



# Basic Blood Bank Testing for the Clinician

Yulia Lin, MD, FRCPC, CTBS

Dept of Laboratory Medicine & Pathobiology,  
University of Toronto

Christopher Gashaija

Rwanda Biomedical Centre

# Disclosure

- Y. Lin
  - Research funding from Canadian Blood Services and Octapharma
  - Consultant for Choosing Wisely Canada
- C. Gashaija
  - 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

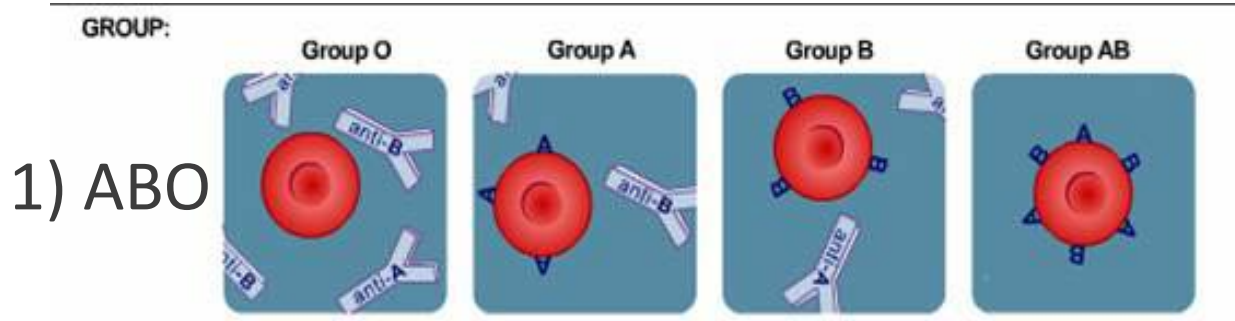
# Poll



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?

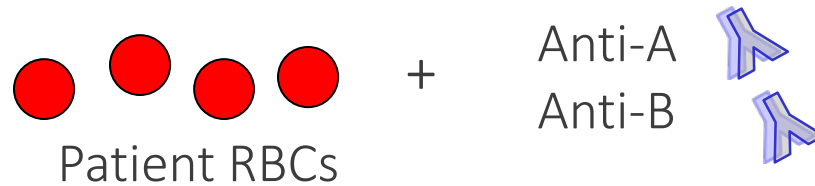


Mexico	61%	27%	9%	2%
Uganda	50%	25%	21%	4%
Canada	46%	42%	9%	3%

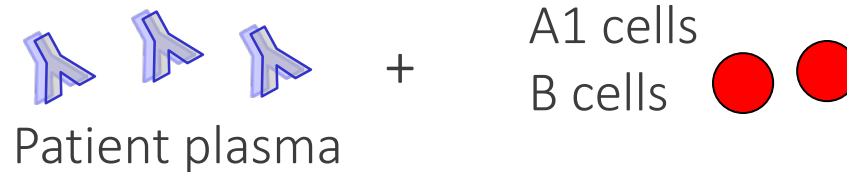
Anti-A and Anti-B are naturally occurring (IgM)

# How is the Group test performed?

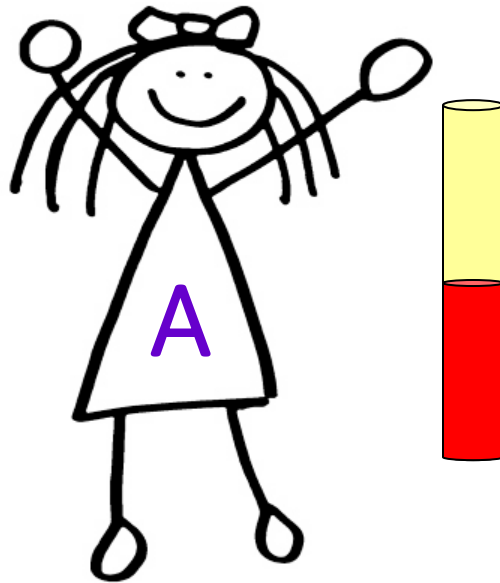
- What ABO antigens are on patient's RBCs?



- What ABO antibodies does patient have?

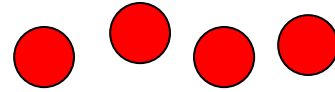


# ABO Blood Group

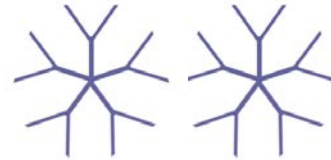


Group A Patient

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?

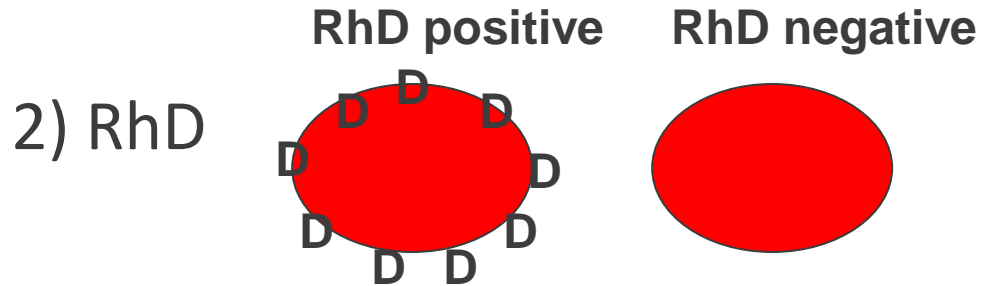
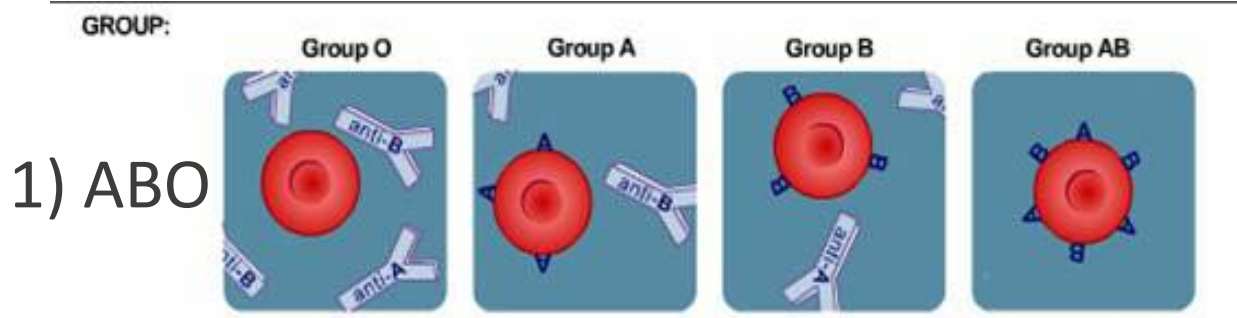
A. Group A

B. Group B

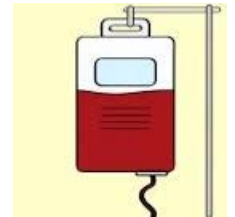
C. Group O

D. Group AB

# What does the Group test?



Anti-D develops only after exposure



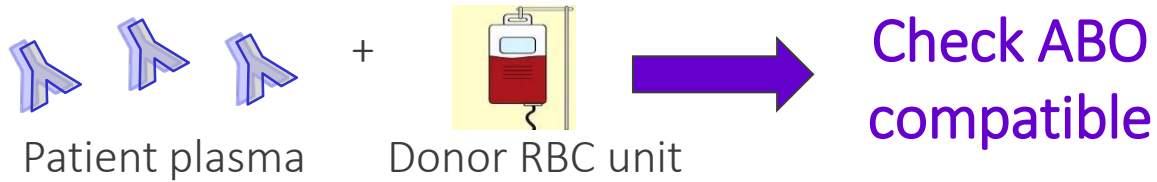
# Crossmatch

- Detect compatibility between recipient plasma and donor red cells



# Crossmatch

- Immediate spin (~5 minutes)

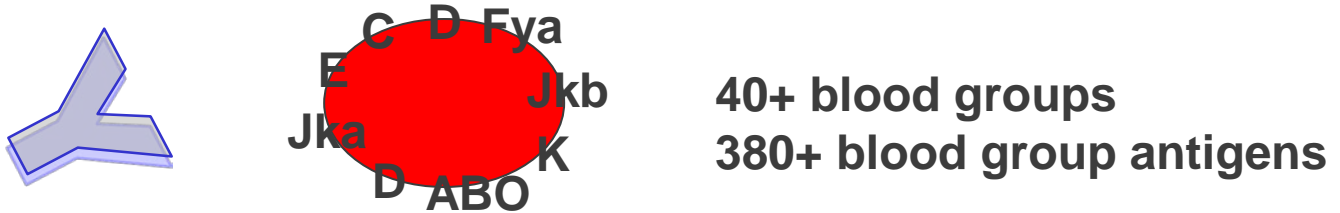


- Crossmatch may be done ahead of elective surgery
- In Rwanda, if the crossmatch is incompatible, then repeat with other units until compatible

Blood Bank Testing:  
next level

# Group and Screen

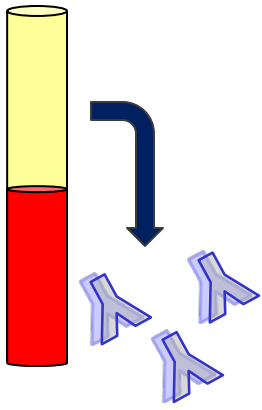
- Antibody Screen: screens for antibodies against non-ABO red blood cell antigens



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

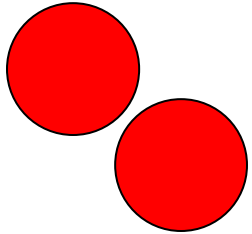
# Antibody Screen

*(indirect antiglobulin test – IAT)*



Patient  
Plasma (IgG)

+



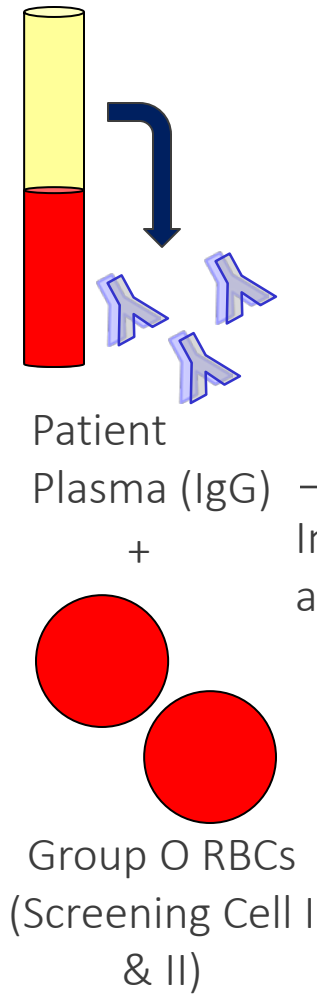
Group O RBCs  
(Screening Cell I  
& II)

	Rh-Hr							Kell					Duffy		Kidd		Lewis		P		MNS				Lutheran		Sex-linked
	D	C	E	c	e	C <sup>w</sup>	K	k	Kp <sup>a</sup>	Kp <sup>b</sup>	Jk <sup>a</sup>	Jk <sup>b</sup>	Fy <sup>a</sup>	Fy <sup>b</sup>	Jk <sup>a</sup>	Jk <sup>b</sup>	Le <sup>a</sup>	Le <sup>b</sup>	P <sub>1</sub>	M	N	S	s	Lu <sup>a</sup>	Lu <sup>b</sup>	Xg <sup>a</sup>	
I	+	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	+	+

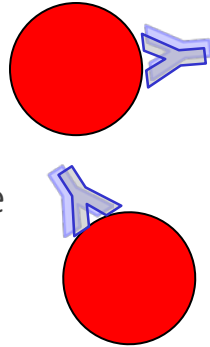
# Antibody Screen

*(indirect antiglobulin test – IAT)*

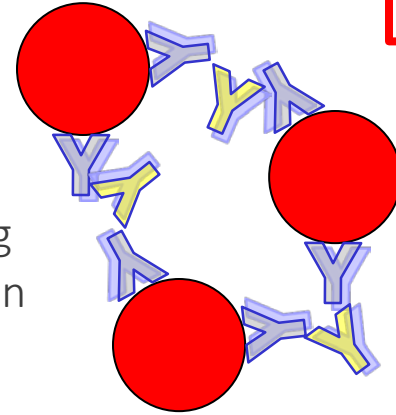
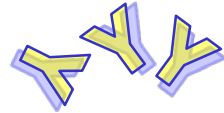
45 minutes



Incubate at 37°C



Add Anti-Ig (Anti-human globulin)



**Agglutination  
= Positive Test**



# Antibody Screen Results

- Antibody screen negative

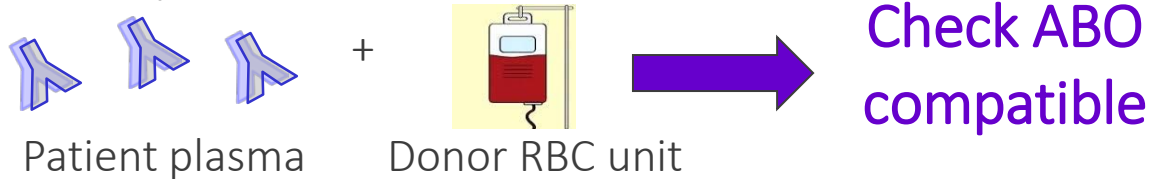
	Rh-Hr						Kell						Duffy		Kidd		Lewis		P	MNS				Lutheran		Sex-linked	37 PEG
	D	C	E	c	e	C <sup>w</sup>	K	k	Kp <sup>a</sup>	Kp <sup>b</sup>	Jk <sup>a</sup>	Jk <sup>b</sup>	Fy <sup>a</sup>	Fy <sup>b</sup>	Jk <sup>a</sup>	Jk <sup>b</sup>	Le <sup>a</sup>	Le <sup>b</sup>	P <sub>1</sub>	M	N	S	s	Lu <sup>a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

# “2<sup>nd</sup> sample”

- Most common cause of ABO incompatibility is human error (wrong blood in tube = 1 in 1,600)
- The “2<sup>nd</sup> sample” confirms the ABO type
  - Historical group or 2<sup>nd</sup> 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 <sup>w</sup>	K	k	Kp <sup>a</sup>	Kp <sup>b</sup>	Jk <sup>a</sup>	Jk <sup>b</sup>	Fy <sup>a</sup>	Fy <sup>b</sup>	Jk <sup>a</sup>	Jk <sup>b</sup>	Le <sup>a</sup>	Le <sup>b</sup>	P <sub>1</sub>	M	N	S	s	Lu <sup>a</sup>	Lu <sup>b</sup>	Xg <sup>a</sup>	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	+	+	3+	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?	

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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 