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## CASE REPORT

# A Rare Case of a Newborn with Blocked RhD Antigen Caused by Low-Titer Antibody

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## ABSTRACT

***Background:*** **Hemolytic disease of the fetus and newborn (HDFN) is a condition characterized by severe hemolysis and anemia in fetuses or neonates. To our knowledge, this is the first reported case of a newborn with blocked RhD antigen caused by low-titer antibody.**
***Methods:*** **Peripheral blood samples were collected from the newborn upon admission. ABO and RhD blood typing was performed using a microcolumn gel agglutination test. Direct antiglobulin test (DAT) was performed using polyspecific anti-human globulin. Indirect antiglobulin test (IAT) was used to screen for irregular antibodies in the serum. Thermal elution was carried out by incubating the newborn's red blood cells at 56°C for 10 minutes, and the resulting eluate was tested for non-ABO antibodies and their titers by IAT.**
***Results:*** **At birth, the infant was typed as O Rh-positive. However, pre-transfusion retesting indicated O Rh-negative status. The DAT was negative, whereas the IAT was positive (2+). Subsequent ABO-compatible elution testing also yielded a positive result (1+). The antibody titer was measured at 1:16.**
***Conclusions:*** **This is the first reported case of blocked RhD antigen caused by low-titer antibody. This case highlights the critical importance of comprehensive serological investigation in affected neonates to guide appropriate clinical management and transfusion strategy.**
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## KEYWORDS

hemolytic disease of the fetus and newborn, blocked RhD antigen, low-titer antibody

## INTRODUCTION

Hemolytic disease of the fetus and newborn (HDFN) is most commonly caused by blood group incompatibility or irregular antibodies. It occurs most frequently when the mother is RhD-negative and the fetus or newborn is RhD-positive. Immunoglobulin G (IgG) antibodies - produced in response to mother-fetus blood group incompatibility or previous incompatible transfusions - cross the placenta and lead to hemolysis and anemia in the fetus [1-3].
The ABO and Rh blood group systems play a critical role in the clinical diagnosis and management of both

transfusion therapy and HDFN. At birth, ABO antigen expression in newborns is relatively weak, while Rh antigens are fully developed [4]. Maternal blood group antibodies - resulting from mother-fetus blood group incompatibility - cause destruction of fetal or neonatal red blood cells, with Rh incompatibility generally leading to more severe outcomes than ABO incompatibility. In cases of HDFN, maternal anti-D antibodies enter the neonatal circulation and bind to D antigens on the newborn's red blood cells. This can result in a rare phenomenon known as RhD antigen "blocking". Under these conditions, blood typing may falsely indicate an Rh-negative result, complicating the accurate determination of the newborn' s blood type.

## CASE PRESENTATION

A female infant was delivered vaginally at 37 weeks of gestation with a birth weight of 2,610 grams. The mother has blood type A RhD-negative. Shortly after birth, the infant presented with severe jaundice and lethargy. The infant's blood type was initially identified as O RhD-positive. Given the maternal RhD-negative status, hemolytic jaundice was highly suspected. The infant was hospitalized locally for 12 days. Management involved phototherapy, intravenous immunoglobulin (IVIG), and transfusion for anemia correction. Despite these interventions, hemolysis persisted. The infant was subsequently transferred to our institution for further evaluation and management.

Upon admission to our institution, the infant's blood type was determined to be O RhD-negative - a finding inconsistent with the prior result from the referring hospital. Laboratory investigations revealed severe anemia, with a hemoglobin (Hb) level of 53 g/L (reference range: 115 - 150 g/L) and total bilirubin (T-BIL) 145.3 μmol/L (reference range: 0 - 21 μmol/L). The infant was promptly transfused with O RhD-negative packed red blood cells.

ABO and Rh typing of the neonatal sample revealed blood type O RhD-negative, contradicting the results previously obtained from the external hospital. The DAT was negative while IAT was a positive result (2+). Thermal elution of the infant's red blood cells was carried out at 56°C for 10 minutes, the resulting eluate was tested for non-ABO antibodies and showed positive reactivity (2+). These findings confirm the presence of antibodies coating the infant's red blood cells, specifically masking D antigens and leading to the discrepant Rh typing. The antibody was identified as anti-D with a titer of 1:16.

## DISCUSSION

In terms of immunogenicity among blood group antigens, the D antigen ranks second only to those of the ABO system [5]. Therefore, the accurate RhD typing is critically important in transfusion medicine. The phenomenon of blocked RhD antigen was first described by Wiener in 1944 [6]. The underlying mechanism is likely the prozone effect in antigen-antibody reactions: an excess of antibodies saturates D antigens on red blood cells, hindering their detection by standard typing reagents and resulting in misinterpretation of the patient's true Rh status [7].

In most reported cases, maternal IgG anti-D antibodies are present at high titers [8-10]. These antibodies cross the placenta, bind extensively to fetal erythrocytes, and subsequently lead to blocking of the RhD antigens. In contrast, this report describes a rare case of a newborn with blocked RhD antigen caused by low-titer antibody. To our knowledge, this is the first reported case of blocked RhD antigen caused by a low-titer of antibody. This finding demonstrates that even a low-titer antibody can be sufficient to induce blocked RhD antigen.

The phenomenon of blocked RhD antigen is highly uncommon in neonates born to RhD-negative multiparous women; however, characteristic serological discrepancies offer crucial diagnostic clues. When an infant presents typed as RhD-negative with DAT but demonstrates a strongly positive IAT, a high index of suspicion for blocked RhD antigen should be maintained.

When RhD antigen blocked is confirmed or strongly suspected, transfusion with RhD-negative blood products is strongly recommended to prevent potential hemolytic reactions and ensure clinical safety.

**Declaration of Interest:**
The authors declare that they have no conflict of interest.

## References:

1. de Winter DP, Kaminski A, Tjoa ML, Oepkes D. Hemolytic disease of the fetus and newborn: systematic literature review of the antenatal landscape. BMC Pregnancy Childbirth 2023 Jan 7;23 (1):12. (PMID: 36611144)

2. Myle AK, Al-Khattabi GH. Hemolytic Disease of the Newborn: A Review of Current Trends and Prospects. Pediatric Health Med Ther 2021 Oct 7;12:491-8. (PMID: 34675752)

3. Avent ND, Reid ME. The Rh blood group system: a review. Blood 2000 Jan 15;95(2):375-87. (PMID: 10627438)

4. Jackson ME, Baker JM. Hemolytic Disease of the Fetus and Newborn: Historical and Current State. Clin Lab Med 2021 Mar; 41(1):133-51. (PMID: 33494881)

5. Lee E. Blocked D phenomenon. Blood Transfus 2013 Jan;11(1): 10-1. (PMID: 22790264)

6. Wiener AS. A new test (blocking test) for Rh sensitization. Proc Soc Exp Biol Med 1944;56:173-6. https://journals.sagepub.com/doi/abs/10.3181/00379727-56-14640

7. Ali A, Basany L, Priyanka GN, Lotkal RR. Blocked D phenomenon implicated in a diagnostic dilemma in RhD-hemolytic disease affecting twins: case report and review of literature. Turk J Pediatr 2025 May 4;67(2):259-67. (PMID: 40466668)

8. Verma A, Sachan D, Bajpayee A, Elhence P, Dubey A, Pradhan M. RhD blocking phenomenon implicated in an immunohaematological diagnostic dilemma in a case of RhD-haemolytic disease of the foetus. Blood Transfus 2013 Jan;11(1):140-2. (PMID: 22790265)

9. Sulochana PV, Rajesh A, Mathai J, Sathyabhama S. Blocked D phenomenon, a rare condition with Rh D haemolytic disease of newborn - a case report. Int J Lab Hematol 2008 Jun;30(3):244-7. (PMID: 18205842)

10. Wang H, Chen J, Jiang Y. A Case of a Newborn With Blocked RhD Antigen and HDFN. Lab Med 2017 Nov 8;48(4):381-3. (PMID: 29053863)