



Immunohematology Case Studies 2023 – 1

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Clinical History



- April 2019: 78 year old male Caucasian patient expecting heart surgery
- Transfusion history of 3 red blood cell concentrates in 2001 and 2 red blood cell units in 2003
- Blood group O, R2r (D+ C- c+ E+ e+) K-
- Positive antibody screening test
- Negative direct antiglobulin test

Methods



- Gel technique (BioRad, Switzerland) in indirect antiglobulin test
- Untreated and papain treated test red blood cells (BioRad, Switzerland and DRK-BSD Baden-Baden, Germany)

Serologic History



- Serologic records from 2003:
anti-Fy^a
and
additional weak positive reactions with
unclear specificity in antibody identification

Serological Results 1



- Present results:
anti-Fy^a (next slide) and
additional weak positive reactions with
unclear specificity in antibody identification
(gel technique, indirect antiglobulin test)
- The unclear reactions weaker with papain-
treated cells
- 8 cross-matches with Fy(a-) red cell units:
3 weakly positive and 5 negative
(gel technique, indirect antiglobulin test)

Genotyped in-house Panel 1

Untreated and papain treated RBCs in indirect antiglobulin test; gel technique



DRK-BSD Identification RedCells

IVD CE 0344

LOT DRK-BSD IRC-0043 DRK-BSD IRC-0043P

2019-03-18



System	Rh		Rh					Kell				Duffy		Kidd		Lewis		P	MNS				Xg	Lutheran		Dombrock		Auberger		Spezial-Antigene Special types	Results					
	Rh	Component Lot	D	C	c	E	e	C ^w	K	k	Kp ^a	Kp ^b	Fy ^a	Fy ^b	Jk ^a	Jk ^b	Le ^a	Le ^b	P ₁	M	N	S	s	Xg ^a	Lu ^a	Lu ^b	Do ^a	Do ^b	Au ^a		Au ^b	IAT	Enzyme			
1	C ^w CD.ee	R1 ^w R1	70219380457	+	+	0	0	+	+	0	+	+	+	0	+	+	+	+	+	+	+	+	0	0	0	+	+	+	+	+	0	HLA ^a	1	--	--	
2	CCD.ee	R1R1	70319100085	+	+	0	0	+	+	0	+	0	+	0	+	0	+	+	0	+	0	+	0	0	0	+	+	0	+	0		2	(+)	VW		
3	ccD.EE	R2R2	70119300040	+	0	+	+	0	0	0	+	0	+	0	+	0	0	+	+	+	+	+	0	+	0	+	+	+	+	+		3	++	VW		
4	ccD.ee	Ror	70419100093	+	0	+	0	+	0	0	+	0	+	0	+	0	0	+	0	+	0	0	+	+	0	+	+	0	+	0		4	++	VW		
5	Ccee	r ⁺ r	70119500128	0	+	+	0	+	0	0	+	0	+	0	+	0	+	+	+	+	0	0	+	+	+	+	+	0	+	0	KCAM-	5	(+)	+		
6	ccEe	r ⁺ r	70319100073	0	0	+	+	+	0	0	+	0	+	+	0	0	+	0	0	0	+	0	+	+	0	+	+	+	+	+		6	--	--		
7	ccee	rr	70119260338	0	0	+	0	+	0	+	+	0	+	0	+	+	0	+	+	+	+	+	+	+	+	+	+	+	+	+	Lu14 ⁺ WH ⁺	7	--	--		
8	ccee	rr	70419406106	0	0	+	0	+	0	0	+	+	0	+	+	0	+	+	0	+	+	0	+	0	+	+	+	+	+	0	HLA ^a	8	++	VW		
9	ccee	rr	70119100100	0	0	+	0	+	0	0	+	0	+	0	+	0	0	+	+	+	+	+	0	+	+	+	+	+	+	0		9	(+)	VW		
10	ccee	rr	70119260185	0	0	+	0	+	0	0	+	+	0	+	0	+	0	+	+	+	+	+	+	0	+	+	+	+	+	+	Yk(a ⁺ Y ^w) ^a Yt(b ⁺) ^a	10	(+)	VW		
11	ccee	rr	70219320035	0	0	+	0	+	0	0	+	+	0	+	0	+	0	0	+	+	0	0	+	0	+	+	+	+	+	0	Co(b ⁺) Cs(a ⁻) ^a	11	++	VW		
Patientenzellen Patient's cells																																				

Siehe Anmerkungen auf der Rückseite / Refer to remarks on the reverse

Name:

Blutgruppe:
Blood group:

Interpretation:

Anti-Fy^a + ???

Datum / Unterschrift:
Date / Signature:

Serological Results 2



- The additional positive reactions possibly associated with the Knops blood group system because the KCAM negative test cell shows the strongest reaction
 - Antibody to an antigen antithetical to KCAM (KN9)?
(so far not described)

Use of the genotyped 2 in-house Panel

Blood group alleles for special types tested for the in-house Panel:

Do(a/b); Yt(a/b); Di(a/b) , LW(a/b)

Js(a/b); K11/K17

Lu:8,14; Au(a/b); Sc:1,2

*Kn(a/b); McC(a/b); Sl:1,2; Yk(a+/-); **KCAM+/-***

Cx+/-; Vel+/-

Ch:1,2,3,4,5,6; Rg:1,2

KCAM negative phenotype
KN*01.-09 (KCAM-; c.4843A>G; p.1615Val)

Genotyped in-house Panel 3

Untreated and papain treated RBCs in indirect antiglobulin test; gel technique



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	Rh	Component Lot	D	C	c	E	e	C ^w	K	k	Kp ^a	Kp ^b	Fy ^a	Fy ^b	Jk ^a	Jk ^b	Le ^a	Le ^b	P ₁	M	N	S	s	Xg ^a	Lu ^a	Lu ^b	Do ^a	Do ^b	Atr ^a	Atr ^b	IAT	Enzyme							
1	C ^w CD.ee	R1 ^w R1	70219380457	+	+	0	0	+	+	0	+	+	+	0	+	+	+	+	+	+	+	+	0	0	0	+	+	+	+	+	0	HLA ^a	1	--	--	+/-			
2	CCD.ee	R1R1	70319100085	+	+	0	0	+	0	+	+	0	+	0	+	0	+	+	0	+	0	+	0	0	0	+	+	0	+	0		2	(+)	VW	+/+				
3	ccD.EE	R2R2	70119300040	+	0	+	+	0	0	0	+	0	+	+	0	0	0	+	+	+	+	0	+	0	+	+	+	+	+	+		3	++	VW	+/+				
4	ccD.ee	Ror	70419100093	+	0	+	0	+	0	0	+	0	+	+	0	0	+	0	+	0	0	+	+	0	+	+	0	+	0		4	++	VW	+/+					
5	Ccee	r'r	70119500126	0	+	+	0	+	0	0	+	0	+	0	0	+	0	+	+	0	0	+	+	+	+	+	0	+	0	KCAM ⁻	5	++	+	-/+					
6	ccEe	r''r	70319100073	0	0	+	+	+	0	0	+	0	+	0	+	0	0	+	0	0	+	0	+	+	+	+	+	+	+		6	--	--	+/-					
7	ccee	rr	70119280338	0	0	+	0	+	0	+	+	0	+	0	0	+	+	0	+	+	+	+	+	+	+	+	+	+	+	Lu14 ⁺ WH ⁺	7	--	--	+/-					
8	ccee	rr	70419406106	0	0	+	0	+	0	0	+	0	+	+	0	+	+	0	+	+	0	+	0	+	+	+	+	+	0	HLA ^a	8	++	VW	+/+					
9	ccee	rr	70119100100	0	0	+	0	+	0	0	+	0	+	0	0	+	0	0	+	+	0	+	0	+	+	+	+	+	0		9	(+)	VW	+/+					
10	ccee	rr	70119280185	0	0	+	0	+	0	0	+	+	+	0	0	+	0	+	0	+	+	+	+	+	0	+	+	+	+	+	Yk(a ⁺ vm) ^a Yt(b ⁺) ^a	10	(+)	VW	+/+				
11	ccee	rr	70219320035	0	0	+	0	+	0	0	+	0	+	+	0	+	0	0	+	+	0	+	0	+	+	+	+	+	0	Co(b ⁺) Cs(a ⁻) ^a	11	++	VW	+/+					
Patientenzellen Patient's cells																												Patientenzellen Patient's cells											

**KCAM
Genotype**

Siehe Anmerkungen auf der Rückseite / Refer to remarks on the reverse

Name:

Blutgruppe:
Blood group:

Interpretation:

Datum / Unterschrift:
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Genotyping and Serological Results 1



Interpretation of the panel results:

- One Fy(a-), KCAM negative test cells 2+ positive
 - All 3 Fy(a-), KCAM heterozygous test cells weakly reactive
 - All 3 Fy(a-), KCAM homozygous positive test cells negative
- **The unclear reactions with Fy(a-) RBCs might be an antibody to an antigen antithetical to KCAM**

Genotyping and Serological Results 2



Testing further KCAM genotyped test cells

- 9 RBC samples Fy(a-),
KCAM negative: ++
 - 23 of 24 RBC samples Fy(a-),
heterozygous *KCAM* positive: (+)
 - 23 Fy(a-) RBC samples,
homozygous KN*01 (*KCAM* positive): negative
 - Patient's genotype: homozygous *KCAM* positive
- **The unclear reactions with Fy(a-) RBCs
definitely caused by an antibody to a new antigen
antithetical to *KCAM***

Genotyping and Serological Results 3



- **The new Knops antigen was named KDAS (KN10)**
- **It was recognized by the ISBT in June 2019 at the International ISBT Congress in Basel, CH**
- **The antibody could not be inhibited by recombinant Knops blood group protein (whereas anti-KCAM is inhibited)**

Frequency Studies of KDAS and KCAM Antigens



Results of genotyping of 1,730 blood donors in South-Western Germany:

Frequency of the *KN*01.-09* allele (= *KN*01.10*) 23.9 %

- **632 (36.5 %) heterozygous donors (predicted KDAS+ and KCAM+)**
- **98 (5.7 %) homozygous donors (predicted KDAS+ and KCAM-)**

- **Predicted KCAM antigen frequency: 94.3 %**
- **Predicted KDAS antigen frequency: 42.2 %**

Lessons Learned by the Case



- We have identified a new Knops blood group antigen **KDAS (KN10)** which is antithetical to **KCAM (KN09)**
- The KDAS frequency is 42.2 %
(predicted from genotype in southwestern Germany)
- The KCAM frequency is 94.3 %
(predicted from genotype in southwestern Germany)

References



- Scharberg EA, et al. KDAS, a new blood group antigen in the Knops blood group system antithetical to KCAM. *Transfusion* 2020;60;E25–E27.
- Westhoff C, et al. Two examples of Anti-KCAM, an antibody to an antigen in the Knops system (Abstract). *Transfusion* 48 (Suppl.); 189A
- Reid ME, Lomas-Francis C, Olsson ML. *The blood group antigen factsbook*. 3rd ed. London (UK): Academic Press; 2012