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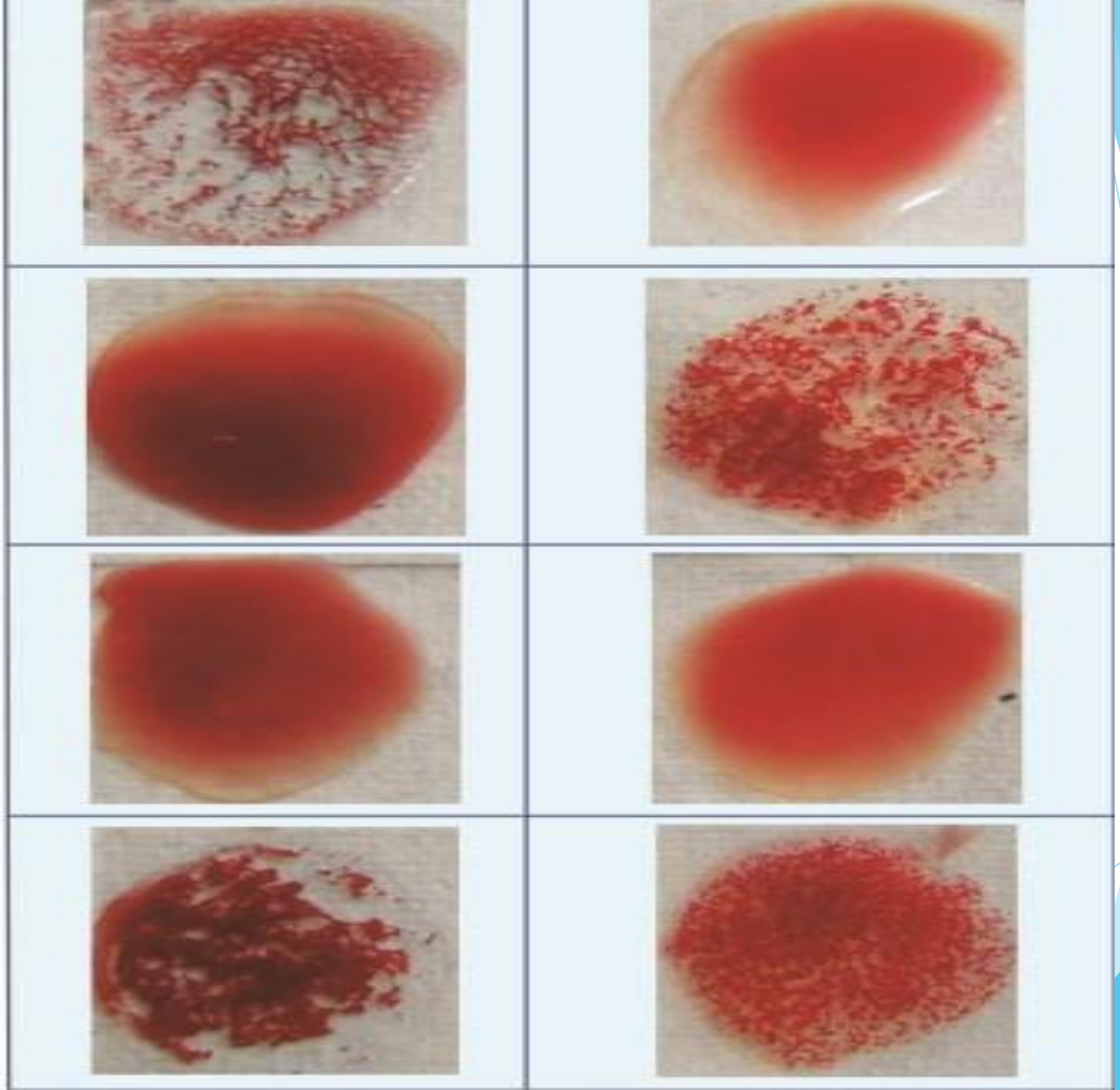


Learning objectives

- Describe the medico legal importance of blood groups.

DIFFERENT BLOOD GROUP SYSTEMS

- There are several quite distinct and unrelated types of differences between the blood of different individuals. These are due to:

- Red blood cells antigens
- Blood protein such as haptoglobins
- Polymorphic enzymes
- White blood cell antigens
- The secretor status allows blood group determination in the absence of blood or blood stains.

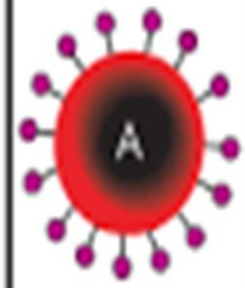
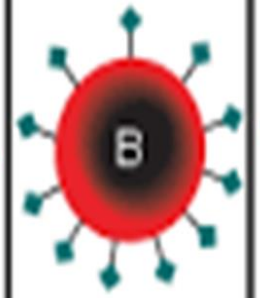
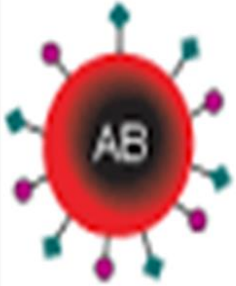
GROUPING BASED ON RED CELL ANTIGENS

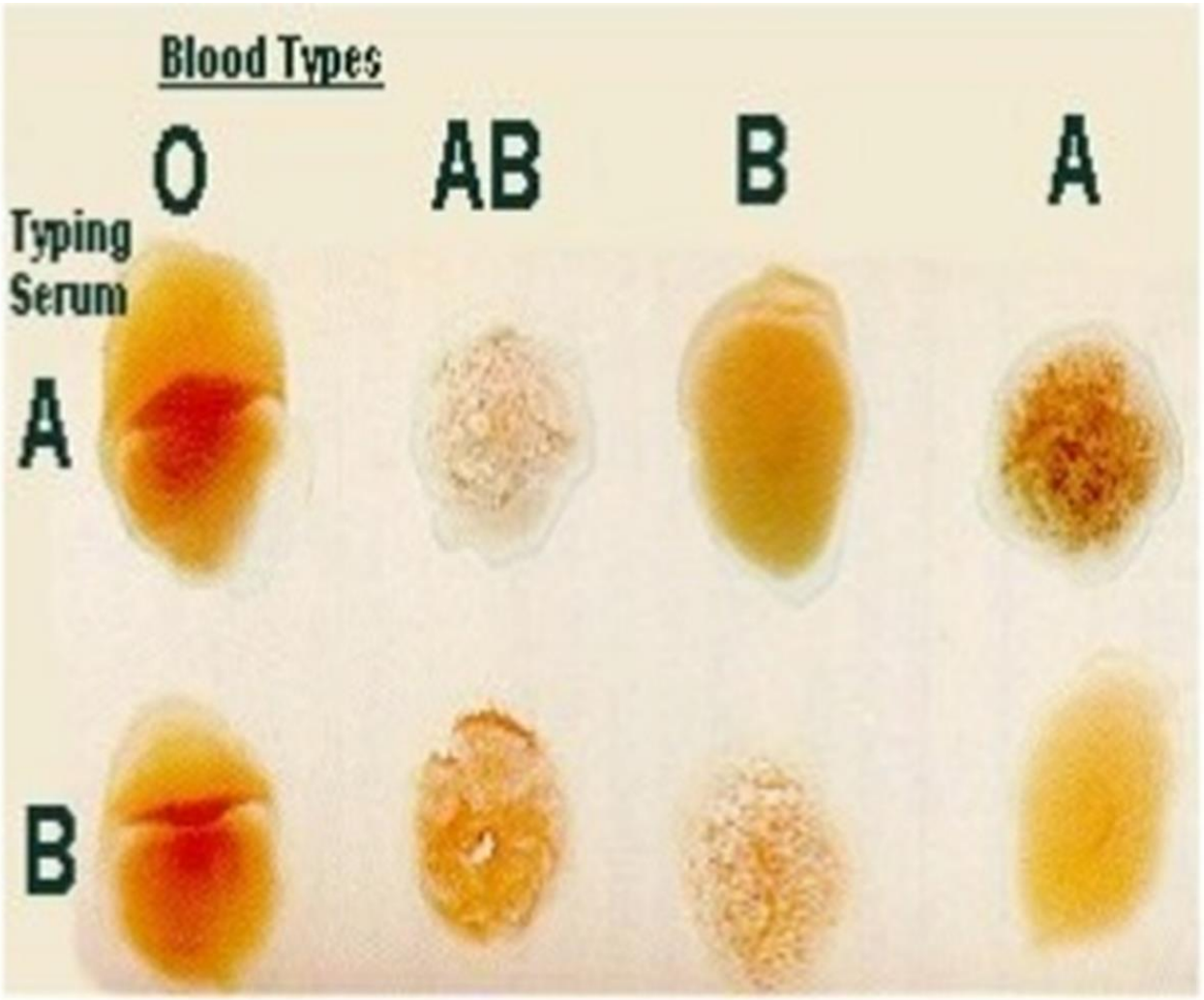
- The different systems based on red cell antigens are:
- ABO system
- MN system
- Rh system
- Other groups: Lewis, Duffy, Lutheron, Kell, Kidd etc.

- The red cell antigens are identified by simple objective tests.
- A persons red cells are mixed with antiserum specific for a given group antigen. if the red cell contains the antigens, it is clumped by the antiserum
- For some groups , the testing sera will determine the full genotype of the blood.

ABO SYSTEM

- The ABO system divides mankind into four main blood groups. i.e A, B, AB and O depending on the presence or absence in the red blood cells of two agglutinogens known as A and B.
- Group A contains agglutinogen A, group B, agglutinogen B, those of group AB contain agglutinogens A and B, while those of group O contain neither A nor B.

	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies in Plasma	 Anti-B	 Anti-A	None	 Anti-A and Anti-B
Antigens in Red Blood Cell	 A antigen	 B antigen	 A and B antigens	None


Blood Types
O
AB
B
A
Typing Serum
A
B

- An integral part of ABO System is the secretory system.
- Approximately 80% of the population secrete ABO blood group susbstances in most of the cells and fluids of the body.
- These individuals are called secretors
- All secretors secrete a substance called substance H.

- Accordingly an A blood group person will secrete in his body cells and fluids group A substance and substance H, B blood group, group B substance and H substance and blood group O only substance H.
- The secretor status is determined by two alleles, Se and se.
- ABH specific substances are present in a very high concentration in saliva, semen, vaginal secretion and gastric juice and very low concentration in sweat, tears and urine.

MN SYSTEMS

- Agglutinogens M and N exist in red blood cells.
- Human blood can thus be divided into types M, N and MN.
- No blood lacking any agglutinogens has been found.
- There are no corresponding antibodies in this systems

RH SYSTEM

- Useful in cases of disputed paternity
- Rh antigens are responsible for haemorrhagic disease of new born.
- Untoward reactions in cases where transfusion of ABO compatible blood has been given

Grouping based on blood proteins

- Haptoglobin
- Group spec8fic component globulin
- Gm and inv immunolglobulins
- Hb types
- These are determined by electrophoresis

GROUPING BASED ON ENZYMES

- Usually demonstrated by electropheresis.
- Phosphoglucomutase
- Erythrocyte acid phosphatase
- Glycooxylase
- Esterase D
- Adenylate kinase
- Adenosine diaminase

Grouping based on white cell antigens

- Human leukocyte antigen (HLA)
- These antigens can be identified by histolymphotoxicity tests.
- The test is not routinely used.
- In tissue grafts, the better the HLA match between the donor and the recipient, the better are the chances for the survival of the graft.

- Blood group antigens are situated in the outer envelope of red blood cells and the antibodies are present in the serum.
- Formation of antigens is controlled by genes which are present in nuclei of all cells.
- Each parent contributes half of each pair of homologous chromosomes carrying single allele.
- Fertilization restores the normal number of chromosomes. Each allele pairs with its counterpart on the homologous chromosome form a gene.

- A child is called homozygous for a particular gene. If the alleles contributed by each parent are similar and called heterozygous, if the contributed alleles are different.
- There are two methods for the determination of blood group

1. Direct agglutination and
2. Indirect agglutination method.

- Toughest antigens are those of ABO and they remain detectable for years.
- MN antigens remain active for maximum of nine months.
- Rh antigens become inactive usually within six weeks. Mixed stains such as blood of one mixed with the saliva of another or semen mixed with vaginal fluid are most difficult to group.
- Gm factor can be demonstrated even after several months. As this factor is usually not present in semen and saliva and its apparent absence in these fluids makes it possible to obtain the correct Gm grouping of the blood stains which are suspected or contaminated by the fluids.

Medico legal importance of blood

- Disputed paternity and maternity.
- To determine the possible source of blood stains in circumstances such as murder, wounding, rape and vehicular accidents.
- In heritance claims.
- Rh hazards and
- transfusion errors

Inheritance claims

- In inheritance claims the question of legitimacy arises.

since a legitimate child only can inherit the parent's property. Blood group determination is helpful in such cases.

Rh hazards

- The Rh factor has an important practical bearing on the etiology of haemolytic disease of the newborn and in unexpected reactions in cases where transfusion of compatible ABO blood has been given.
- An Rh negative mother may receive Rh antigen from the foetus through the placenta when the child is Rh positive, the father having been Rh positive. This Rh antigen produces Rh antibodies in the mother.

- This anti Rh agglutinin may pass from the mother by way of the placenta into the foetus which is Rh positive and the child may develop hydrops, erythroblastosis foetalis or hemolytic diseases of the newborn.
- Rh positive blood transfused into an Rh negative individual will also produce anti Rh agglutinin in the recipients serum, consequently when second transfusion from an Rh positive donor is given at a late date haemolysis may follow.

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Transfusion errors

The transfusion errors and adverse reaction relate to

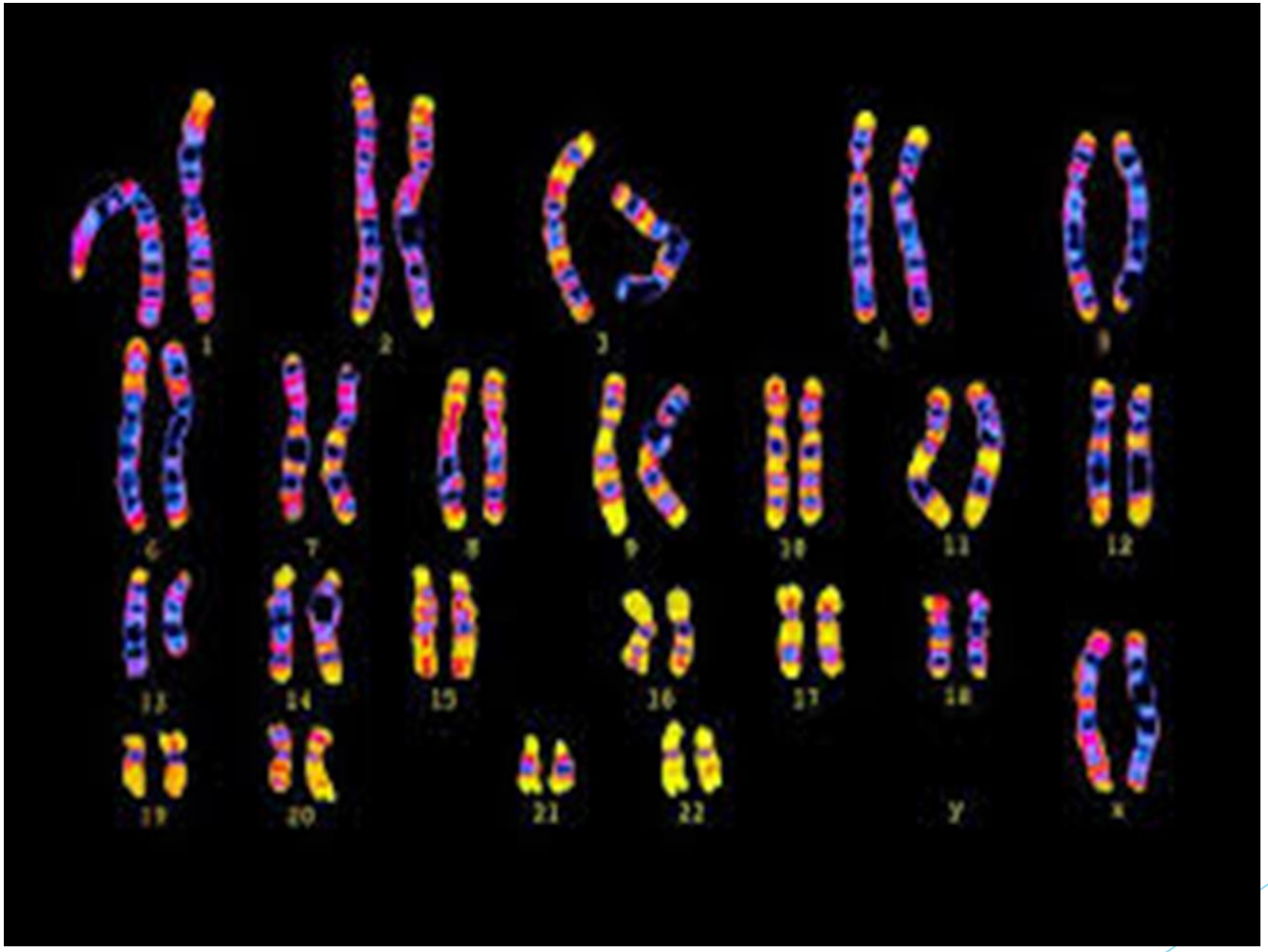
- Compatibility testing in the laboratory.
- Neglect of expiry dates and
- Presence of pathogenic organisms in the transfused blood.

- Even in an emergency when blood transfusion is urgently required, delay due to testing offers less risk than an unmatched transfusion or one which is not fully compatible.
- If expiry dates are not observed, transfusion reaction may arise from leakage of electrolytes from damaged red cells.
- The blood may also contain pathogenic organisms such as hepatitis B and AIDS virus, these must be excluded before use.

DNA profiling fingerprinting

- This test looks directly at a person's genetic makeup
- With the exception of truly identical twins, the structure of each person's DNA is unique.
- The essence of DNA profiling in forensic work is comparison between two samples.
- Samples for DNA testing must contain nucleated cells e.g leucocytes, seminal fluid, brain, bone marrow, muscle, skin, dental pulp, hair with root sheath cells and dried stains.

- Identity of a criminal is determined by comparing the accused man's DNA profile with a biological item e.g blood or seminal stain found at the scene of crime.
- Identification is absolute if tests are properly performed.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Disputed paternity and maternity

- Blood groups are inherited according to mendelian principles
- a blood group antigen substance cannot appear in child unless it is present in one of the parents
- if one of the parents is homozygous for a particular blood group antigen that antigen must appear in the child blood and
- if a child is homozygous for a particular blood group antigen the gene for the same must have been inherited by it from each of the parents.

- if a child is homozygous for a particular blood group antigen the gene for the same must have been inherited by it from each of the parents.
- In cases of disputed paternity or maternity, it is possible to determine the group of one parent if the groups of the child and the other parent are known or
- If the groups of both parents are known to determine the blood groups possible for the child.

CHILD BLOOD TYPE CHART

PARENT 1	PARENT 2	CHILD - A	CHILD - B	CHILD - AB	CHILD - O
A	A		-	-	
A	B				
A	AB				-
A	O		-	-	
B	B	-		-	
B	AB				-
B	O	-		-	
AB	AB				-
AB	O				-
O	O	-	-	-	

- The question of disputed paternity arises in the following circumstances
- Alleged adultery and suits for nullity of marriage:
  when the child is born in lawful wedlock and the husband denies that he is the father of the child and seeks divorce on this ground.
- Blackmailing:
  when a child is born out of lawful wedlock and the mother accuses a certain man as the father of the child but the man denies the accusation.

- The ABO grouping system can exclude paternity in one sixth of all cases
- addition of the MN system can exclude paternity in one third of the cases addition
- of the Rh subgroups will exonerate about 50 percent of wrongly accused men
- the other factor if determined will raise the figures to about 60 percent and
- examination of saliva adds another 2.5 percent to the chance the addition of groupings based on blood protein and red exclusion rate to about 90 percent

- The human leucocyte antigen HLA system alone can demonstrate non paternity in 90 percent of cases but in combination with other grouping system it can raise non father exclusion rate up to 98 percent .
- In actual practice this percentage of exclusion is never achieved as many of men accused are actual fathers of the children in question.
- DNA profiling is fool proof it provides absolute certainty rather than a probable exclusion as in other system.

The question of disputed maternity arises in the following circumstances:

- when two women claim the same child.
- when there has been an allegation of interchange of child with another in the maternity home or hospital either purposely or accidentally.

- In cases of a kidnapped child when the woman who has kidnapped the child, claims to be the mother having given birth to the child at home and birth certificate is therefore not available, she may name a friend as alleged father.
- In case of a suppositious child, when a woman pretends pregnancy and delivery and brings forth a suppositious child to pass it off as her own.


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