.91

Notes: * chi square test was used; 1x refers to mean and s refers to standard deviation; 2 the denominator for the incidence of anemia was the 127 full-term abo-hdn cases enrolled.

4 CONCLUSIONS

In this study, children with full-term ABO-HDN were divided into groups according to gender, ethnicity, blood group, and parity, and the differences in the lowest hemoglobin, age at onset (h), and incidence of anemia were compared, respectively. We found that there was no significant difference ($P>0.05$) in the incidence of full-term ABO-HDN among different gender, ethnic group, blood group, and parity among the children with ABO-HDN treated in the People's Hospital of Baise combined with previous studies, Specific discussion follows:

4.1 Ethnic Differences and ABO-HDN

Ethnic differences are mainly reflected in the differences in social culture, living habits and regional physical environment. The selection of ethnic groups as variables is mainly based on the fact that Baise region is located in Guangxi Zhuang Autonomous Region, at the junction of Yunnan,

Guizhou and Guangxi, and has eight ethnic minorities, including Miao, Yi, Tujia and Yao, In this study, 127 cases of full-term ABO-HDN of five nationalities (Han, Zhuang, Yi, Yao and Miao) in the People's Hospital of Baise of Guangxi were counted, including 53 cases of Han nationality (41.7%), 69 cases of Zhuang nationality (54.3%), 2 cases of Yao nationality (1.56%), 1 case of Yi nationality (0.78%) and 2 cases of Miao nationality (1.56%), of which Zhuang nationality accounts for the largest proportion, and Baise is the gathering area of Zhuang nationality, The overall composition of Zhuang population is relatively large.In addition, in the univariate analysis of ethnic groups, there is no difference in the lowest hemoglobin, age at onset (h) and incidence of anemia (P>0.05). Ethnic factors have little effect on the occurrence of anemia and onset time of full-term ABO-HDN, which has been confirmed by other relevant domestic studies(Chen, Deng, Huang, et al 2019). Relevant studies show that Han, Hui, Uygur, Inner Mongolia There was no significant difference in the prevalence of full-term ABO-HDN, the degree of hemolysis and the clinical manifestations of hemolysis among Tibetans. A foreign study on different ethnic groups in Iraq and India(Zhu, Wei, Zhang 2019) confirmed that there was no significant difference in full-term ABO-HDN in different countries. The research on different ethnic groups showed that there were differences in the degree of ABO hemolysis among black, yellow and white people, but there was no significant difference in the incidence.

To sum up, the proportion of full-term ABO-HDN children of Zhuang Nationality in this study is higher than that of other nationalities. The main reason is that Baise area is the gathering place of Zhuang nationality, and the population base of Zhuang nationality is large. There is no significant difference in whether ABO-HDN is anemia and related indicators of onset time, and ethnic factors have no significant impact on the onset and development of ABO-HDN.

4.2 Blood Group Difference and ABO-HDN

Of the 127 cases enrolled in this study, 52 (40.9%) were children with blood group A ABO-HDN and 75 (59.1%) were children with blood group B ABO-HDN.

Relevant studies have confirmed that the incidence of ABO-HDN hemolysis in different blood groups is different(Sun, Zhang 2007). Since there are about 810000-1170000 A antigen binding sites on the surface of type A red blood cells and 610000-830000 B antigen binding sites on the surface of type B red blood cells, in theory, children with ABO-HDN are more common in type A blood. However, the actual incidence rate is not consistent with this, which is related to the frequency of A blood type and type B blood in the opulation.Studies have shown that(Simmons, Savage 2015), the frequency of B blood type in Asian population is higher than that of A blood type expression, which may be the reason that the incidence rate of ABO-HDN in type B blood is higher than that of A type blood. Some scholars also believe that(Leger 2002), in the hemolysis degree of ABO-HDN, children with type B blood are heavier than those with type A blood.

The data of this study showed that there were no significant differences in the lowest hemoglobin, age at onset (h) and incidence of anemia among full-term ABO-HDN children with different blood groups, and the results did not reach statistical significance (P>0.05). This may produce errors on the results because this study is a single center and small sample study, which needs to be further expanded in the future The number of samples further verified whether different blood groups had an impact on the pathogenesis and development of ABO-HDN.

4.3 Parity Difference and ABO-HDN

Of the term ABO-HDN children selected for this study, 22 (17.3%) had the 1st fetus, 34 (26.8%) had the 2nd fetus, and 71 (55.9%) had the 3rd fetus and above (including the 3rd fetus). Relevant studies at home and abroad(Zhao Li, Huang Xinghua,2003) showed that pregnant women with 2 or more pregnancies carried significantly more positive IgG antibodies against a or anti-B than those with a first pregnancy.The main reasons are: during and at the end of pregnancy, fetal blood will enter the mother for many times, stimulating the mother to produce antibodies against fetal blood group antigens. With the increase of pregnancy times, T cells and B cells stimulated by foreign allogeneic ABO blood group antigens in the mother continue to proliferate and differentiate, and the immune response continues to strengthen, The high titer IgG antibody gradually increases. If the maternal fetal ABO blood group is still incompatible during pregnancy again, the antibody IgG with high titer is transported into the fetal circulation through the placenta, causing sensitization, agglutination and dissolution of fetal red blood cells, and aggravating the degree of

hemolysis(Wang 2001). On the premise of inconsistent maternal and infant blood groups, the more the number of pregnancies, the more significant the clinical symptoms of ABO-HDN in fetuses or newborns, and the more obvious the degree of hemolysis.

The data of this study show that the composition ratio of different parity is different, and the proportion of full-term ABO-HDN of three parity and above is the largest. However, there is no significant difference in the lowest hemoglobin, age at onset (h) and incidence of anemia among full-term ABO-HDN children with different parity ($P > 0.05$), which may be related to the widespread existence of ABO blood group substances in nature, and the mother may have repeated and repeated before pregnancy Due to a long history of blood group antigen exposure, there was no significant difference in the lowest hemoglobin, age at onset and incidence of anemia.

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