



Basic Blood Bank Testing for the Clinician

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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

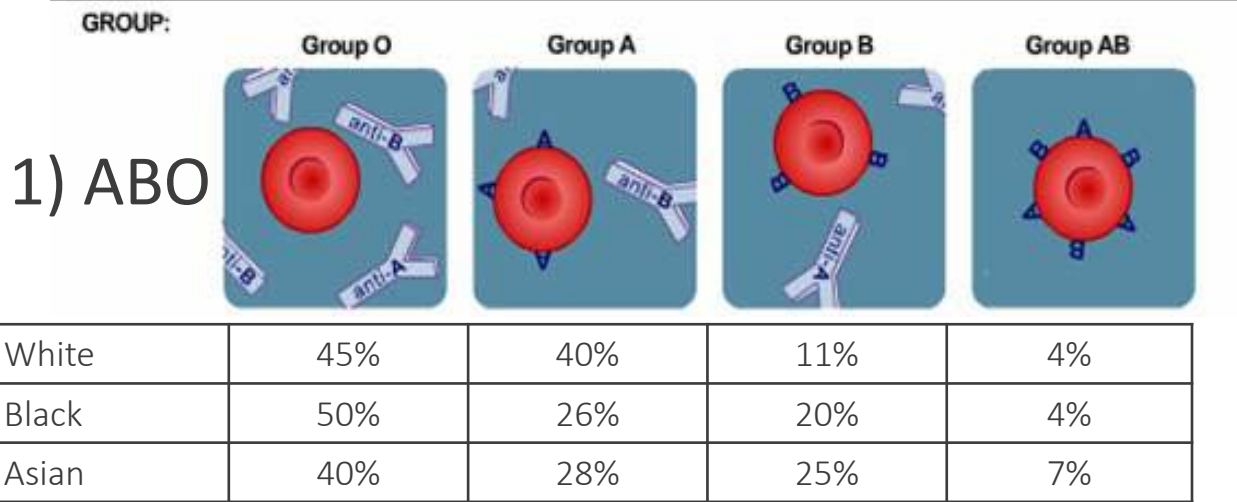
Poll



You are assessing a 75M with a fractured hip on the wait and see OR list. His hemoglobin is 110 g/L (chronic kidney disease). What blood bank test should you order?

- A. Group & Screen
- B. DAT
- C. Crossmatch
- D. Type & Cross

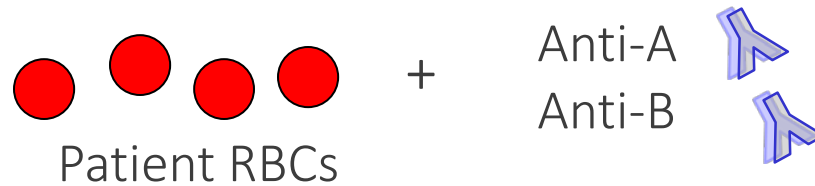
What does the Group test?



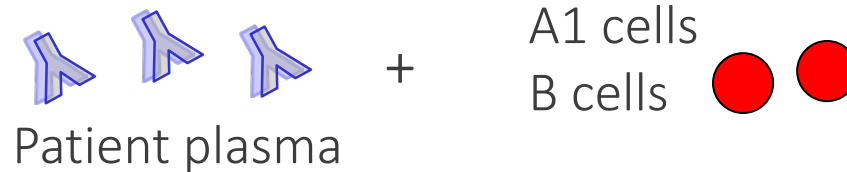
Anti-A and Anti-B are naturally occurring (IgM)

How is the Group test performed?

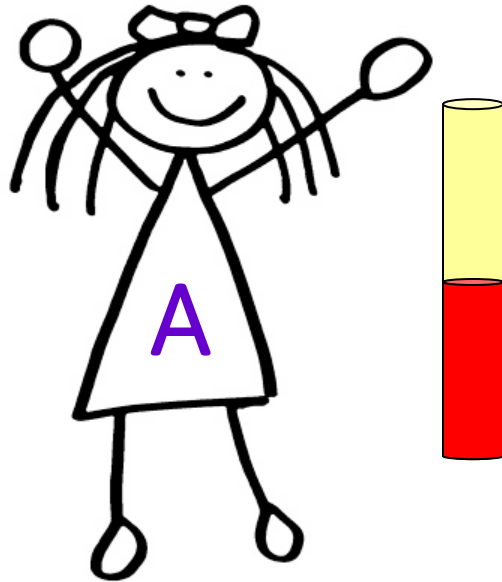
- What ABO antigens are on patient's RBCs?



- What ABO antibodies does patient have?

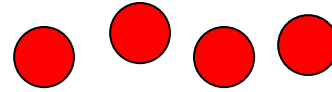


ABO Blood Group



Group A Patient

Immediate Spin



Group A RBCs
+ IgM Anti-A



5 min

Agglutination
= Positive Test

Poll

Which is the universal red cell donor?

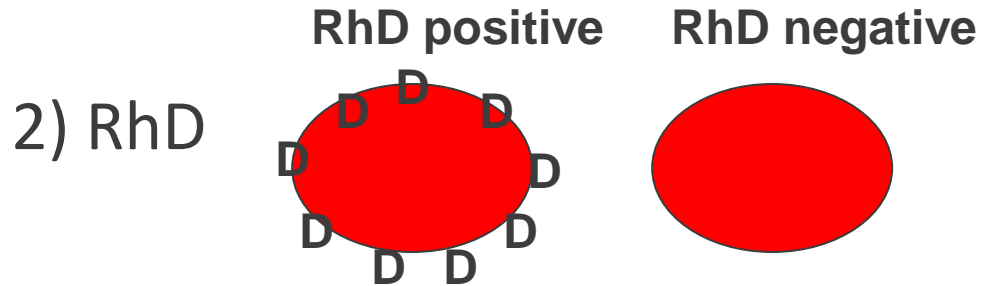
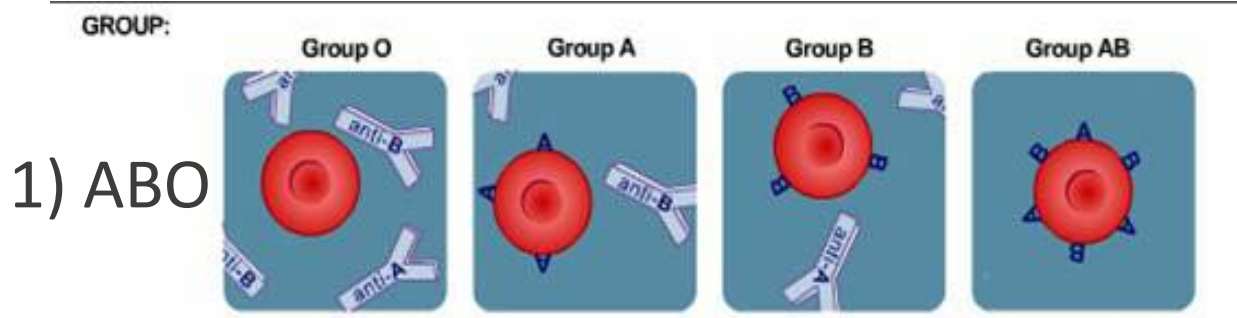
- A. Group A
- B. Group B
- C. Group O
- D. Group AB

Poll

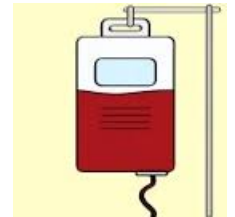
Which is the universal plasma donor?

- A. Group A
- B. Group B
- C. Group O
- D. Group AB

What does the Group test?

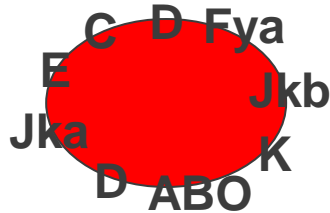


Anti-D develops only after exposure



Group and Screen

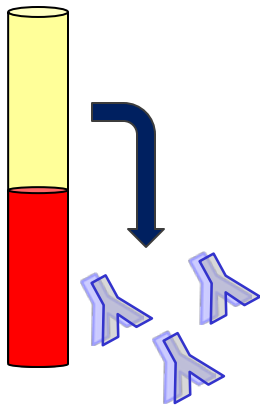
- Antibody Screen: screens for antibodies against non-ABO red blood cell antigens



35+ blood groups
346+ blood group antigens

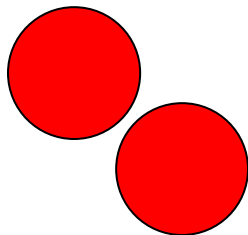
Antibody Screen

(indirect antiglobulin test – IAT)



Patient
Plasma (IgG)

+



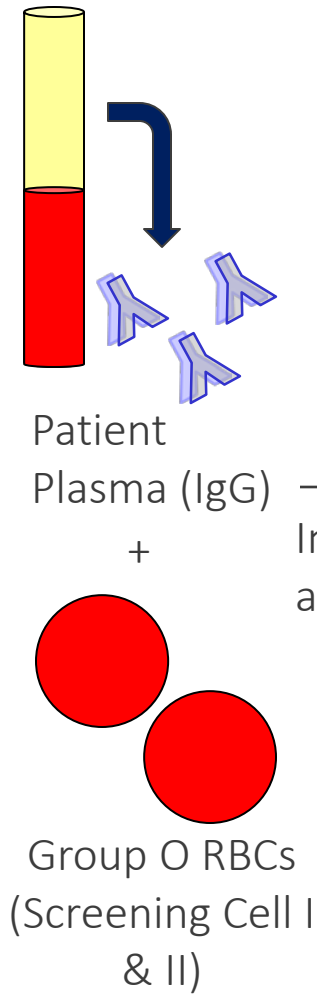
Group O RBCs
(Screening Cell I
& II)

	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

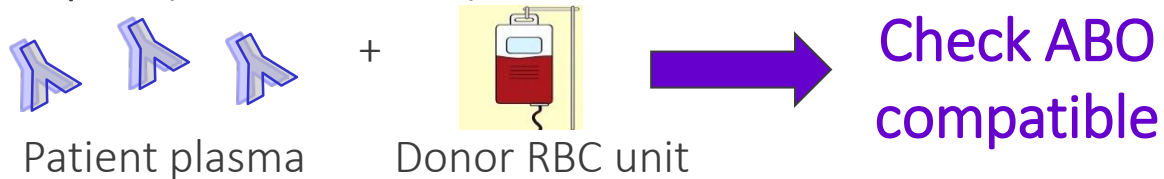
- Detect compatibility between recipient plasma and donor red cells



Crossmatch - FAST

- 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

Crossmatch – FAST

- If the antibody screen is negative and patient is eligible for a FAST crossmatch, then do not need to order crossmatch units

~~*Crossmatch 2 RBC units*~~

“Why do I need a 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	+	+	3+				



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

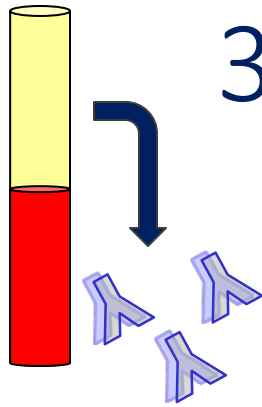
2) Find Antigen Negative Units

- Find antigen negative unit by label or by phenotyping (i.e. typing) the RBC unit in Blood Bank
- Phenotype patient

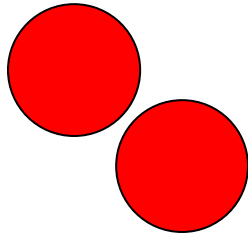


3) Full CROSSMATCH

45 minutes

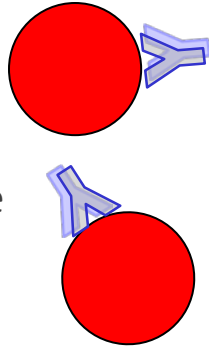


Patient Plasma
+

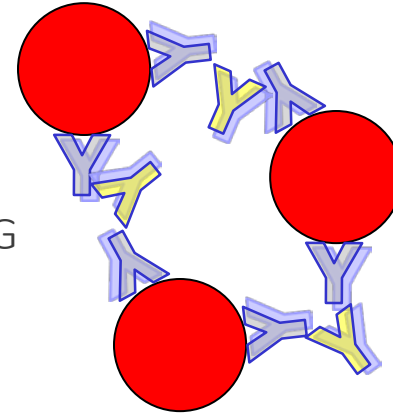


Donor RBCs

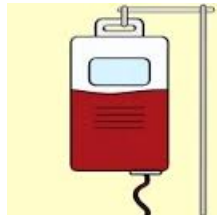
Incubate
at 37°C



Add Anti-IgG
(AHG)



**Agglutination
= Incompatible!**



Crossmatch - SLOW

- If antibody screen **positive** → **PROBLEM!!**
 1. Identify antibody (minutes to hours to days)
 2. Find antigen negative units (minutes to hours)
 3. Full crossmatch (45 minutes)
- Give Blood Bank as much notice as possible that RBC units are needed
- For surgery, Blood Bank will crossmatch units ahead of time as per the Maximum Surgical Blood Ordering Schedule (MSBOS)

Go or No Go?

- 75 M for hip fracture surgery:
 - Group A pos; Screen negative
 - Group A pos; Screen positive
 - What if the patient is on the OR table?
 - Group A pos; Screen positive; Anti-E; Crossmatch compatible
 - Group A pos; Screen positive; Anti-E; Crossmatch incompatible

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
- 65 F MVC, blunt trauma, pelvic fracture, hypotensive
- Remember that giving O negative does not address non-ABO antibodies

Summary

What does the group test?	
What does the antibody screen test?	
How long does a fast crossmatch take?	
When can the Blood Bank use a fast crossmatch?	
How long does a full/slow crossmatch take?	
If there is a positive antibody screen, what does this mean for your patient?	

Summary

What does the group test?	ABO & Rh
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How long does a full/slow crossmatch take?	45 minutes
If there is a positive antibody screen, what does this mean for your patient?	There may be a delay in blood availability 

One more practical point...

- What to do if you don't end up needing the unit?
- Return back to blood bank ASAP
 - Return within 60 minutes (CSA standards)
 - If in a cooler, return within cooler time (~ 4 hours)
- Return the products as you received them
 - RBCS in cooler: keep cooler closed and return in cooler
 - If platelets in a room temp bag, return in bag
 - If plasma in a separate bag, return in separate bag
 - If plasma in a cooler, then return in cooler