

Chapter 2

Rhesus Pieces

Clinical History

A 25-year-old female, now 37 weeks pregnant and without any complications throughout the pregnancy, presents for a routine prenatal clinic visit. A type and screen sample (ethylenediaminetetraacetic acid, EDTA anticoagulant) is submitted to the blood bank.

ABO/Rh/Antibody Screen

<i>ABO/Rh (tube method)</i>				
Patient RBCs (forward type)			Patient plasma (reverse type)	
Anti-A	Anti-B	Anti-D	A ₁ cells	B cells
4+	0	0	0	4+
<i>Antibody screen (tube LISS method)</i>				
	37 °C	AHG	CC	
SC1	1 +	2 +	NT	
SC2	1 +	2 +	NT	

Reaction scale=0 (no reaction) to 4+ (strong reaction)
RBC red blood cell, LISS low ionic strength solution, AHG antihuman globulin, CC check cell, NT not tested, SC screen cell

Tube Panel

Cell #		Rh-hr										Kell					Duffy		Kidd		Lewis		MNS			P		Lutheran		Test Results: IA/T/tube LISS			
		D	C	E	c	e	f	C ^w	V	K	k	Kp ^a	Kp ^b	Jk ^a	Jk ^b	Fy ^a	Fy ^b	Jk ^a	Jk ^b	Le ^a	Le ^b	M	N	S	s	P ₁	Lu ^a	Lu ^b	Cell #	37°C	AHG	CC	
1	R ₀ R ₁	+	+	0	0	+	0	0	0	+	0	+	0	+	0	+	0	+	+	+	0	+	0	+	+	+	+	0	+	1	1+	2+	NT
2	R ₁ R ₁	+	+	0	0	+	0	0	0	+	0	+	0	+	+	+	+	+	0	0	0	+	+	+	+	+	0	0	+	2	1+	2+	NT
3	R ₂ R ₂	+	0	+	0	0	0	0	0	+	0	+	0	+	0	+	0	+	0	0	0	0	+	+	+	+	+	0	+	3	1+	2+	NT
4	R ₀ r	+	0	0	+	+	+	0	+	0	+	0	+	0	+	0	0	+	0	0	0	0	+	+	+	+	+	0	+	4	1+	2+	NT
5	r'r	0	+	0	+	+	+	0	0	0	+	0	+	0	+	0	+	0	+	+	0	0	0	0	0	0	+	0	+	5	0	0	2+
6	r''r	0	0	+	+	+	+	0	0	0	+	0	+	0	+	+	0	0	+	0	+	+	+	+	+	+	+	0	+	6	0	0	2+
7	rr	0	0	0	+	+	+	0	0	+	0	+	0	+	0	+	0	+	+	0	0	0	+	+	+	+	+	0	+	7	0	0	2+
8	rr	0	0	0	+	+	+	0	0	0	+	0	+	0	+	+	+	0	+	+	0	0	+	+	+	+	+	0	+	8	0	0	2+
9	rr	0	0	0	+	+	+	0	0	0	+	+	+	0	+	0	+	+	0	0	0	+	0	0	0	0	0	0	+	9	0	0	2+
10	rr	0	0	0	+	+	+	0	0	0	+	+	+	0	+	+	0	+	+	0	+	+	+	+	+	+	+	0	+	10	0	0	2+
11	R ₀ r'	+	+	0	0	+	+	0	0	0	+	0	+	0	+	0	+	+	0	0	0	+	+	+	+	+	+	0	+	11	0	W+	NT
Patient Cell																															0	0	2+

Reaction scale = 0 (no reaction) to 4+ (strong reaction)

Questions

1. What is the patient's ABO/Rh blood type?
2. What antibodies did you identify?
3. Can the weaker reaction strength on cell #11 seen in the panel be explained?
4. What are the possible causes or sources of the antibodies in this patient?
5. What additional testing would you do in the blood bank to help you determine the nature or source of the antibodies?

Answers

1. **What is the patient's ABO/Rh blood type?** The patient is group A, Rh-negative blood type. Refer to Chap. #1, question 1 answer for further information on forward and reverse ABO typing.
2. **What antibodies did you identify?** Alloantibody against the D antigen (Rh1) is present.
3. **Can the weaker reaction strength on cell #11 seen in the panel be explained?** Cell #11 is an R_0r' (Dce/Ce) red cell, meaning that the D antigen is in the *trans* position (i.e., on the opposite allele) relative to the C antigen. D antigen expression is weakened by the steric arrangement of the C antigen (known as the "Ceppellini" effect) [1]. Thus, the panel shows weaker reactions with these cells from the anti-D antibody present in the patient's serum. It is best to use R_2R_2 cells when testing for weak or low-titer anti-D antibodies. In reality though, this effect is not commonly seen on panels but is illustrated here as a learning point. See the table below for a review of the Rh haplotypes [2].

Wiener Haplotype	Fisher-Race Haplotype	Wiener Haplotype	Fisher-Race Haplotype
R_1	DCe	r	ce
R_2	DcE	r'	Ce
R_0	Dce	r''	cE
R_z	DCE	r ^y	CE

4. **What are the possible causes or sources of the antibodies in this patient?** We are not given a transfusion history in this pregnant patient, but it is possible that she was transfused with D-positive blood products in the past, either mistakenly or in the case of an emergency when sufficient Rh-negative blood was not available. It is also possible that the patient developed anti-D antibodies as a result of fetal-maternal hemorrhage, either during current pregnancy or during prior pregnancies (including abortion or fetal loss). Given that the current pregnancy is uncomplicated, the most likely explanation for the anti-D antibodies is passive administration of anti-D (i.e., Rh immune globulin, RhIg). RhIg (300 mcg dose) is routinely given at 28 weeks of gestation to Rh-negative women who have not been previously sensitized [2].

5. **What additional testing would you do in the blood bank to help you determine the nature or source of the antibodies?** Besides careful history taking, including all pregnancies, abortions, transfusions, and RhIg injections, the titer of anti-D antibodies could be helpful in distinguishing anti-D from active immunization (i.e., exposure to Rh-positive red blood cells, RBCs) versus passive immunization (i.e., Rh immune globulin). A low titer of anti-D (i.e., titer ≤ 4) would favor passively acquired anti-D versus higher titers of the antibody. A room temperature indirect antiglobulin test (IAT) may also be of value since the presence of such reactions would indicate the presence of immunoglobulin M (IgM) anti-D (i.e., newly developing anti-D); IgM is not present in manufacturer RhIg preparations and thus would indicate active immunization. In any case, a history of RhIg injection should always be elicited to confirm the suspicion of passively acquired anti-D [2].

References

1. Ceppellini R, Dunn LC, Turri M. An interaction between alleles at the Rh locus in man which weakens the reactivity of the Rh₀ factor (D₀). *Proc Natl Acad Sci U S A*. 1955;41:283.
2. Denomme GA, Westhoff CM. The Rh system. In: Roback JD, Grossman BJ, Harris T, Hillyer CD, editors. *Technical manual*. 18th ed. Bethesda: AABB; 2014. p. 320.

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