



Basic Blood Bank Testing for the Clinician

Transfusion Camp 2019-2020

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Disclosure

- No disclosures related to this session
- Grants/Research Support
 - Novartis, Octapharma
- Consulting
 - Amgen, Pfizer

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

Blood Bank Tests

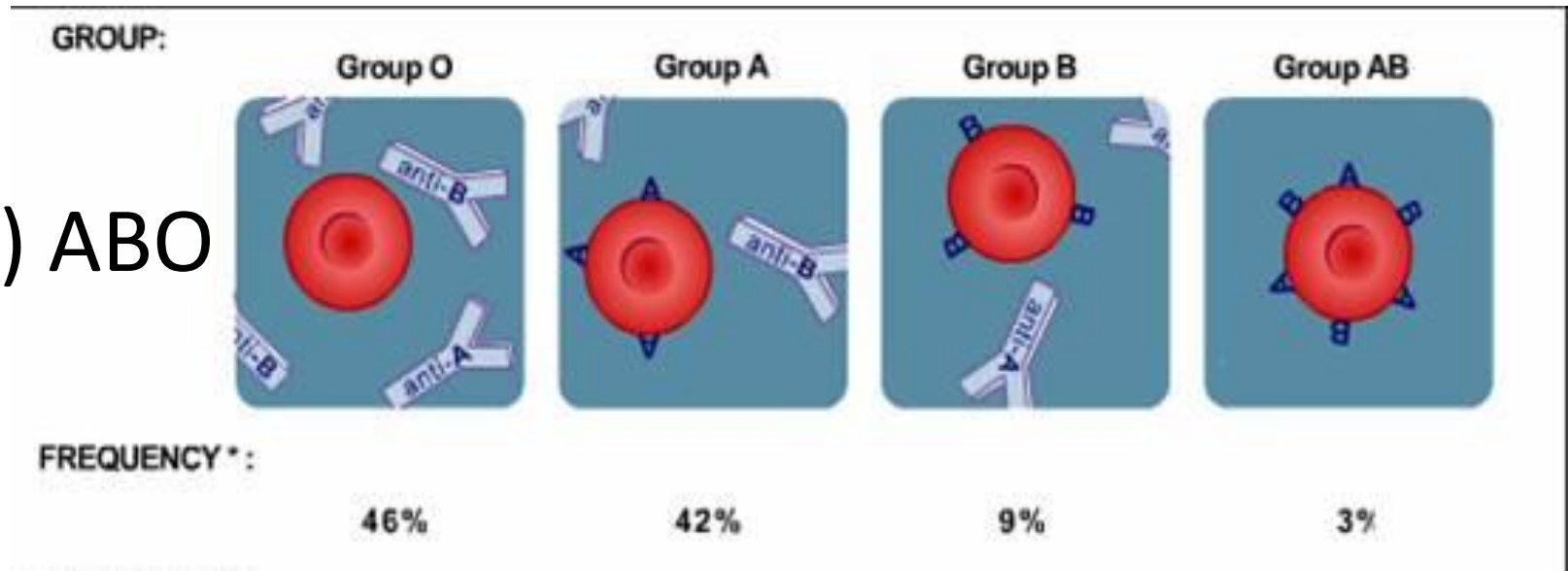


You are assessing a 75M with fracture hip on the wait and see OR list. His hemoglobin is 110 g/L (chronic kidney disease). What blood bank test should you order?

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

What does the Group test?

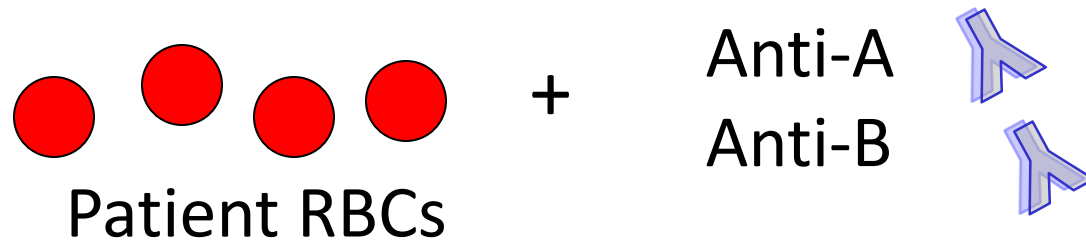
1) ABO



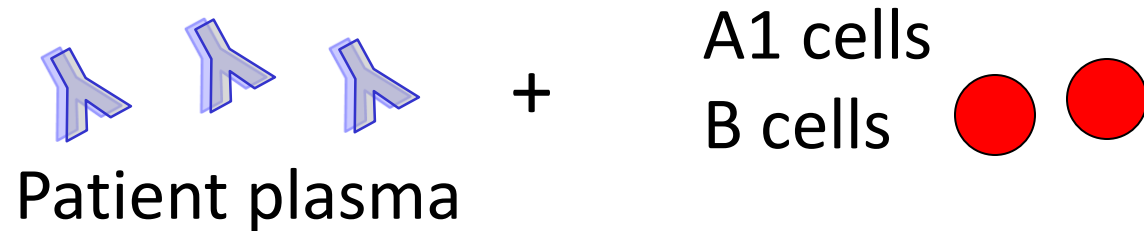
Naturally occurring antibodies to A and B antigens not present on own RBCs (IgM)

How is the Group test performed?

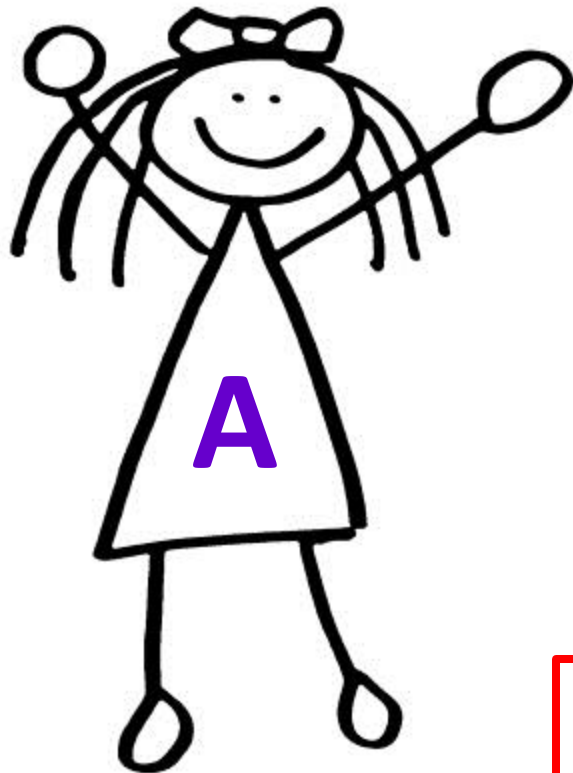
- What ABO antigens are on patient's RBCs?



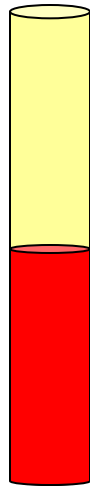
- What ABO antibodies does patient have?



ABO Blood Group

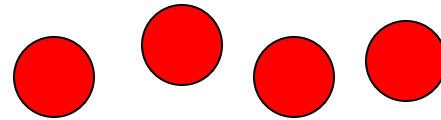


Group A Patient

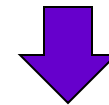
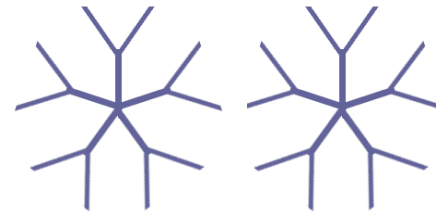


5 min

Immediate Spin



Group A RBCs
+ IgM Anti-A



Agglutination
= Positive Test

Which is the universal red cell donor?

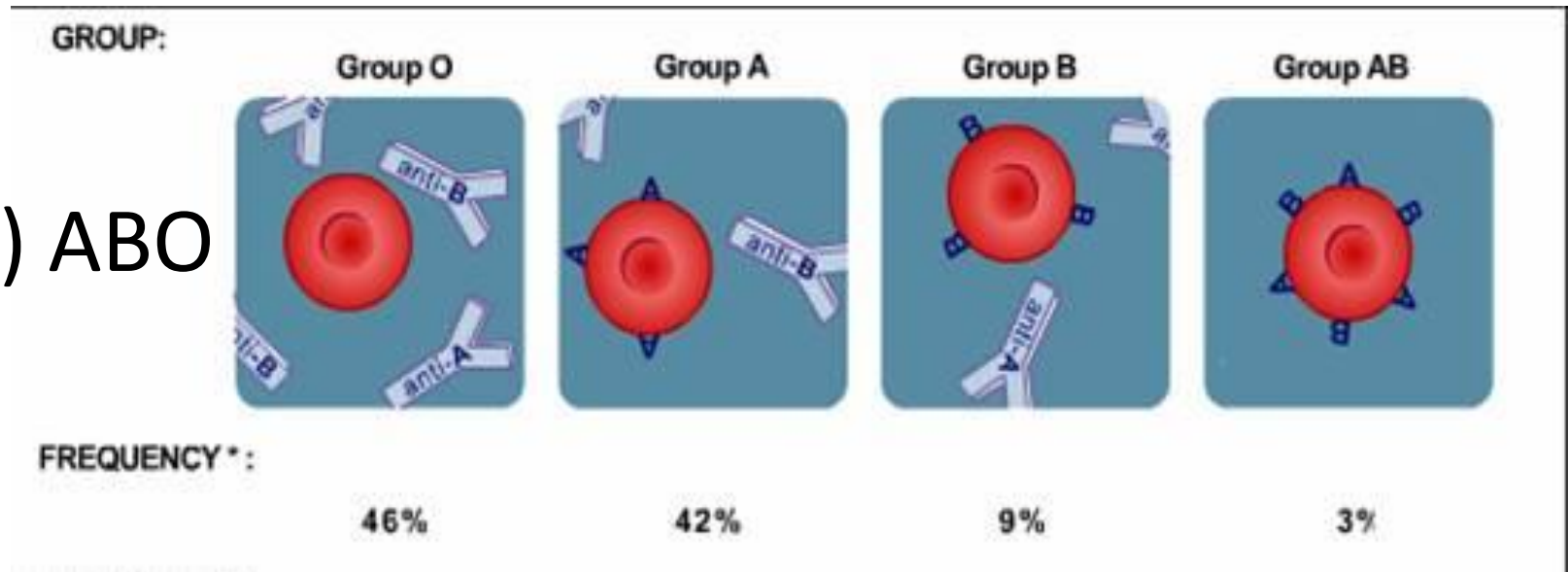
- A. Group A
- B. Group B
- C. Group O
- D. Group AB

Which is the universal plasma donor?

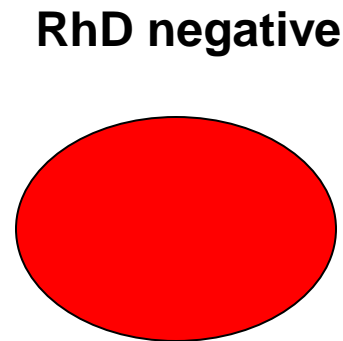
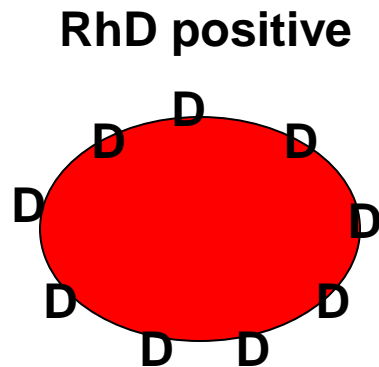
- A. Group A
- B. Group B
- C. Group O
- D. Group AB

What does the Group test?

1) ABO



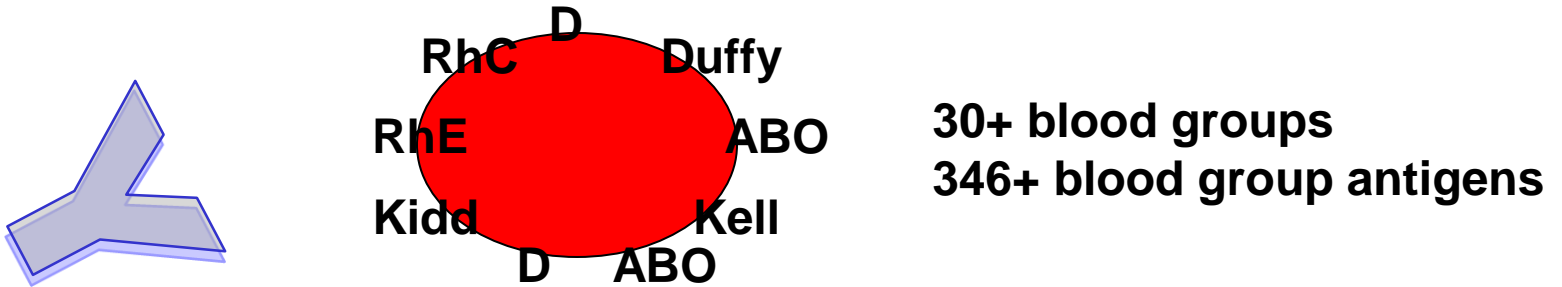
2) RhD



Anti-D develops only after exposure

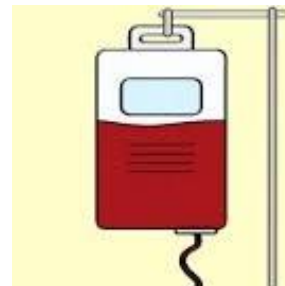
Group and Screen

- Antibody Screen
 - Screens patient for antibodies against minor (non-ABO) red blood cell antigens



- Antibodies can develop after exposure to RBCs

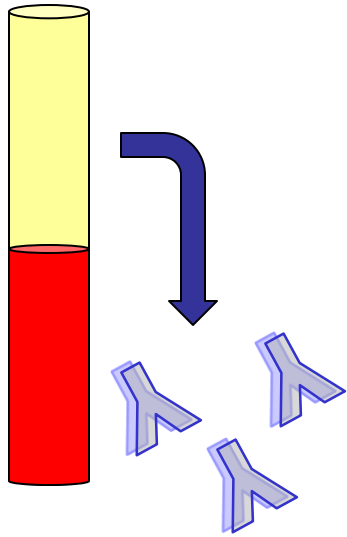
Pregnancy



Transfusion

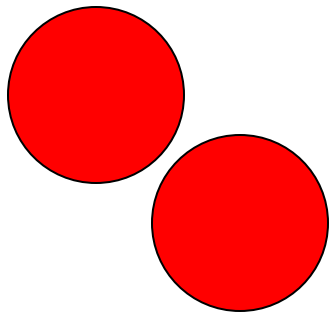
Antibody Screen

(indirect antiglobulin test – IAT)



Patient
Plasma (IgG)

+

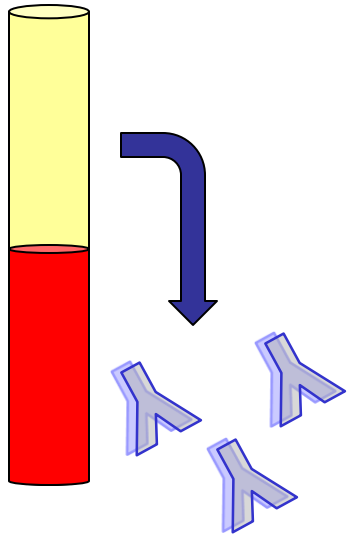


Group O RBCs
(Screening Cell I
& II)

	Rh-Hr						Kell						Duffy		Kidd		Lewis		ϖ	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

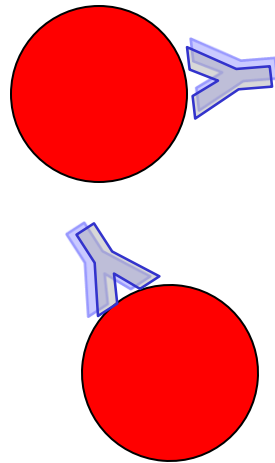
(indirect antiglobulin test – IAT)



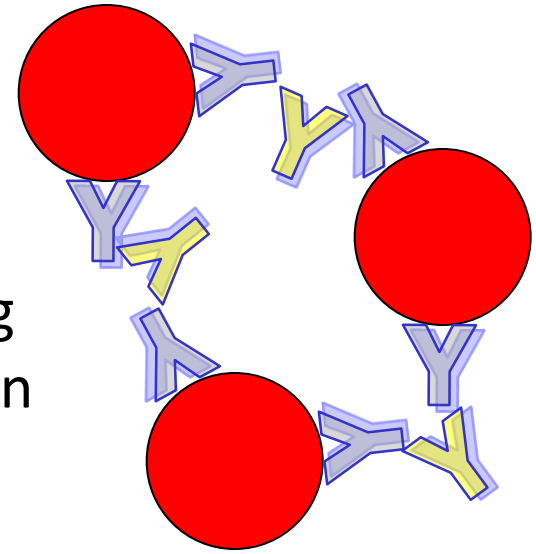
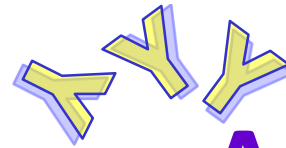
Patient
Plasma (IgG)

+

Incubate
at 37°C



Add Anti-Ig
(Anti-human
globulin)



Group O RBCs
(Screening Cell I
& II)

45 minutes

**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	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	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

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

Crossmatch

- 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)

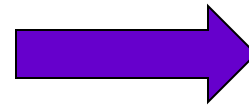


Patient plasma

+



Donor RBC unit



**Check ABO
compatible**

- Electronic crossmatch (~2 minutes)

- Recipient ABO double-checked and computer system validated to detect ABO incompatibility between recipient and donor unit

Crossmatch – FAST

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

~~*Crossmatch 2 RBC units*~~

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	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	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+



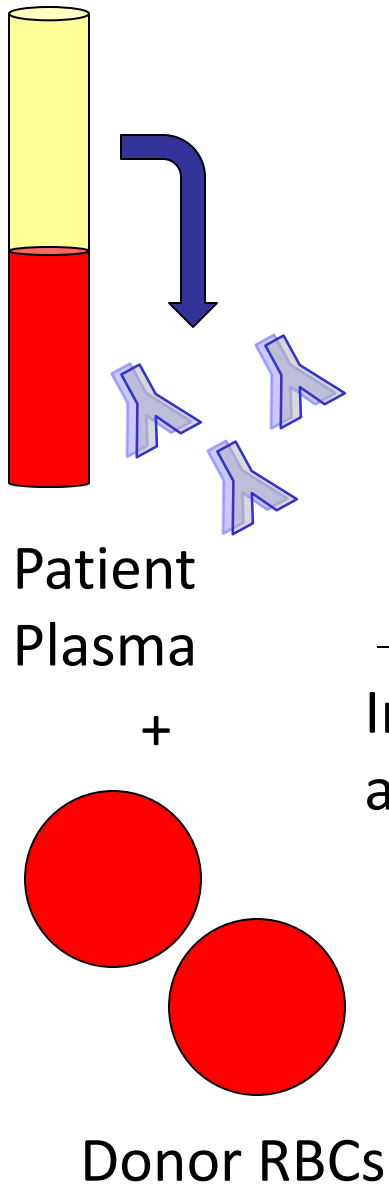
Chance that blood could be delayed because of extra steps to find blood!!

2) Find Antigen Negative Units

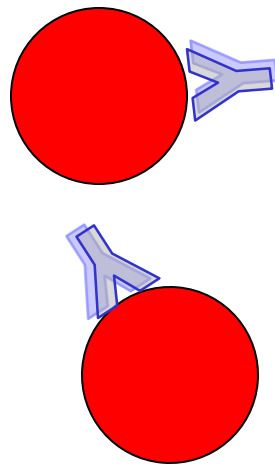
- Find antigen negative unit by label or by phenotyping (i.e. typing) the RBC unit in Blood Bank
- Also phenotype patient



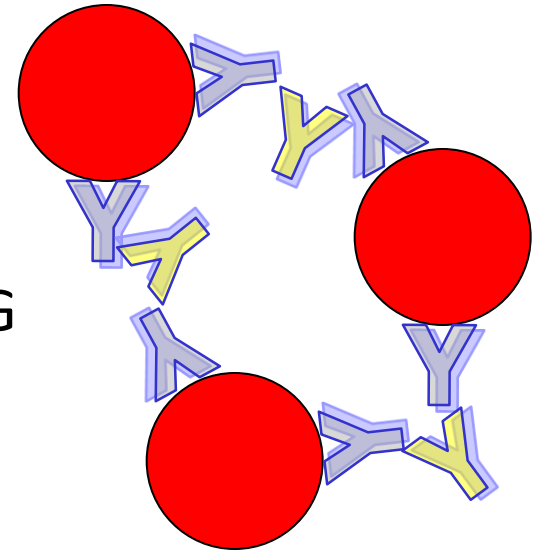
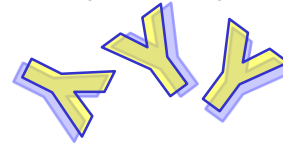
3) Full CROSSMATCH (Slow 45 min)



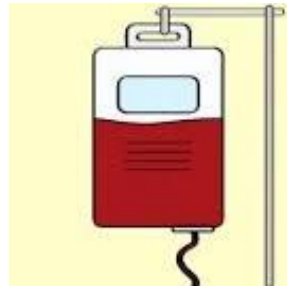
Incubate
at 37°C



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 with incubation and anti-IgG (45 minutes)
- Crossmatch units ahead of time → Blood Bank needs as much notice as possible that you need blood

A. Go or B. 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
 - Group A pos; Screen positive; Panel pan-reactive; 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

A. Group O Pos vs. B. 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

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Summary

What does the group test?	ABO & Rh
What does the antibody screen test?	Antibodies against non-ABO antigens
How long does a fast crossmatch take?	2-5 minutes
When can the Blood Bank use a fast crossmatch?	Antibody Screen negative
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 