

Division of Blood Transfusion Services

Ministry of Health and Family Welfare



Compatibility Testing



Teaching Aims

- To understand the principle of cross match procedure and significance of compatibility tests
- To understand the procedure of cross matching in special circumstances

Compatibility testing

Purpose

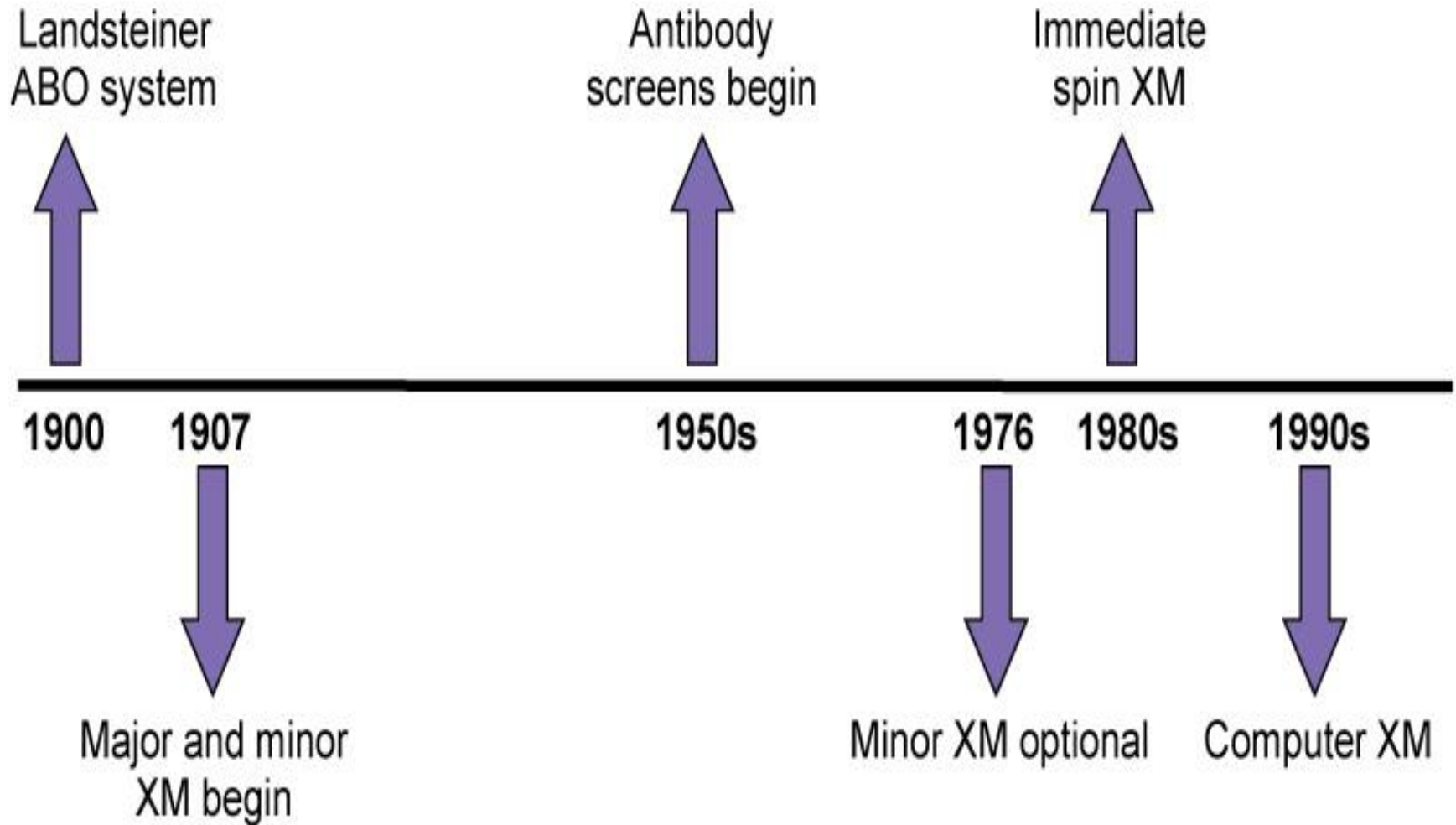
- Selection of safest blood components for transfusion
- With acceptable donor's red cell survival rates
- Without destruction of recipient's red cells

Compatibility testing

- Confirms ABO compatibility
- Detects clinically significant unexpected antibodies



History



Importance of cross matching

- Routine blood grouping involves only ABO and Rh.
- Other clinically significant blood group systems not matched routinely
- Though, antibodies to minor antigens are of rare occurrence, they can cause transfusion reactions
- Cross matching between patient's serum and donor's cells will detect antibodies to other blood groups, if present.



Steps in pre-transfusion testing

1. Identification of patient & its sample
 - Patient full name & hospital registration #
 - Name of requesting physician
 - Date & time of sample collection
 - Initials of phlebotomist
 - Information clearly written on requisition form and sample
2. ABO & Rh of recipient and donor blood
3. Test for clinically significant red cell antibodies on patient serum



Steps in pre-transfusion testing (contd...)

4. Selection of appropriate unit of blood

- ABO & Rh compatible
- Expiration date
- Component as per need of patient
- PRBC, FFP, PC, Cryo

5. Performance of serological cross match

6. Labeling of component with patient identification details

7. Issue after verification of patient identity along with compatibility report & reaction form



Pre-transfusion testing procedure

Donor Unit Testing

- ABO grouping: Forward and Reverse
- Rh grouping: Rh (D) including weak D (D^u)
- TTD testing for mandatory markers

Recipient Testing

- ABO grouping: Forward and Reverse
- Rh grouping, Weak D (D^u) not required
- IAT testing: Antibody screen
- Cross match: Major & Minor



Serological cross match

Major crossmatch: Test donor cells with recipient's serum to detect antibodies in patient

Minor crossmatch: Test donor serum with recipient's red cells to detect antibodies in donor plasma

Inclusion of **autocontrol** helps to rule out

- Auto antibodies
- Allo antibodies
- Rouleaux formation



Correct Identification

- Phlebotomist (nurse / technician / doctor) must confirm recipient's ID from patient file
 - full patient name and registration number
 - name of physician
- The sample should have
 - patient name,
 - hospital number
 - date and time of collection
 - phlebotomist's initials
- All of this should be on the request form & the sample



Preparation of donor cells for cross-matching

- Select appropriate unit of blood from inventory
- Check for
 - Donor ID
 - Blood Group
 - Expiry date
 - Hemolysis / leakage
- Detach a segment from the blood bag, cut ends of segments and pour the contents in a labeled test tube
- Wash red cells with saline 3 times and prepare 5% suspension



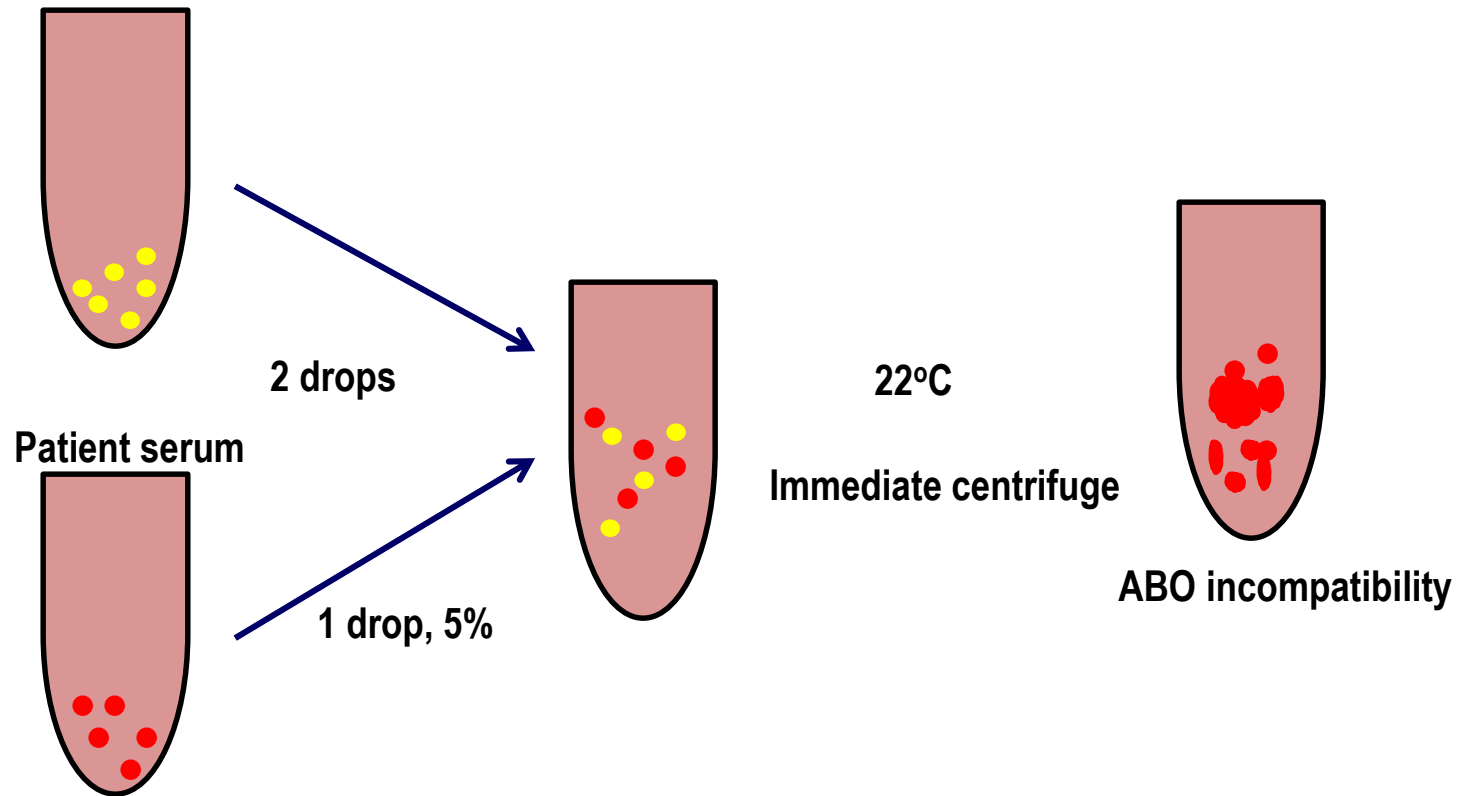
Cross Matching Procedure

- Cross matching should be performed at following phases
 - Saline phase at room temperature
 - AHG phase

- Cross matching can be performed using conventional test tubes or by using newer technologies such as
 - Column Agglutination Technology
 - Solid Phase Technology
 - Electro Magnetic (EM) Technology

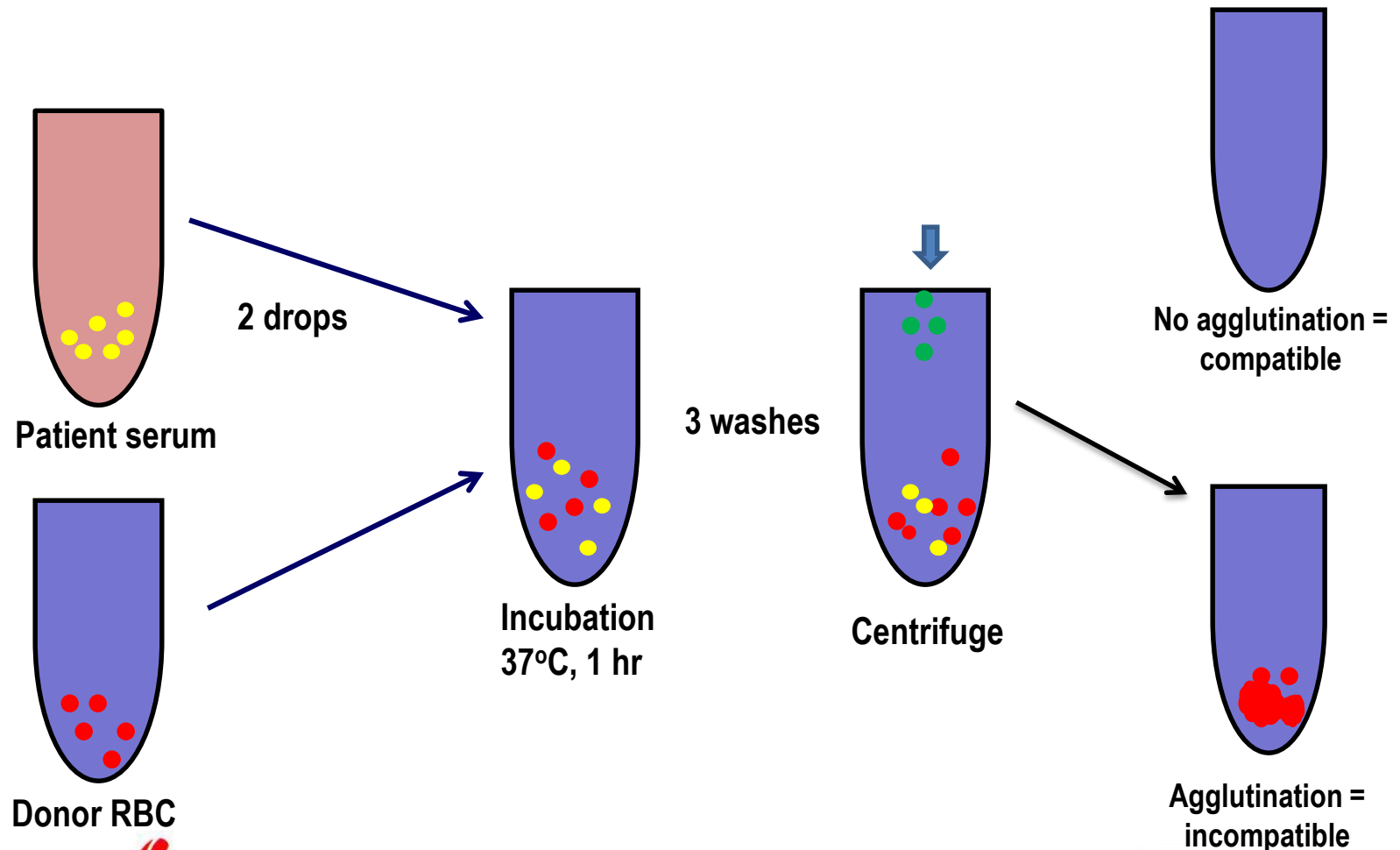
Immediate Spin Technique (IST)

- ✓ Detects only IgM antibody, reactive at 22°C.
- ✓ Clinically significant IgG antibody reactive at 37°C not detected



Conventional AHG-cross match

Detects clinically significant (IgG) antibody

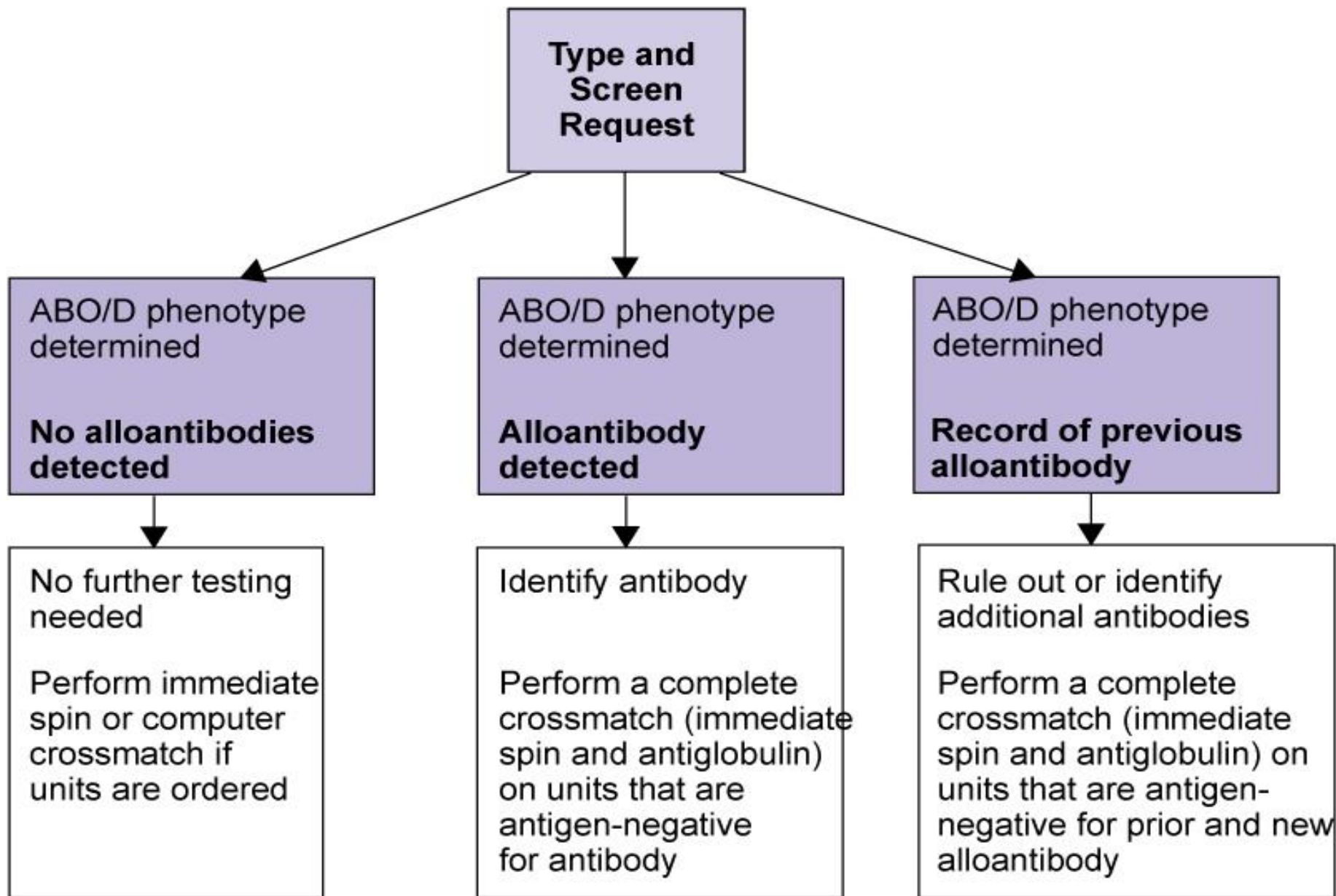


Serological cross match

Phase	Detects
IS phase	ABO incompatibilities
AHG phase	Rh, Duffy, Kidd, others

Points to remember:

- ✓ Preserve recipients serum & donor red cell segment for a week.
- ✓ However, fresh sample of the patient is needed after 48 hrs of transfusion
- ✓ Do not withdraw sample from the IV line
- ✓ Infuse red blood cells within 4 hours



Documentation

- All record to be initialed by the technician performing the test
- Result to be entered in blood grouping register, cross matching report proforma, donor and master donor record register

Records should
be maintained for
atleast
5 years

Cross Match Record

Patient's Blood Group

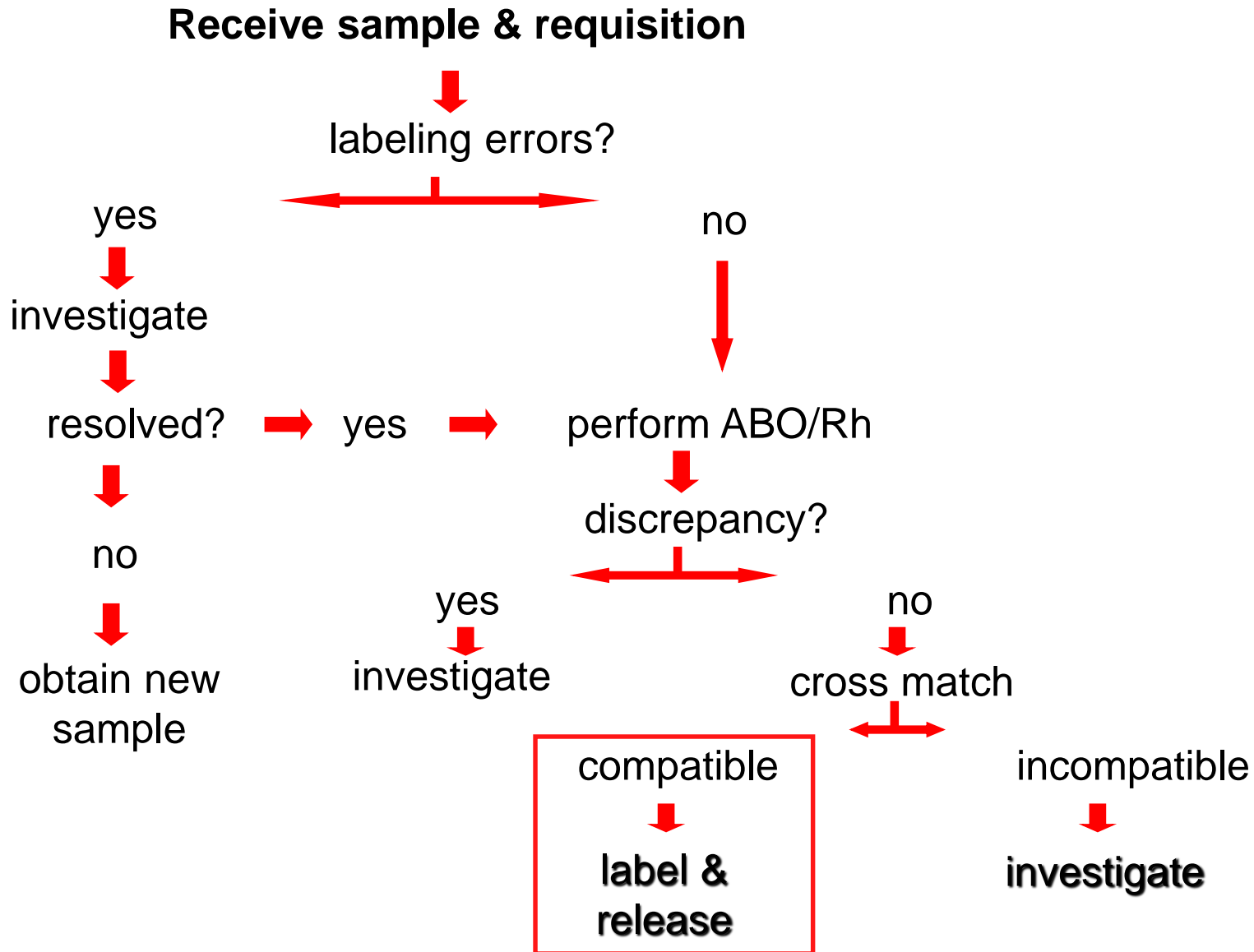
Cell Grouping				Serum Grouping			Blood Group	
Anti-A	Anti-B	Anti-AB	Anti-D	Ac	Bc	Oc	ABO	Rh(D)

Routine Crossmatch Report

Sn	Unit No	ABO/Rh	Vol of red cells (ml)	Saline X match (RT)	AHG X match (37C)	Compatible	
						Yes	No

Auto control: Positive/ Negative

Traditional Approach to Pre Transfusion Testing



Cross matching for platelets & plasma

- No compatibility testing required for platelets and plasma components
- Only ABO matching is required for fresh frozen plasma
- No need for compatibility, ABO and Rh matching for platelet concentrates and cryoprecipitate

Exceptions

- Neonates, alloimmunized patients –
preferably ABO & Rh matched platelets
- If RBC contamination is > 2 ml,
compatibility testing



Problems In Cross Matching

- Incomplete requisition forms
- Hemolyzed samples
- EDTA and clotted sample
 - Plasma prevents detection of complement dependent antibodies
 - Fibrin clots, which may form, can be mistaken for agglutination

Incompatible crossmatches

Antibody screen	Cross match	Cause	Resolution
Pos	Neg	Antibody directed against antigen on screening cell	ID antibody, select antigen negative blood
Neg	Pos	Antibody directed against antigen on donor cell which may not be on screening cell OR donor may be DAT positive	ID antibody, select antigen negative blood OR perform DAT on donor unit
Pos	Pos	Antibodies directed against both screening and donor cells	Antibody ID, select antigen negative blood


Ideal Requisition Form & Sample

Department of Transfusion Medicine
Blood/Component Requisition Form

Name : Vijay Kumar Singh Address : Bihar Garivankati Farukhabad Uttar Pradesh
CR No : 2011286417 Hospital : Dr A. B. C
Age/Sex : 59/M Consultant :
Diagnosis : Obst. uropathy Left PUJO with Renal failure Department : Urology
Tx History : - Ward/Type : B04/GEN Bed/Type : 12/GEN
Hb : - 7.5 Platelet Count : - 40
Blood_Group/Rh D.O.A : 31-MAY-11

Blood/Component	Unit	Priority
Packed red cells (PRBC)	2	Urgent

Certified that I have personally collected the Blood Sample and Checked the labels.

Signature :- 
Dr. Jatinder Kumar
Date/Time: 07-Jun-2011 08:53

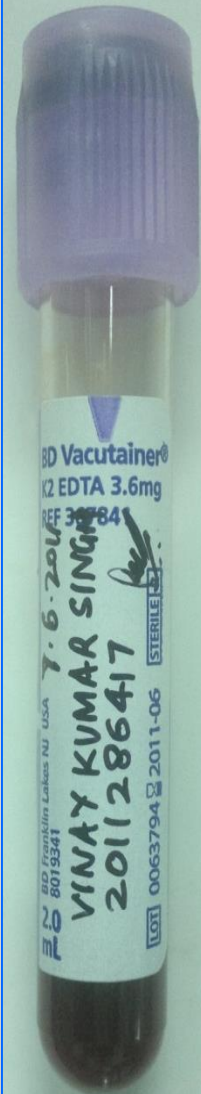
Requisition_no :2011060559 (Space To be Used by the Blood Centre)

Registered at Blood Centre No :- Date :- Time :- Mode of adjustment (Replacement Slip No) :-

Blood Group :- Rh :- Compatible with Donor(s):

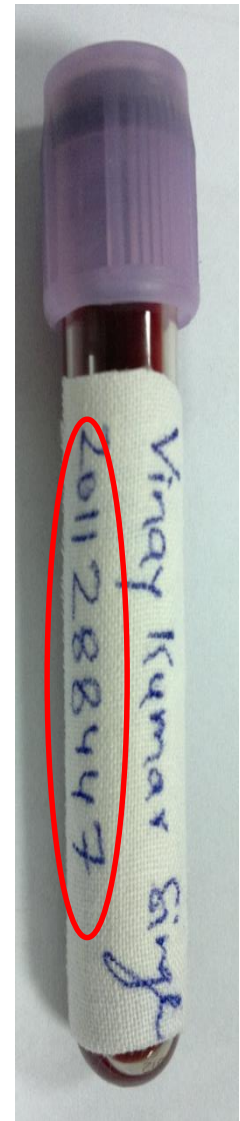
Replacement Slip No.	Donor's Name
2011060619517	Jitendra Singh

Whole Blood	Platelets	Plasma	Cryoprecipitate
2011051618465			
2011051618466			



Incomplete Requisition Form

Department of Transfusion Medicine Blood/Component Requisition Form			
Name : Vijay Kumar Singh		Address : Bihar Garivankati Farukhabad Uttar Pradesh	
CR No : 2011286417		Hospital :	
Age/Sex : 59/M		Consultant :	
Diagnosis : Obst. uropathy Left PUJO with Renal failure		Department : Urology	
-		Ward/Type : B04/GEN	
Tx History : -		Bed/Type : 12/GEN	
		Hb : -	
		Platelet Count : -	
		D.O.A : 31-MAY-11	
Blood_Group/Rh			
Blood/Component	Unit	Priority	
Packed red cells (PRBC)	2	Urgent	
Certified that I have personally collected the Blood Sample and Checked the labels.			
		Signature :-	
		Dr. Jatinder Kumar	
		Date/Time: 07-Jun-2011 08:53	
Requisition_no : 2011060559		(Space To be Used by the Blood Centre)	
Registered at Blood Centre No :-		Date :- Time :- Mode of adjustment (Replacement Slip f	
Blood Group :- Rh :- Compatible with Donor(s):			
		Replacement Slip No. Donor's Name.	
		2011060619517 Jitendra Singh	
		Platelets Plasma Cryoprecipitate	
		Whole Blood	
		2011051618465	
		2011051618466	



Inappropriate request for components

Department of Transfusion Medicine
Blood/Component Requisition Form


Name : Uma Shanker Soni
CR No : 2010189965
Age/Sex : 56/M
Diagnosis : CAD, SEVERE TVD, AOE III
Tx History : X

Address : Purabazar Pura Bazar Faizabad Uttar Pradesh
Hospital : [REDACTED]
Consultant : Dr A. B. C
Department : Cardiovascular And Thora Surg
Ward/Type : A02/GEN
Hb : 6
Bed/Type : 1/GEN
Platelet Count : 210
D.O.A : 08 JUN-11

Blood_Group/Rh
Unit
Priority

Blood/Component
Platelets (random donor)
15
Immediate

Certified that I have personally collected the Blood Sample and Checked the labels.

Signature :- 
Dr. Ravi Kumar Singh
Date/Time: 07-Jun-2011 19:34

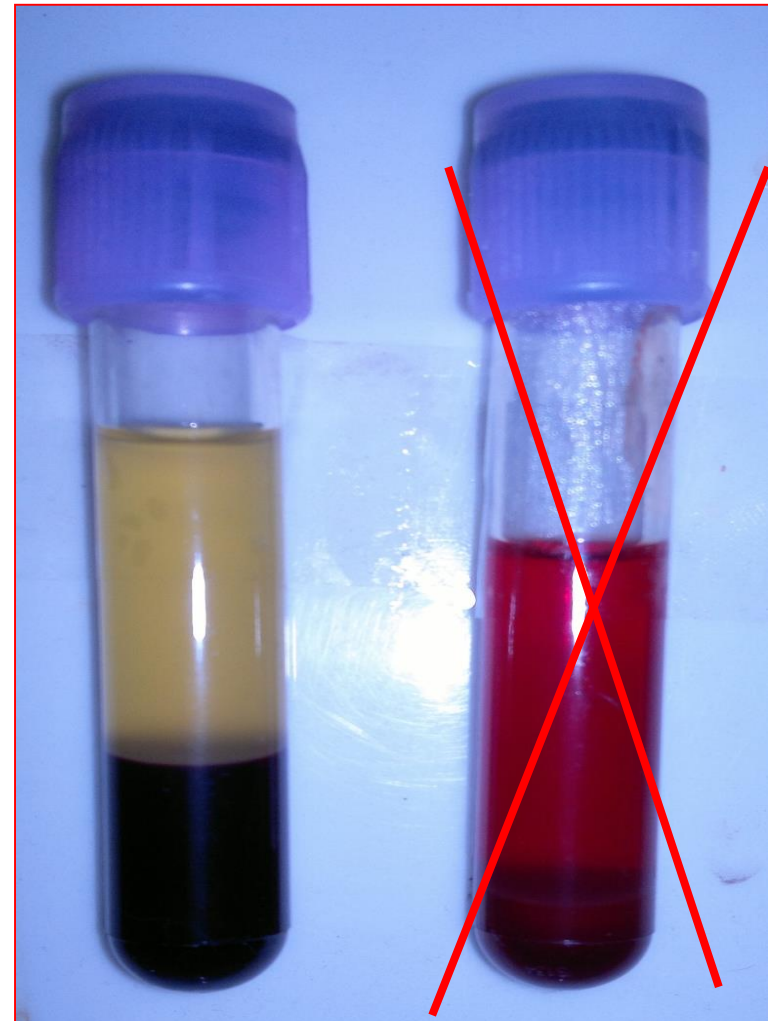
Requisition_no : 2011060626 (Space To be Used by the Blood Centre)

Registered at Blood Centre No :- Date :- Time :- Mode of adjustment (Replacement Slip No)

Blood Group :- Rh :- Compatible with Donor(s):

Replacement Slip No.	Donor's Name
2011010610402	Neeraj Soni
2011042917579	Chandra Prakash Soni
2011042917578	Satish Soni
2011042917580	Pawan Kumar Yadav
2011042917574	Pankaj Soni
2011043017646	Shailendra Soni

Whole Blood	Platelets	Plasma	Cryoprecipitate
	2011060319381	2011052518903	
	2011060319382	2011052518908	
	2011060319410	2011052518914	



Normal sample Hemolyzed

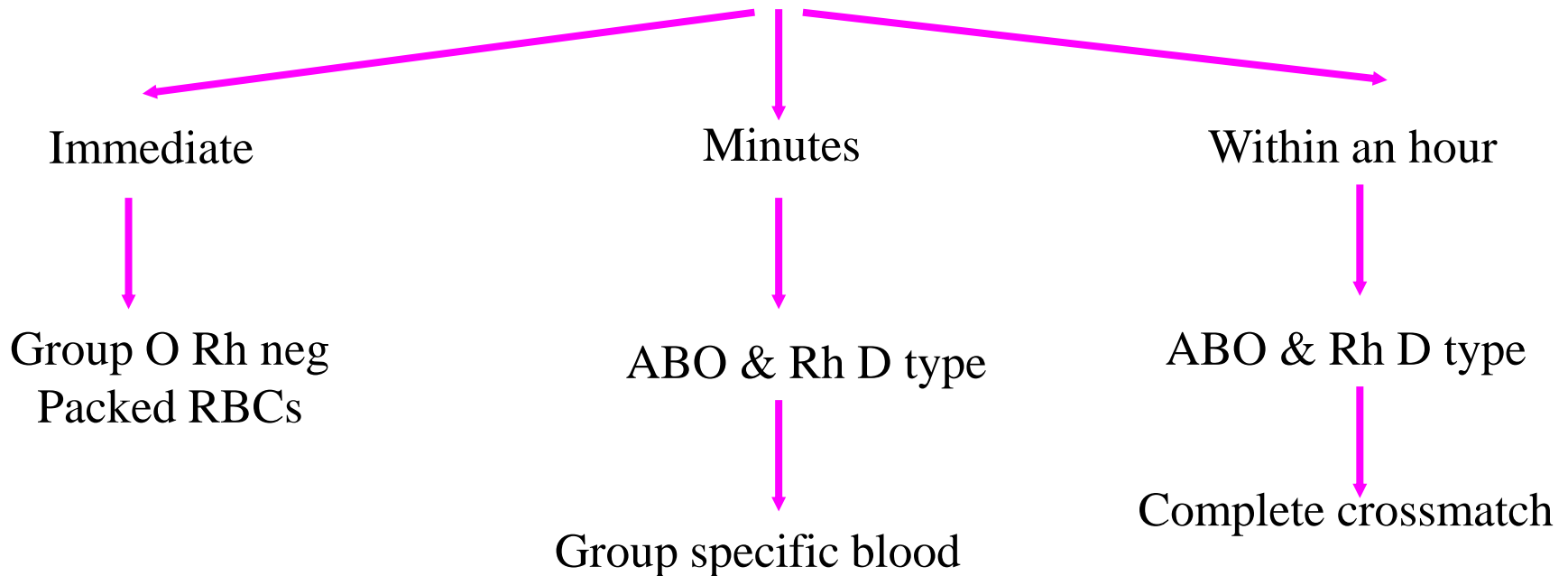
Technical Problems

- ✓ Expired / contaminated reagents
- ✓ Improper cell concentration (cell : serum ratio)
- ✓ Labeling errors
- ✓ Improper washing of red cells before forward grouping
- ✓ Equipment – Improper centrifugation
- ✓ Dirty glass wares
- ✓ Reading and recording reactions
 - Grading of reaction strength
 - Hemolysis – positive result
 - Mixed field reaction
 - Auto-agglutination



Cross matching: Special Circumstances

Clinical urgency



If units are issued without X match – take written consent of physician, complete X match after issue

Cross Matching: Special circumstances

Neonatal (< 4 months) Transfusions

- Only ABO and Rh grouping; no serum grouping
- Antibody screen with maternal serum
- Exchange transfusion:
 - WB or PRBCs within 7 days of collection
 - ABO and Rh D compatible with maternal sample
 - Irradiated unit for infant weight < 1500 gm
- Top up transfusions:
 - ABO and Rh D group specific
 - Blood bags with small satellite bags



Selecting Blood For Exchange Transfusion In Neonates

Group of Neonate	Rh D HDN	ABO HDN
O Rh positive	O Rh neg	NA
O Rh negative	NA	NA
A Rh positive	A Rh neg / O Rh neg	O Rh pos
A Rh negative	NA	O Rh neg
B Rh positive	B Rh neg / O Rh neg	O Rh pos
B Rh negative	NA	O Rh neg
AB Rh positive	AB Rh neg / O Rh neg	O Rh pos
AB Rh negative	NA	O Rh neg

Selecting Blood (PRBCs) For Exchange Transfusion In Neonates

Baby's Blood Group	Mother's Blood Group	1 st choice	2 nd choice
O	O	O	-
O	A	O	-
O	B	O	-
O	AB	O	-
A	O	O	-
A	A	A	O
A	B	O	-
A	AB	A	O
B	O	O	-
B	A	O	-
B	B	B	O
B	AB	B	O
AB	O	O	-
AB	A	A	O
AB	B	B	O
AB	AB	AB	A,B,O
Rh positive	Rh Negative	Rh Negative	-
Rh Negative	Rh positive	Rh Negative	-

- If mother's blood is not available, or group is not known, give O Rh negative
- Blood used should not be more than 5 to 7 days old.'
- A compatible plasma or AB plasma should be issued for reconstitution.

Transfusion in AIHA

- Avoid transfusion as far as possible in Warm AIHA
- There could be problems in blood grouping
 - Spontaneous agglutination of red cells on addition of antisera in WAIHA
 - Non specific agglutination of reagent cells during serum grouping in cold AIHA
- Difficult to find absolutely compatible blood for such patients.



Transfusion in AIHA (contd...)

- In emergency, consider the least incompatible blood.
 - Blood unit showing minimum strength of reaction in terms of titer designated as the 'least incompatible'.
 - Blood unit must be compatible with the patient's auto-absorbed-serum.
- Transfusion should be done under strict medical supervision.



Selection of alternative blood group for transfusion of PRBC

	A	B	O	AB	Rh pos	Rh neg
A	Option 1		Option 2			
B		Option 1	Option 2			
O			Option 1			
AB	Option 2	Option 3	Option 4	Option 1		
Rh pos					Option 1	Option 2
Rh neg						Option 1

Rh D Positive PRBC can be transfused to Rh Negative patients (post menopausal females, older men) only in emergency after due precautions and ICT testing. Rh D negative blood can safely be transfused to Rh D positive patients

“Dangerous group O donor”

- In emergency situations group ‘O’ donor blood is used as universal donor where group identical blood is not available.
- This is an outdated concept in major blood banks. Certain donors possess in their plasma potent ABO antibodies, which are dangerous to the recipients’ red cells.
- These are anti A and anti B haemolysins, titer of which is > 32
- Such donors are called as “dangerous O donor”
- Therefore, if group O blood is to be used as universal donor, it should always be plasma depleted (packed red cells)

Learning Outcome

- You will now understand methods and significance of correct cross matching procedures
- You will now be able to select proper unit, perform cross match for special situations

