



Basic Blood Bank Testing for the Clinician

Yulia Lin, MD, FRCPC, CTBS

Transfusion Medicine & Tissue Bank, Sunnybrook Health Sciences Centre

Dept of Laboratory Medicine & Pathobiology, University of Toronto

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Disclosure

- None

Objectives

- By the end of this session, the attendee will be able to:
 - List the blood bank tests required before blood is available for a patient
 - State how long it takes for this testing to be done
 - Accept uncrossmatched blood when appropriate

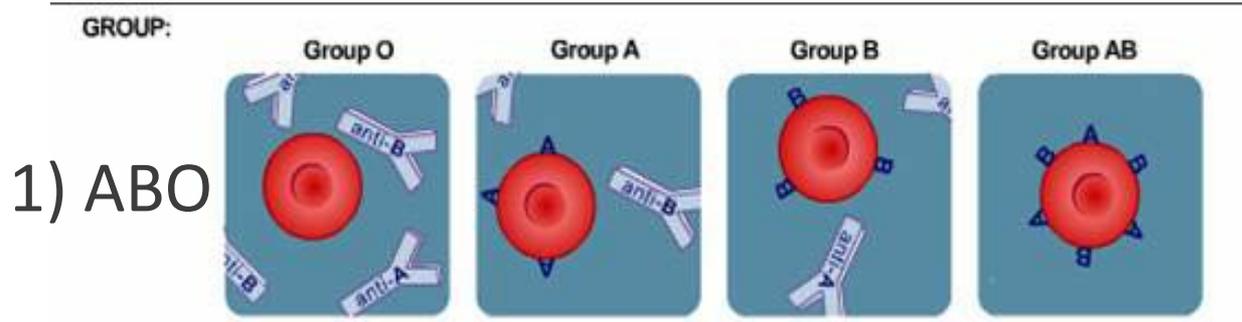
Poll



You are assessing a 70 y.o with a fractured hip on the wait and see OR list. The hemoglobin is 10 g/dL. What blood bank test should you order?

- A. Group
- B. Group & Screen
- C. Direct antiglobulin test
- D. Crossmatch

What does the Group test?

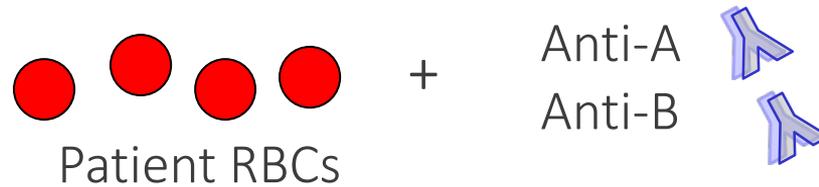


Mexico	61%	27%	9%	2%
Uganda	50%	25%	21%	4%
Canada	46%	42%	9%	3%
Taiwan	44%	26%	24%	6%

Anti-A and Anti-B are naturally occurring (IgM)

How is the Group test performed?

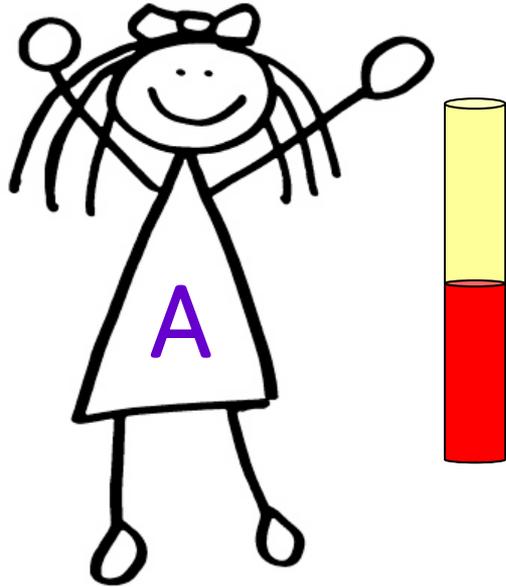
- What ABO antigens are on patient's RBCs?



- What ABO antibodies does patient have?

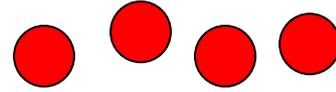


ABO Blood Group

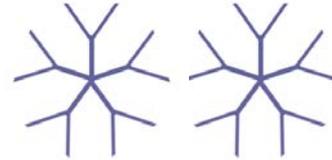


Group A Patient

Immediate Spin



Group A RBCs
+ IgM Anti-A



5 min

↓
**Agglutination
= Positive Test**

Poll

Which is the universal red cell donor?

A. Group A

B. Group B

C. Group O

D. Group AB

Poll

Which is the universal plasma donor?

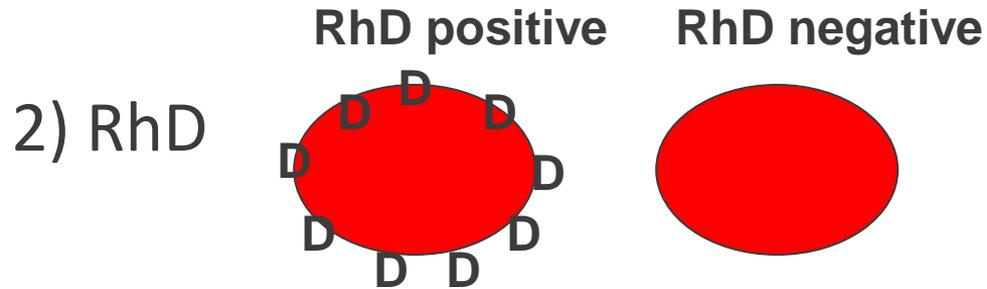
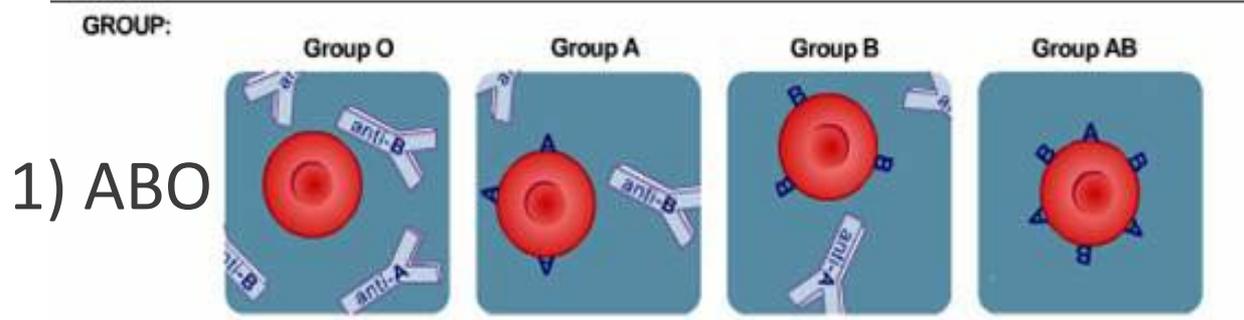
A. Group A

B. Group B

C. Group O

D. Group AB

What does the Group test?

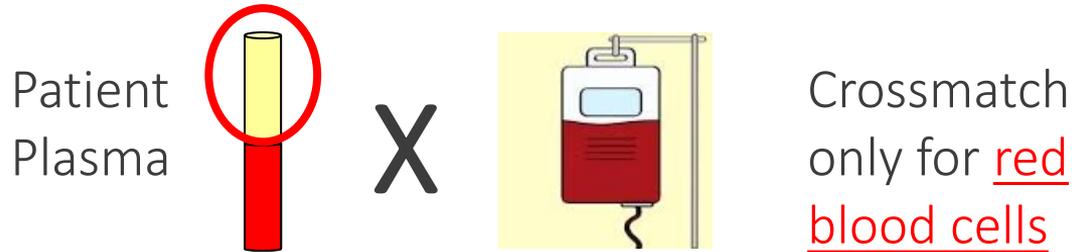


Anti-D develops only after exposure



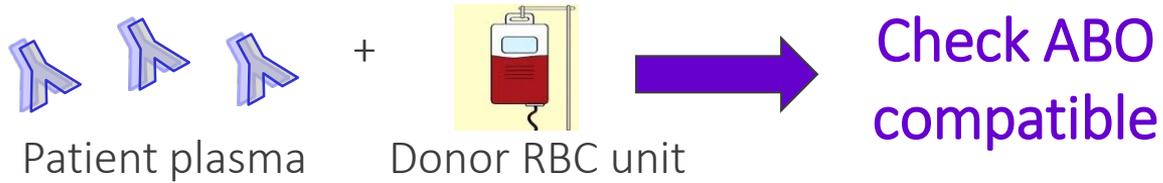
Crossmatch

- Detect compatibility between recipient plasma and donor red cells



Crossmatch

- Immediate spin (~5 minutes)

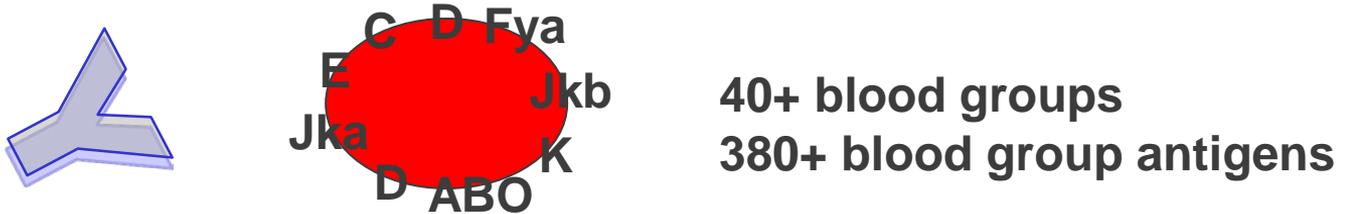


- Crossmatch may be done ahead of elective surgery
- In Rwanda, if the crossmatch is incompatible, then repeat with other units until compatible

Blood Bank Testing:
next level

Group and Screen

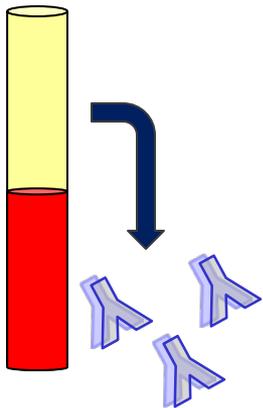
- Antibody Screen: screens for antibodies against non-ABO red blood cell antigens



- Antibodies are developed from previous exposure: pregnancy or prior transfusion

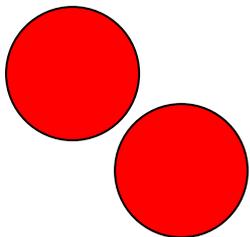
Antibody Screen

(indirect antiglobulin test – IAT)



Patient
Plasma (IgG)

+



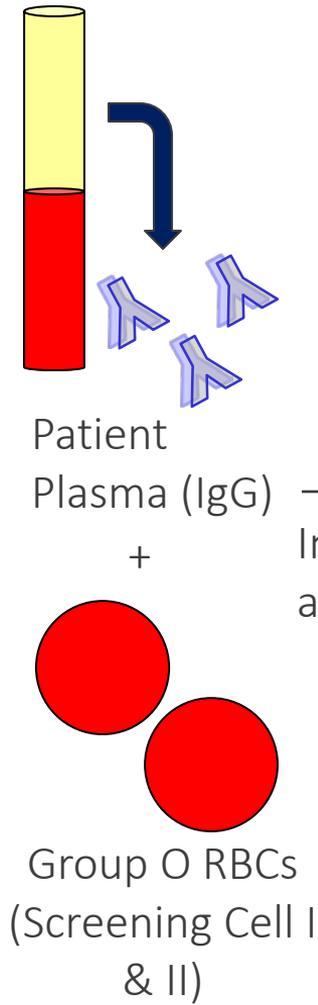
Group O RBCs
(Screening Cell I
& II)

	Rh-Hr							Kell					Duffy		Kidd		Lewis		P		MNS				Lutheran		Sex-linked
	D	C	E	c	e	C ^w	K	k	Kp ^a	Kp ^b	Js ^a	Js ^b	Fy ^a	Fy ^b	Jk ^a	Jk ^b	Le ^a	Le ^b	P ₁	M	N	S	s	Lu ^a	Lu ^b	Xg ^a	
I	+	0	0	0	+	0	+	+	0	+	0	+	0	0	0	+	0	0	0	+	+	0	+	0	+	0	
II	+	+	+	+	0	0	0	+	0	+	0	+	+	+	0	+	+	+	+	+	0	+	+	0	+	+	

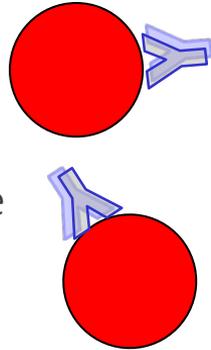
Antibody Screen

(indirect antiglobulin test – IAT)

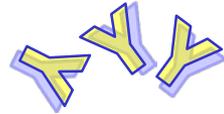
45 minutes



Incubate
at 37°C



Add Anti-Ig
(Anti-human
globulin)



**Agglutination
= Positive Test**

Antibody Screen Results

- Antibody screen negative

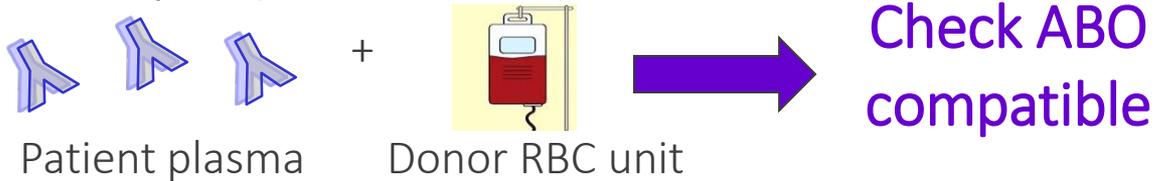
	Rh-Hr						Kell						Duffy		Kidd		Lewis		P	MNS				Lutheran		Sex-linked	37 PEG
	D	C	E	c	e	C ^w	K	k	Kp ^a	Kp ^b	Jk ^a	Jk ^b	Fy ^a	Fy ^b	Jk ^a	Jk ^b	Le ^a	Le ^b	P ₁	M	N	S	s	Lu ^a	Lu ^b	Xg ^a	AHG
I	+	0	0	0	+	0	+	+	0	+	0	0	0	0	+	0	0	0	0	+	+	0	+	0	+	0	0
II	+	+	+	+	0	0	0	+	0	+	0	+	+	+	0	0	+	+	+	+	0	+	+	0	+	+	0

Limitation: 97-98% sensitive
 (2-3% could have antibody against
 antigen not on antibody screen cells)

Crossmatch

- Screen negative = FAST crossmatch
 - Assume no antibodies: Check ABO compatible

- Immediate spin (~5 minutes)



- Electronic crossmatch (~2 minutes)
 - Recipient ABO on 2 occasions and validated computer system to detect compatibility

“2nd sample”

- Most common cause of ABO incompatibility is human error (wrong blood in tube = 1 in 1,600)
- The “2nd sample” confirms the ABO type
 - Historical group or 2nd sample drawn independently
 - **DO NOT DRAW 2 TUBES at same time and hold one back to send later! = DANGER**
- Electronic positive patient identification (barcode technology)
↓ errors to 1 in 14,606

Antibody Screen Results

- Antibody screen positive

	Rh-Hr						Kell						Duffy		Kidd		Lewis		P	MNS				Lutheran		Sex-linked	37 PEG
	D	C	E	c	e	C ^w	K	k	Kp ^a	Kp ^b	Jk ^a	Jk ^b	Le ^a	Le ^b	P ₁	M	N	S	s	Lu ^a	Lu ^b	Xg ^a	AHG				
I	+	0	0	0	+	0	+	+	0	+	0	+	0	0	0	0	+	+	0	+	0	+	0	0			
II	+	+	+	+	0	0	0	+	0	+	0	+	+	+	+	0	+	+	0	+	+	0	+	3+			



Chance that blood could be delayed because of extra steps to find blood!!

Full Crossmatch

- If antibody screen **positive** → **PROBLEM!!**
 1. Identify antibody (minutes to hours to days)
 2. Find antigen negative units (minutes to hours)
 3. Full indirect antiglobulin (IAT) crossmatch (45 minutes)

What if you don't have time...

RBC Product	Turn-Around Time	Comments
Crossmatched RBCs	45 minutes for patients without antibodies, up to 3 hours or more for patients with antibodies	Preferred choice, as safest product available

What if you don't have time...

RBC Product	Turn-Around Time	Comments
Uncrossmatched blood	5 minutes	Only in emergencies (when risks of delaying transfusion outweigh risks of acute hemolysis – watch for red urine and hypotension). Also delayed hemolysis
Crossmatched RBCs	45 minutes for patients without antibodies, up to 3 hours or more for patients with antibodies	Preferred choice, as safest product available

Uncrossmatched Blood

Group O Pos vs. Group O Neg

- 18M multiple gunshot wounds, hypotensive
- 25F MVC, blunt trauma, hemothorax, free fluid in abdomen
- 58F MVC, blunt trauma, pelvic fracture, hypotensive
- Remember that giving O negative does not address non-ABO antibodies

Summary

What does the group test?	
How long dose a group test take?	
How long does a crossmatch take?	
What does the antibody screen test?	
How long does a full crossmatch take?	
If there is a positive antibody screen or incompatible crossmatch, what does this mean for your patient?	

Summary

What does the group test?	ABO & RhD
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What does the antibody screen test?	Antibodies against non-ABO antigens
How long does a full crossmatch take?	45 minutes
If there is a positive antibody screen or incompatible crossmatch, what does this mean for your patient?	There may be a delay in blood availability 