Earthline Journal of Chemical Sciences
ISSN (Online): 2581-9003
Volume 4, Number 2, 2020, Pages 175-182
https://doi.org/10.34198/ejcs.4220.175182

The Basic Concepts of the Effect of Rhesus (Rh) Factor on Fetus: A Mini Review

Mohammed Alwan Farhan

Department of Chemistry, College of Sciences, Diyala University, Iraq
e-mail: mohammed.alwan@sciences.uodiyala.edu.iq

Abstract

We often hear about cases of incompatibility of the blood of newly married couples, where it results in fears of fetal blood breakdown and others. The same problem generates by transferring blood from a donor to a recipient. This mini-review discusses this problem, outlines the possible reasons for blood aggregation and its negative effects and gives tips to avoid this problem in the future.

Introduction

Blood groups classify into four types, depending on the presence of glycoproteins on the surfaces of red blood cells (antigens) and the plasma contents of antibodies; this what is called ABO system [1-2]. In which, group A defines the presence of antigen-A in red blood cells and antibody-B in the blood plasma, group B defines antigen-B in red blood cells and antibody-A in the blood plasma, groups AB refers to the presence of antigen-A and antigen-B in red blood cells, but no antibodies in blood plasma and the fourth group O indicates no antigens in the red blood cells, but the blood plasma contains antibody-A and antibody-B [3-9].

Figure 1 shows the antigens on the surfaces of the white blood cells and the antibodies in the blood plasma.

Received: May 7, 2020; Accepted: July 2, 2020

Keywords and phrases: blood groups, Rhesus factor, newly married couples, pregnancy, the placenta, fetus.

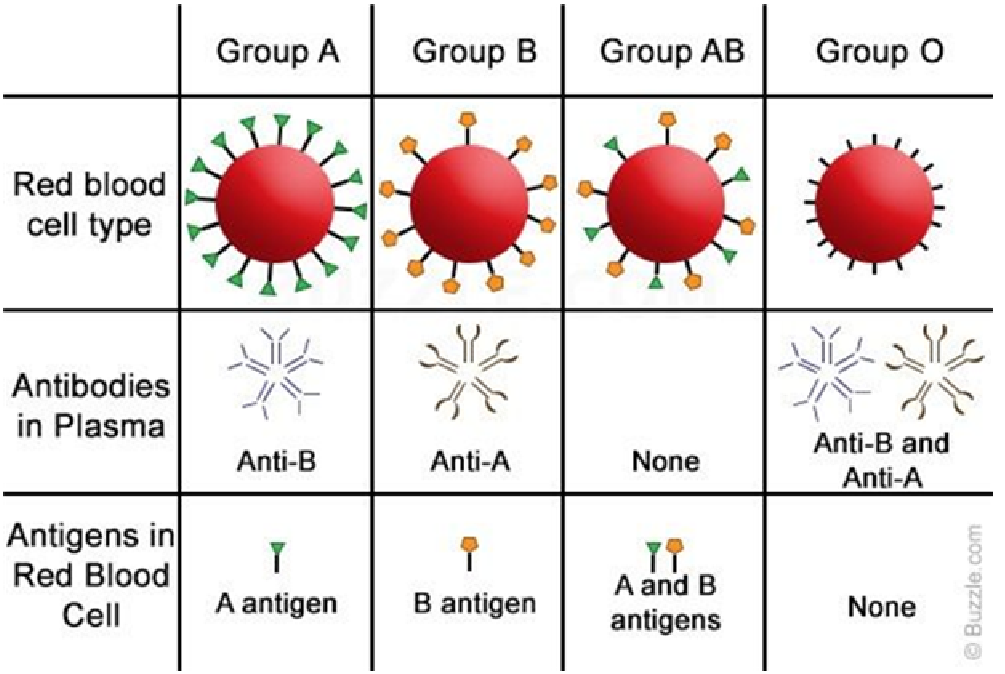

Figure 1. ABO blood group system.

Blood can be transferred from one person to another, depending on their antibodies. For example, groups A and B patients transfer blood to group AB because these do not have antibodies in the plasma, see Chart 1. Group A cannot transfer to group B due to the presence of antibodies to antigen-B in the plasma, which will cause blood agglutination and hemolysis. Likewise, any recipient group has an antibody to the antigen of the donor should avoid transfusion to avoid antigen-antibody interaction that leads to blood clotting [10-14]. On the other hand, group O able to transfer to all other groups due to the presence of antibodies for both antigens. For safe blood transferring, the type of the donor blood group should also be compatible with that of the recipient. Table 1 shows the compatibility between blood groups of the donor and recipient

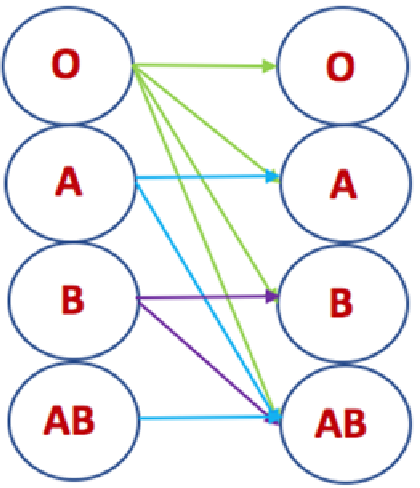

Chart 1. Illustration of blood transfusion.

Table 1. The compatibility of red blood cells of donor and recipient.

Recipient	Donor							
	O-	**O+**	**A-**	**A+**	**B-**	**B+**	**AB-**	**AB+**
O-	√	X	X	X	X	X	X	X
O+	√	√	X	X	X	X	X	X
A-	√	X	√	X	X	X	X	X
A+	√	√	√	√	X	X	X	X
B-	√	X	X	X	√	X	X	X
B+	√	√	X	X	√	√	X	X
AB-	√	X	√	X	√	X	√	X
AB+	√	√	√	√	√	√	√	√

Transfusion and Rhesus (Rh) Factor

The second important factor that must be taken into account when blood transfusion is the Rhesus (Rh) factor, which is one of the most important systems in blood transfusion along with (A-B-AB-O) system. Rh factor was first discovered in 1940 when researched on a type of monkey called (Rhesus monkeys). The same factor present in humans as a protein molecule found on the surfaces of red blood cells. Its presence on the surface makes it with positive Rh family (Rh+) and represents about (85%) of the population in the world, but its absence makes it with negative Rh family (Rh-) and it represents about (15%) of the world's population. Therefore, safe blood transfusion requires compatibility between blood groups of the donor and acceptor, as well as, their Rhesus factors, to avoid blood clotting, breakage and sedimentation in the kidney, which causes death to the recipient [15-17].

Blood Group Test for Newly Married Couples

As it is important for newly married couples to test blood group, the type of Rh is of high importance to the fetus in certain cases. The following cases should be under consideration for newly married couples:

1. The pregnant mother has (Rh+) and the husband has either Rh+ or Rh- factor: No negative effect on the fetus because the blood of Rh+ accepts the blood of the Rh- due to the absence of antibodies.

2. The mother's blood is of Rh- and her husband is of Rh+ factor:

(a) If the fetus's blood has Rh-: No negative effects.

(b) If the fetus's blood has Rh+: Possible negative effects occur on the fetus once he delivered. At birth, fetus's blood transfer to his mother at a small extent (through cut the umbilical cord), which force her immune system to form antibodies as a normal response to the foreign protein (Rh+). Thus, a certain risk is expected for the next pregnancy, where the fetus will expose to severe jaundice or even develop into death due to blood decomposition. To overcome such fetal danger, anti-D injection is required for the mother within 72 hours after the first delivery, see Figure 2. The anti-D injection will help the mother to get rid of any blood that has leaked from the first fetus during childbirth so that her blood will not produce antibodies, which could affect the next pregnancy [18-22].

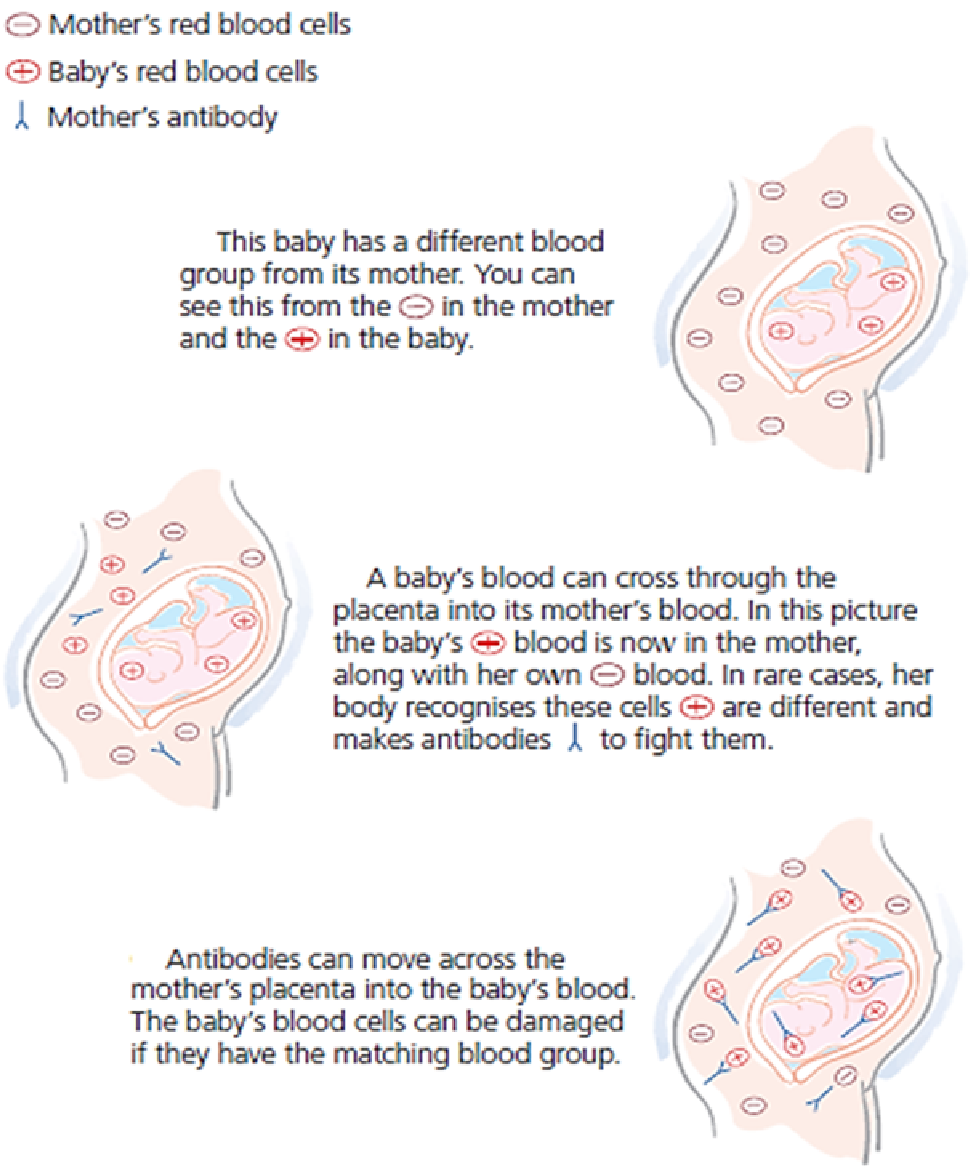

Figure 2. Formation of red cell antibodies during pregnancy.

Figure 2 illustrated the effect of different Rh types on the fetus and his mother. This figure raises some interesting questions, such as how does the fetus get his oxygen and food if no matching with his mother's blood? How does the second fetus get jaundice if no mixing occurred with his mother's blood? Gurkan and Akkus explained that the

fetus's blood form in the bone marrow and spleen during the second month of pregnancy, and oxygen and food transfer from mother to fetus by the placenta with the property of osmosis [23]. This explains why the first child unaffected by jaundice and blood clotting even though his Rh+ is different from that of his mother (Rh-). During birth, when the umbilical cord is cut, a small amount of the child's blood is transferred to the mother's blood through the umbilical cord. This causes the mother's immune system will recognize the foreign body (Rh+) and start forming antibodies against it. However, if the mother did not receive anti-D injection after the first pregnancy, her blood will form antibodies against Rh+ and this will transfer through the placenta to the second fetus and causes jaundice and blood clotting and may lead to the death of the fetus in some cases.

Conclusion

Blood transferring is safe for the donor and recipient, when their blood groups and Rhesus (Rh) factors are identical or compatible with each other. Otherwise, the recipient suffers clotting of the red blood cells, breakage and sedimentation into the kidney and death. Besides, blood groups and type of Rh factor should be carefully considered among newly married couples to avoid fetal risks.

References

[1] P. D. Issitt, W. J. Judd, M. Moulds, G. Schlanser, M. Connolly, W. N. Erber, D. E. Grey, C. M. Jenkins, S. T. Johnson, D. B. Bellissimo, J. L. Gottschall and C. M. Westhoff, *Immunohematology: Journal of Blood Group Serology and Education* 21(4) (2005), 141-185.

[2] Omolbanin Amjadi, Alireza Rafiei, Abolghasem Ajami, Reza Valadan, Zahra Hosseini-khah, Mehrdad Hajilooi and Ghasem Janbabaei, Blood groups: in health and diseases, *Res. Mol. Med.* 3(4) (2015), 1-9.

[3] Hemalatha N. R., ABO and Rh blood group distribution among medical students in Mandya, *International Journal of Contemporary Medical Research* 4(8) (2017), 1655-1658.

[4] F. A. Atire, Analysis of the blood type and group among undergraduate physics students of Dilla University, Ethiopia, *Hereditary Genet* 4(1) (2015), 1-8.

[5] Razaw Omer Ibraheem, Comparison between blood group types between students of College of Medicine and College of Education in University of KirKuk, *Scholars Journal of Applied Medical Sciences* 4(1C) (2016), 196-200.

[6] Mohammed A. Farhan, Wafaa Sh. Al-Zuhairi and Nuha Abduljaleel Imran, The influence of stress on erythrocyte sedimentary rate (ESR) for the staff of College of Science – Diyala University, *Earthline J. Chem. Sci.* 1(1) (2019), 71-77. https://doi.org/10.34198/ejcs.1119.7177

[7] Elaf Junainah, Saeed Al-Amoudi, Jamal Junainah, Yahya El-ficki, Eman baothman, Abdulazziz andijani, Hadir mir, Sahar al fatta and Muhannad Qarah, Prevalence of ABO and Rh blood groups in Saudi Arabian population, *Life Sci. J.* 13(2) (2016), 69-73.

[8] Luma Salman Abd, Mohammed Alwan Farhan and Nidhal Meteab Khamees, A preliminary study of the effect of drinking black tea on the absorption of iron in the blood, *Diyala J. Pure Sci.* 14(2) (2018), 17-30. https://doi.org/10.24237/djps.1402.342c

[9] Wafaa Sh. Al-Zuhairi, Ekhlas Abdallah Hassan, Alzahraa Ibrahim Abdulmajeed and Mohammed A. Farhan, Association of serum cortisol and testosterone levels with males Iraqi smokers, *Indian J. Forensic Med. Toxicol.* 13(4) (2019), 767-773. https://doi.org/10.5958/0973-9130.2019.00386.4

[10] Muhammad Tariq Hamid Rahmani, Maqsood Ahmad, Muhammad Saeed, Shahida Hussain, Aamir Hanif and Nadia Rashid, Determination of weak "D" antigen among Rhesus negative Pakistani blood donors, *Ann. Pak. Inst. Med. Sci.* 12(3) (2016), 131-135.

[11] Ayele Mandefro, Musin Kelel and Gary Wessel, Association of ABO blood group and Rh factor with Malaria and some gastrointestinal infectious disease in a population of Adet and Merawi, Ethiopia, *Global J. Biotechnol. Biochem.* 9(4) (2014), 137-142.

[12] J. P. Prasad, Meena, Madhu E., Kanchan Ahuja, Subhash Kumar and Priya Bhatt, Trend of blood groups and Rh factor in last decade within Indian Capital: Delhi, *Int. J. Curr. Res. Acad. Rev.* 3(10) (2015), 115-120.

[13] Hossam A. Eid, Effects of Rhesus factor (Rh) and blood group type on gingival health status, *Egyptian Dental Journal* 57(4) (2011), 1-6.

[14] Shamima Nasrin Shadia, Md Rabiul Islam and Moazzem Hossain, ABO and Rhesus blood group distribution among garment factory workers, *Acta Scientific Microbiology* 1(7) (2018), 68-71.

[15] Himanshu Shekhar, Ashmeet Kaur, Pooja Jadeja, P. M. Parihar and Ketan K. Mangukiya, Frequency and distribution of ABO blood group and Rh (D) factor in Southern Rajasthan, *Int. J. Sci. Nat.* 5(3) (2014), 494-497.

[16] B. V. Sai Prasad, Md Khader Faheem, N. V. H. Rajesh Krishna et al., Demographic distribution and prevalence of ABO and rhesus blood groups in blood donors: study from

a tertiary care centre in southern region of Andhra Pradesh, *IOSR Journal of Dental and Medical Sciences* 17(7) (2018), 01-05.

[17] Niharika Mathur and Rachna Lamichaney, A hospital based study to find the distribution of ABO and Rh blood group in the local population of Sikkim, North-Eastern India, *The Journal of Medical Research* 3(6) (2017), 273-276. https://doi.org/10.31254/jmr.2017.3606

[18] Sreelatha S., Vandana Ambastha, Chaitra S., Satish D. and Sandeep, Maternal and neonatal outcome in rhesus positive women in a tertiary care center, *MOJ Women's Health* 5(2) (2017), 202-204. https://doi.org/10.15406/mojwh.2017.05.00114

[19] C. Phaloprakarn and S. Tangjitgamol, Maternal ABO blood group and adverse pregnancy outcomes, *J. Perinatol.* 33 (2013), 107-111. https://doi.org/10.1038/jp.2012.73

[20] Ezhil Arasi Nagamuthu, Padmavathy Mudavath, Pasupuleti Prathima and Srilatha Bollipogu, Prevalence of rhesus negativity among pregnant women, *International Journal of Research in Medical Sciences* 4(8) (2016), 3305-3309. https://doi.org/10.18203/2320-6012.ijrms20162284

[21] Sadia Nasim, M. Ayaz Mustufa and Anjum Shahid, Rhesus negative blood incompatibility: knowledge of primiparous in a community, *Pak. J. Med. Res.* 50(3) (2011), 108-110.

[22] Krishna Agarwal, Anubhuti Rana and Anoosha K. Ravi, Treatment and prevention of Rh isoimmunization, *J. Fetal Med.* 1 (2014), 81-88. https://doi.org/10.1007/s40556-014-0013-z

[23] Umut Atakan Gurkan and Ozan Akkus, The mechanical environment of bone marrow: a review, *Ann. Biomed. Eng.* 36(12) (2008), 1978-1991. https://doi.org/10.1007/s10439-008-9577-x