



# Prevalence of fetomaternal Rhesus incompatibility at the tertiary care hospital: a cross-sectional study

Olivier Nyakio, MD, MSc, PhD<sup>a,b,e,\*</sup>, Fabrice Kibukila, MD<sup>b</sup>, Tarun Kumar Suvari, MBBS<sup>f</sup>, Priyadarshini Bhattacharjee, MD, MSc, FRSPH, AFHEA<sup>g</sup>, Aymar Akilimali, MD<sup>c,d,e</sup>, Denis Mukwege, MD, MSc, PhD<sup>a</sup>

**Background:** Fetomaternal Rhesus incompatibility is a medical condition that affects the pregnant woman [of blood group (A, B, AB, O) and a negative Rhesus] and the foetus (of positive Rhesus). The objective of this study is to determine the prevalence and to present the clinical characteristics of fetomaternal Rhesus incompatibility in a tertiary care hospital.

**Methods:** The authors conducted a retrospective cross-sectional study and 37 participants were recorded during the study period of 4 years.

**Results:** A total of 11 898 pregnant women admitted to the maternity and 37 of them (women with blood groups A, B, AB or O and with a negative Rhesus) participated in our study, including a frequency of 0.31%. Thirty cases of fetomaternal Rhesus incompatibility were recorded in new-borns. 27 (73%) of the women are from the urban region and the age group between 21 and 25 is the most affected with 37.8%. Twenty-two (59.5%) of pregnant women have blood group O (and negative Rhesus) and primiparous women are the most affected with 64.9%. For the discovery of allo-immunization, 43.2% of women discovered it during the second pregnancy and 48.7% women received a single infusion of Anti-D serum during the first pregnancy. Twelve (40%) new-borns developed jaundice as a perinatal prognosis.

**Conclusion:** Fetomaternal Rhesus incompatibility remains a major problem of maternal health because it is likely to lead to the formation of antibodies in women, which by crossing the placental barrier, they destroy red blood cells and thus cause serious complications.

**Keywords:** Female, foetal blood, hemoglobinopathies, pregnancy, phenotype, prevalence

## Introduction

Rhesus incompatibility exists when there is a difference between the antigens of the figured elements of the blood of the pregnant woman and her foetus likely to cause the formation of antibodies in the woman, when these antibodies exist, they pass the barrier placental and destroy the formed elements of the blood

<sup>a</sup>Faculty of Medicine, Evangelic University in Africa, <sup>b</sup>Faculty of Medicine, Official University of Bukavu, Bukavu, <sup>c</sup>Department of Research, Medical Research Circle (MedReC), <sup>d</sup>Standing Committee of Research and Exchange, Medical Students Association (MSA), Goma, DR Congo, <sup>e</sup>Society for Maternal-Fetal Medicine (SMFM), Washington, DC, <sup>f</sup>Department of Medicine, Rangaraya Medical College, Kakinada, Andhra Pradesh, India and <sup>g</sup>Department of Clinical Medicine, Cambridge University Hospitals NHS Foundation Trust, University of Cambridge, Cambridge, UK

Sponsorships or competing interests that may be relevant to content are disclosed at the end of this article.

\*Corresponding author. Address: Faculty of Medicine, Evangelic University in Africa, Bukavu, DR Congo Faculty of Medicine, Official University of Bukavu, Bukavu, DR Congo Society for Maternal-Fetal Medicine (SMFM), Washington, DC 20024, United State of America Ibanda, 3323 Bukavu, Bukavu, South Kivu, DR Congo. Tel.: +243 997 817 834. E-mail: oliviernyakio@yahoo.fr (O. NYAKIO).

Copyright © 2024 The Author(s). Published by Wolters Kluwer Health, Inc. This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

Annals of Medicine & Surgery (2024) 86:1901–1905

Received 22 September 2023; Accepted 17 January 2024

Published online 28 February 2024

<https://dx.doi.org/10.1097/MS9.0000000000001846>

## HIGHLIGHTS

- Fetomaternal Rhesus incompatibility (FMRhI) remains a major problem of maternal health as it can form of antibodies, which by crossing the placental barrier, lead to red cell destruction.
- Correct identification and record of such a condition is pivotal to medical practice. In our study spanning over four years, it was found in more than 40% pregnant women and subsequent perinatal jaundice was also observed in the new-borns.
- Implementation of strategies and plans in the prevention and reduction of the problems of FMRhI in women as well as in new-borns in DR Congo is essential.

(erythrocytes, platelets or leucocytes), only the woman with a blood group (A, B, AB, O) and a negative Rhesus are concerned by this problem of incompatibility if their baby is positive Rhesus and there is no incompatibility when the pregnant mare is positive Rhesus and her baby is negative Rhesus<sup>[1]</sup>. Rhesus incompatibility is a medical condition and does not affect the first pregnancy because anti-Rhesus antibodies appear only after the first delivery or after a miscarriage<sup>[2]</sup>. Fetomaternal Rhesus incompatibility (FMRhI) is a medical problem to be feared in pregnant women and in the foetus during the second pregnancy (or a subsequent pregnancy), and it can lead to the destruction of the red blood cells of the foetus often causing anaemia, jaundice, brain damage and in utero death in the foetus and abortion, miscarriage in the mother<sup>[2,3]</sup>. Anti-Rhesus drugs increase as the

number of pregnancies with Rh incompatibility increase<sup>[3]</sup>. The FMRhI being a medical problem to be feared, the objective of this study is to determine the prevalence and to present the clinical characteristics of the FMRhI in the woman as well as in her future baby in a tertiary treatment hospital in the eastern region of the Democratic Republic of Congo (DR Congo).

## Methods

### Study design, period and setting

The retrospective, cross-sectional and descriptive study was conducted from January 2019 to December 2022 (a period of 4 years), the study was carried out in the Gynaecology and Obstetrics department of a tertiary care hospital located in the city of Bukavu, from the eastern region of the DR Congo.

### Inclusion and exclusion criteria

In our study, we included all pregnant women admitted to the Gynaecology and Obstetrics department and whose Rhesus negativity was confirmed by the laboratory, as well as new-borns resulting from their pregnancies. We excluded in our study all the women with a positive Rhesus admitted within the service as well as the women with a negative rhesus and who are not pregnant were also excluded in our study.

### Variables and analysis tools

The variables were divided into socio-epidemiological and clinical. Sociodemographic characteristics included; the distribution by age, residence and parity. Clinic included: the number of abortions, the history of caesarean section, the number of prenatal consultations carried out, the history of medical pathologies, the circumstances of the discovery of iso-immunization. The circumstances of delivery as well as the weight, blood group and the rhesus of the new-born, the prognosis and maternal-Foetal complications, prevention were also part of the variables.

The results are grouped and presented in tabular form. For the analysis of the results, we used Microsoft Word 2016 for windows (Version 19, Microsoft Inc.), Microsoft Excel 2016 for windows (Version 19, Microsoft Inc.) and SPSS.

The work has been reported in line with the STROCCS criteria<sup>[9]</sup>.

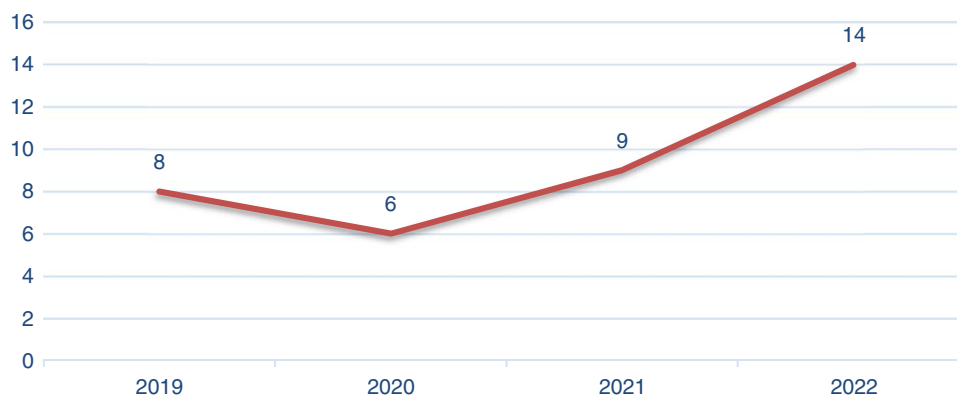
## Results

Our study covered a period of 4 years and a total of 11 898 pregnant women admitted for delivery and monitoring of their pregnancies. During this study period, 37 women were recorded with a blood group (A, B, AB, O) and negative Rhesus, that is a frequency of 0.31%. In these 37 women with negative Rhesus, in 30 cases of them, Fetomaternal Rhesus Incompatibility was recorded in new-borns, a frequency of 88.2%.

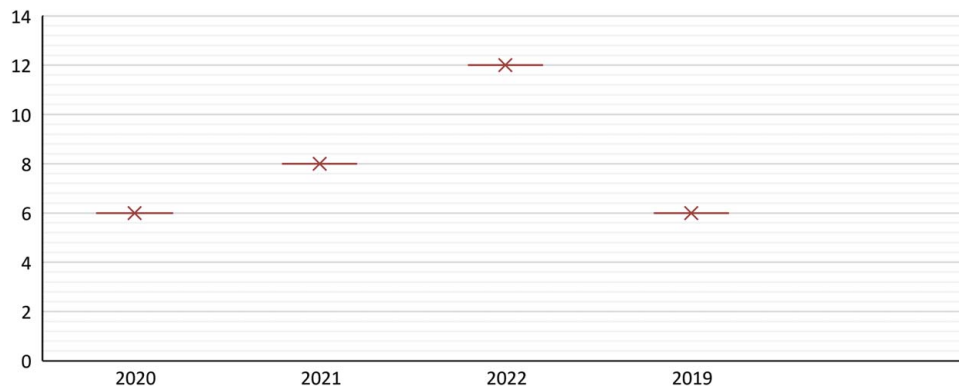
According to the distribution of cases over the 4 years of study, in the year 2022, 14 cases of women with negative Rhesus were recorded out of a total of 2974 women admitted for childbirth and for pregnancy monitoring or prenatal consultations. and whose results are represented in Graph 1. In the same year 2022, we recorded 12 cases of FMRhI out of 14 women with negative Rhesus, that is a frequency of 85.7% (Graph 2).

Starting from the sociodemographic data of pregnant women with negative Rhesus, the data are shown in Table 1. We have the distribution of women according to residence, of which 27 (73%) of women with negative Rhesus are from the urban region and 10 (27%) are from the rural area. For the distribution by age, the age group between 21 and 25 years is the most affected with 14 cases or 37.8%. For the distribution of blood groups, 22 (59.5%) of pregnant women have blood group O and negative Rhesus followed by blood group B with 10 (27%) of cases. Primiparous women are the most affected by negative Rhesus with 24 cases or 64.9%. The frequency of abortions during old pregnancies or during previous pregnancies is 26 women or 70.3% who have not yet aborted while 8 women or 21.6% have already aborted between 1 and 3 times.

Starting from the medical history of pregnant women with negative Rhesus, the results of the medical history are shown in Table 2. We found the history related to caesarean section, of which 27 (73%) of the women benefited from a caesarean section during their previous pregnancies or old pregnancies. Two (5.4%) women have a history of arterial hypertension, two (5.4%) women have a history of diabetes and one (2.7%) woman has sickle cell disease. Several women benefited from prenatal consultations, of which 14 (40.5%) women had more than 4 prenatal consultations and 7 (19%) did not benefit from a prenatal consultation. Regarding the circumstances of the discovery of allo-immunization, 16 (43.2%) women discovered allo-immunization during the second pregnancy while 21 (56.8%) women discovered after the second pregnancy. Eighteen (48.7%)



Graphic 1. Annual distribution of negative Rhesus.



**Graphic 2.** Annual distribution of fetomaternal Rhesus incompatibility.

women received a single infusion of Anti-D serum at the first pregnancy and 14 other women did not receive the Anti-D serum infusion.

Concerning the circumstances of childbirth, Table 3 shows us that 21 (56.8%) of the women delivered their babies by the normal way (the basic way), 3 other women aborted their pregnancies while 13 women gave birth by caesarean section. The indications for caesarean section were multiple between and others placenta previa, acute Foetal distress, severe preeclampsia, lack of engagement of the foetus, macrosomia as well as cord prolapse.

In our study, we recorded 30 cases of FMRhI. In Table 4, we have the characteristics of new-borns at birth, new-borns whose weight is between 3 and 3.5 kg were the most exposed to FMRhI and blood group B positive was the most affected. with 13 cases, a frequency of 43.3%.

**Table 1**  
**Sociodemographic characteristic of pregnant women with negative Rhesus**

Variables	Effective, N (%)
Place of residence	
Urban	27 (73)
Rural	10 (27)
Age group in years	
Less to 20	4 (10.8)
21–25	14 (37.8)
26–30	6 (16.2)
31–35	7 (13)
36–40	3 (8.1)
Upper to 40	3 (8.1%)
Distribution of pregnant women's blood group	
A-	4 (10.8)
AB-	1 (2.7)
B-	10 (27)
O-	22 (59.5)
Distribution of parity	
Primiparous	24 (64.9)
Multiparous	13 (35.1)
Prevalence of past abortion	
Any abortion	26 (70.3)
1-3 abortions	8 (21.6)
Upper to 4 abortions	3 (8.1)

–, negative.

The results concerning the perinatal prognosis, 12 (40%) new-borns developed jaundice, 1 (3.3%) new-born developed hypothermia and 17 other new-borns did not develop any pathology. No deaths were recorded in this study among new-borns and their mothers.

### Discussion

FMRhI being a major problem of maternal and foetal health in the world in general and in the DR Congo in particular, there remains a major medical condition to be feared in a pregnant woman and in her foetus because it is likely to lead to the formation of antibodies in women, which by crossing the placental barrier, they destroy the red blood cells and thus cause serious complications.

Thus, this study aims to study as well as determine the prevalence and clinical characteristics of FMRhI in women as well as in their future babies in a tertiary care hospital from the eastern region of DR Congo.

### Main findings

In our study, we found as key results. The frequency of FMRhI is a little high compared to other gynaecological pathologies in our study area. Women in the urban area and women of young ages (21–25 years old) are the most affected by the problems of FMRhI. Pregnant women with blood group O and negative Rhesus and primigravid women were most affected by FMRhI. Caesarean section, arterial hypertension, diabetes and sickle cell disease are the pathologies found in the medical histories of the women recorded in this study. Many women have discovered allo-immunization in the second pregnancy and the infusion of Anti-D serum. The sufficient number of women had given birth to their babies by caesarean section because of multiple problems including placenta previa, acute foetal distress, severe preeclampsia, foetal decommitment, macrosomia and cord prolapse. New-borns with blood group B and positive Rhesus were the most exposed to FMRhI with jaundice as a perinatal prognosis.

### Interpretation

FMRhI incompatibility being a haemolytic condition that mainly affects foetuses with Rhesus positive mothers with Rhesus negative mothers and its pathophysiology begins when maternal

**Table 2**  
**Medical history of pregnant women with negative Rhesus**

Variables	Effectives, N (%)
Caesarean	
No caesarean	27 (73)
1–3 caesarean	9 (24.3)
Upper to 3 caesarean	1 (2.7)
High blood pressure	
Yes	2 (5.4)
No	35 (94.6)
Diabetes	
Yes	2 (5.4)
No	35 (94.6)
Sickle cell disease	
Yes	1 (2.7)
No	36 (97.3)
Prenatal consultation	
No prenatal consultation	7 (19)
1–3	15 (40.5)
Upper to 4	15 (40.5)
Circumstance of discovery of allo-immunization	
At the second pregnancy	16 (43.2)
After the second pregnancy	21 (56.8)
Infusion of anti-D serum at the 1st pregnancy	
No infusion	14 (37.8)
1	18 (48.7)
2	5 (13.5)

antibodies attack the red blood cells of the foetus due to allo-immunization due to Rhesus incompatibility between maternal and foetal blood<sup>[4]</sup>. In our study, we recorded only 37 women with negative Rhesus (a frequency of 0.31% compared to the total number of women admitted to the maternity ward) and 30 cases of FMRhI. *Cortey et al.*<sup>[5]</sup>, in his study shows us that pregnant women carrying Rhesus negative carry 60–70% the foetus of Rhesus positive. *Runkel et al.*<sup>[6]</sup>, in their work of a systematic review study in 2020 on Rhesus incompatibilities, they found in their result, a frequency of fetomaternal incompatibilities with a percentage similar to our study. According to *Osaro et al.*<sup>[7]</sup>, they show in their study that the frequency of the Rhesus negative phenotype among pregnant women in Nigeria is 4.44%, in Kenya is 3.9%, in Guinea is 4.06% and in Cameroon is 2, 4%, these results are much higher than the 0.31% prevalence of the Rhesus negative phenotype observed in our study. We

**Table 3**  
**Circumstance of birth for pregnant women with negative Rhesus**

Variables	Effectives, N (%)
Way of birth (N=37)	
Upper way or caesarean	13 (35.1)
Base way	21 (48.7)
Abortion	3 (8.1)
Indication of caesarean (N= 13)	
Collapse of umbilical cord	1 (7.7)
Placenta previa	2 (15.4)
Acute foetal suffering	5 (38.4)
Severe preeclampsia	2 (15.4)
Flaw engagement	2 (15.4)
Macrosomia	1 (7.7)

**Table 4**  
**Characteristics of children with fetomaternal Rhesus incompatibility at the birth**

Variables (N= 30)	Effectives, N (%)
Weight at the birth	
Less to 1 Kg	1 (3.3)
1–2,5 Kg	4 (13.4)
2.6–3 Kg	8 (26.7)
3–3.5 Kg	16 (53.3)
Upper to 3.5 Kg	1 (3.3)
Distribution of children blood group	
A +	5 (16.7)
AB +	3 (10)
B +	13 (43.3)
O +	9 (30)

+ , positive.

noticed in our study that the majority of women with blood group O have a Rhesus negative.

Rhesus incompatibility is not dangerous during the first pregnancy because of the anti-Rhesus antibodies that appear after the first delivery (or after a miscarriage). It can be dangerous during the second pregnancy. In case the anti-Rhesus antibodies were formed in a previous pregnancy, a Rhesus positive baby could have problems with Rhesus incompatibility and the more anti-Rhesus antibodies there are, the greater the problems with the next baby (2.8). This demonstrates why the women in our study discovered allo-immunization during their second pregnancy.

It is recommended that all women in most developed countries be screened for blood type and antibodies at the first prenatal visit. It has been reported that 1.5–2% of pregnant women have atypical blood group sensitization, in our study at least a majority of women performed antenatal care as recommended despite the antibody screening test n is not among the routine examinations in antenatal consultations in DR Congo<sup>[7]</sup>. In our study, most of the women received an infusion of Anti-D serum, whereas in most of the countries of sub-Saharan Africa, the prevention of allo-immunization is weak or even non-existent following potentially sensitizing events and during medical termination of pregnancy in Rhesus negative women (4.7). Often postnatal treatment with anti-D immunoglobulin to prevent Rh sensitization is successful in about 90% of all Rhesus negative mothers. Studies conducted in Canada, Great Britain and Sweden have shown that injecting an additional dose of anti-D between the 28th and 34th week of pregnancy leads to an additional 90% reduction in the failure rate<sup>[8]</sup>.

#### Limitation of the study

During the study period, we had many limitations for the realization of this work among others: the loss of certain patient files yet recorded in the patient registers, the absence of several elements in the patient files while that we have prepared them in our protocol and poor access to the hospital's annual statistical data.

#### Conclusion

Fetomaternal Rhesus incompatibility is a medical situation that affects the pregnant woman (of all blood group with the negative Rhesus) and the foetus with positive Rhesus. It remains a major

problem of maternal health because it is likely to lead to the formation of antibodies in women, which by crossing the placental barrier, they destroy red blood cells and thus cause serious complications. For involvement in the prevention and reduction of cases of FMRhI, the hospitals from the country (DR Congo) must be well equipped for the correct diagnosis of allo-immunization and must have the centres of treatment adapted for cases of FMRhI. Researchers must repeat this study on the entire province of South Kivu or on the entire extent of the DR Congo and even in Africa for a good comparison of the results. Thus, the results will make it possible to produce strategies and plans in the prevention and reduction of the problems of FMRhI in women as well as in new-borns in our country, DR Congo.

### Ethical approval

Ethical approval for this study (Ethical Committee UEA/FM/136/2012) was provided by the Ethical committee of the Evangelic University in Africa, DR Congo on 21 January 2023.

### Consent

Written informed consent was obtained from the patient for publication and any accompanying images.

### Source of funding

The authors did not receive any financial support for this work. No funding has been received for the conduct of this study.

### Author contribution

Conception: O.N. Design: A.A. Project administration: O.N. Supervisor: D.M. Funding acquisition: O.N. Investigation: A.A. Resources: F.K. Validation: O.N. Visualization: A.A. Literature search: A.A. and F.K. Provision of study materials or patients: A.A. Collection and assembly of data: F.K. and A.A. Data analysis and interpretation: A.A. Software: A.A. Manuscript preparation: O.N., T.K.S., F.K. and A.A. Manuscript editing: D.M., T.K.S., A.A. and O.N. Manuscript review: all authors. Final approval of manuscript: all authors.

### Conflicts of interest disclosure

The authors declare that there no conflicts of interest.

### Research registration unique identifying number (UIN)

1. Name of the registry: Aymar Akilimali.

2. Unique Identifying number or registration ID: research-registry9529.
3. Hyperlink to your specific registration (must be publicly accessible and will be checked): <https://www.researchregistry.com/browse-the-registry#home/>.

### Guarantor

Aymar Akilimali.

### Data availability statement

Not applicable.

### Provenance and peer review

Not commissioned, externally peer-reviewed.

### Acknowledgements

The authors thank the direction of Medical Research Circle (MedReC) for the realization of this present paper.

### References

- [1] ACOG Practice Bulletin No. 192: Management of Alloimmunization During Pregnancy. *Obstet Gynecol* 2018;131:e82–90.
- [2] Minon JM, Gérard C, Dricot JF, *et al.* New approaches to prenatal diagnosis of rhesus incompatibility. *Rev Med Liege* 2006;61:756–62.
- [3] Le Manuel MSD. Maladie hémolytique du fœtus et du nouveau-né (Incompatibilité Rhésus ; érythroblastose fœtale ou néonatales). Octobre 2022. Main Line Health System. Accessed April 13, 2023. <https://www.msmanuals.com/fr/accueil/problèmes-de-santé-de-la-femme/complications-de-la-grossesse/maladie-hémolytique-du-fœtus-et-du-nouveau-né>
- [4] Myle AK, Al-Khattabi GH. Hemolytic disease of the newborn: a review of current trends and prospects. *Pediatric Health Med Ther* 2021;12:491–8.
- [5] Cortey A, Brossard Y, Beliard R, *et al.* Prevention of fetomaternal rhesus-D allo-immunization. Perspectives. *J Gynecol Obstet Biol Reprod (Paris)* 2006;35(1 suppl):1S119–22.
- [6] Runkel B, Bein G, Sieben W, *et al.* Targeted antenatal anti-D prophylaxis for RhD-negative pregnant women: a systematic review. *BMC Pregnancy Childbirth* 2020;20:83.
- [7] Osaro E, Charles AT. Rh isoimmunization in Sub-Saharan Africa indicates need for universal access to anti-RhD immunoglobulin and effective management of D-negative pregnancies. *Int J Womens Health* 2010;2: 429–37.
- [8] Maas DH. Clinical aspects of prenatal prevention of rhesus incompatibility. *Beitr Infusionsther* 1992;30:425–30.
- [9] Mathew G, Agha R. for the STROCSS Group. STROCSS 2021: Strengthening the Reporting of cohort, cross-sectional and case-control studies in Surgery. *Int J Surg* 2021;96:106165.