History

1628 British physician William Harvey **discovers the circulation of blood.** The first known blood transfusion was attempted sometime after this.

1658 Microscopist Jan Swammerdam **observes and describes red blood cells1665 First recorded successful blood transfusion occurs in dogs** in England.

1667 Several reports of successful transfusions from sheep to humans are reported. Jean-Baptiste in France, Richard Lower and Edmund King in England.
1818 British obstetrician James Blundell performs the **first successful transfusion of humanblood to a patient** for the treatment of postpartum hemorrhage.

1873-1880 U.S. physicians attempt **transfusing milk from cows, goats and humans**. **1884** Saline infusion replaces milk as "blood substitute" due to the increased frequency

of adverse reactions to milk.

1901 Karl Landsteiner, an Austrian physician, **discovers the first three human blood groups.1907** Ludvig Hektoen suggests that the safety of transfusion might be improved by .

cross-matching blood between donors and patients to exclude incompatible mixtures. Reuben Ottenberg **performs the first blood transfusion using blood typing andcross-matching.**
1914 Long term **anticoagulants,** among them sodium citrate, are developed, allowing longer

preservation of blood.

1939-1940 The **Rh blood group system was discovered** by Karl Landsteiner, Alexander Wiener,Philip Levine and R.E. Stetson.

1940 The U.S. government establishes a **national blood collection program.**

Edwin Cohn develops cold ethanol fractionation, the process of breaking down plasma into components and products.
Early blood processing program for relief of English war victims, called Plasma forBritain, begins under the direction of Charles R. Drew. M.D.

1944 Dried plasma becomes a vital element in the treatment of wounded soldiers during WWII.

1947 ABO blood-typing and syphilis testing is performed on each unit of blood.

1949 The U.S. system is comprised of 1,500 hospital blood banks, 46 community blood centers,and 31 American Red Cross regional blood centers.

1950 Audrey Smith reports the use of glycerol cryonpectanant for red blood cells.

1956 Establishment of a **national blood clearing house.**

1957 The American Association of Blood Banks forms its committee on Inspection andAccreditation to monitor the implementation of standards for blood banking.

1961 Platelet concentrates are recognized for **reducing the mortality from hemorrhage in cancerpatients.**

1962 Blood Bank of Alaska is formed..

1969 S. Murphy and F. Gardner demonstrate the feasibility of storing platelets at room temperature,
revolutionizing platelet transfusion therapy.

1970 U.S. blood banks **move towards an all-volunteer** blood donor system.

1971 Hepatitis B surface antigen (HbsAg) testing of donated blood begins.

1972 Apheresis is used to extract one cellular component, returning the rest of the blood to thedonor.
Food & Drug Administration (FDA) begins to regulate all 7,000 U.S. blood and plasma centers**.**

1978 FDA requires blood bags to be labeled “paid” or “volunteer”.

1981 Main Anchorage Blood Bank of Alaska center built.

1983 Additive solutions extend **shelf life of red blood cells to 42 days.**

The U.S. blood banking groups issue their first warning about Acquired Immune Deficiency Syndrome (AIDS).

1985 FDA licenses the first test to detect the antibody to HIV on March 3rd.

1992 Testing of donor blood for HIV-1 and HIV-2 antibodies is implemented.

The ABO grouping system

The ABO grouping system is subdivided into 4 types based on the presence or absence of antigens A and B on the red cell surface as shown below. Red cells that only have antigen A are called group A. Those that only have B antigen are

called group B. Cells that have both A and B antigens are group AB. Cells that lack both antigens are O.

ANTIBODIES

The ABO antibodies ; anti-A and anti-B are naturally occurring antibodies and are present in the sera of individuals who lack the corresponding antigen. Cells with A antigen will have anti-B in the serum. Cells with B antigen will have anti-A in the serum and cells with AB antigens will not have any antibody. Group O individuals will have both anti-A and anti-B antibodies. These antibodies are IgM in nature. The antigens and the corresponding antibodies in each blood group are shown below.

Group	Antigen	Antibody
A	A	Anti-B
B	B	Anti-A
AB	A and B	None
O	None	Anti-A, Anti-B

Slide technique

This can be performed in emergency or outdoor camps but must not be performed as a routine test.

Material required

1. Glass slides/white tile
2. Monoclonal Antisera A and Antisera B
3. Glass rod for mixing
4. Marker pen

Sample: Blood collected in a plain vial. Sample must be tested within 48hours. It should be kept in the refrigerator till processed. There should be no evidence of hemolysis in the sample.

Method

1. Mark one side of the glass slide as A and the other side as B.
2. Put one drop of antisera A on the side marked as A and one drop of antisera B on the side marked as B.
3. Add one drop of test blood sample/20% cell suspension to each antisera.
4. Mix the blood with the reagent using a clean stick. Spread the mixture over

an area of 15mm diameter.

5. Gently rock the slide to and fro and look for agglutination.

6. Record the result.

Interpretation

Agglutination if present indicates a positive result

Tube technique

This is the recommended method for grouping. It involves

z cell grouping or forward grouping: testing test red cells with known antisera.

z reverse or serum grouping: testing serum of donor/patient with known cells.

The procedure for cell and serum grouping is described separately but in all samples both the procedures should be done simultaneously and the results crosschecked.

Reagents required

1. Monoclonal Antisera-A and Antisera-B. Antisera-A, B is optional.

2. Normal saline

3. Known cells of group A, B, O

Equipment required

1. Centrifuge

2. Glass tubes 12 × 100 mm

3. Glass tubes 75 × 10 mm

Cell or forward grouping

In this the donor/patient red cell are tested with known antisera.

Method

1. Check that the name and number of the donor/patient on the vial matches with the form. Write the same donor number on each tube in which grouping will be performed.

2. Centrifuge the sample to separate the cells and serum.

3. Prepare a 2-5% cell suspension of test red cells in normal saline as follows

z Add the cells to a pre labeled tube (75 × 10mm) filled three fourth with normal saline.

z Mix and centrifuge at 1000- 2000 rpm for 1-2 minutes. Decant the

supernatant completely.

z Add saline and repeat the procedure till the supernatant is absolutely clear.

z After three washes, decant the supernatant and to the cell button add saline by counting the drops to make a 2-5% cell suspension.(10ml of normal saline and 0.2 ml/0.5 ml for 2 and 5% respectively).

z Invert gently several times to make an even suspension.

4. Label three tubes as Anti-A, Anti-B and Anti-A,B.

5. Add one drop of Anti-A to tube marked A, one drop of Anti-B to tube marked B and one drop of Anti-A,B to tube marked A,B.

6. Add one drop of 2-5% red cell suspension of donor/patient to each tube and mix gently. Leave at room temperature for15- 30min or centrifuge at 1000rpm for 1 minute after 5-10 min incubation at room temperature.

7. Resuspend the cell button and check for agglutination. Also look for any evidence of hemolysis in the supernatant which is read as a positive result.

8. If no agglutination is seen, the contents of the tube must be examined microscopically.

9. Record the results.

10. An autocontrol (patient's serum and cells) can be set up in grouping. No agglutination should be seen in this tube.

Serum grouping

In this the serum of the donor/patient is tested with known cells. The A cells, B cells and O cells are obtained by pooling fresh group A, B and O cells from at least 3 individuals of these known groups and a 5% cell suspension (1ml of normal saline and 50µl of washed red cells)is prepared in a similar manner as the cell suspension in cell grouping by washing in saline. The cell suspensions must be prepared fresh everyday and may be tested using the corresponding antisera before use. The unit number from which the pooled red cells are prepared must be entered in the blood grouping register.

Method

1. Label three tubes as A cell, B cell and O cell.

2. Place two drops of the donor/patient serum in each tube.

3. Add one drop of A cells to tube marked A, one drop of B cells to tube marked

B and one drop of O cells to tube marked as O.

4. Mix the contents by gentle shaking and leave undisturbed at room

temperature for 30-60min or centrifuge at 1000rpm for 1minute.

5. Look for agglutination. Also look for any evidence of hemolysis in the

supernatant which is read as a positive result.

6. If no agglutination is seen, the contents of the tube must be examined

microscopically.

7. Record the results immediately.

Interpretation

Presence of agglutination or hemolysis is a positive result.

A smooth cell suspension after the button is resuspended is a negative result.

Grading agglutination reactions

The reaction result obtained in grouping is graded as follows:

H Hemolysis. This is a positive result

0 No agglutination, only a smooth suspension

1+ Many small clumps, supernatant has free cells

2+ Many small clumps with clear supernatant

3+ 2-3 clumps, no free cells

4+ One big clump, no free cells

RHESUS BLOOD GROUP SYSTEM

The Rhesus blood group system is the second most important system in transfusion practice. Rh typing is routinely performed along with ABO grouping in all donors and recipients.

CRITERIA FOR SELECTION OF BLOOD DONORS

A. Accept only voluntary/replacement non-remunerated blood donors if following

criteria are fulfilled:

The interval between blood donations should be not less than three months. The donor

shall be in good health, mentally alert and physically fit and shall not be a jail inmate or a

person having multiple sex partners or a drug-addict. The donors shall fulfil the following

requirements, namely: -

(a) the donor shall be in the age group of 18 to 65 years

(b) the donor shall not be less than 45 kilograms

(c) temperature and pulse of the donor should be normal

(d) the systolic and diastolic blood pressures should be within normal limits (Systolic-100-160mmHg & Diastolic 60-90 mmHg) , controlled hypertensive on single drug may be considered

(e) haemoglobin should not be less than 12.5 g/dL

(f) the donor should be free from acute respiratory diseases

(g) the donor should be free from any skin diseases at the site of phlebotomy

(h) the donor should be free from any disease transmissible by blood transfusion, in so far as can be determined by history and examination indicated above

(i) the arms and forearms of the donor shall be free from skin punctures or scars indicative of professional blood donors or addiction of self injected narcotics

(j) donor should not be under the influence of alcohol

B. Defer the donor for the period mentioned as indicated in the following table:

CONDITIONS PERIOD OF DEFERMENT

(a) Abortion /Delivery 6 months

(b) History of blood transfusion 6 months

(c) Surgery 12 months

(d) Typhoid 12 months after recovery

(e) History of Malaria duly treated 3 months (endemic)

3 years (non endemic area)

(f) Tattoo 6 months

(h) Breast feeding 12 months after delivery

(i) Immunization (Tetanus, Plague,Cholera, Typhoid, Rubella, Gamma-globulin) 15days

(j) Rabies vaccination 12 months

(k) History (k) Hepatitis in family or close contact 12 months

(l) Immunoglobulin 12 months

(m) On Antibiotic/Aspirin(for platelet) 3 days after stoppage

(n) Menstruation Till periods finish

(o) Drugs-isotretinoin for acne, finasteride for prostate hyperplasia One month after last dose

(p) Drugs- cortisone 7 days after stoppage

C. Defer the donor permanently if suffering from any of the following diseases:

a. Cancer

b. Heart disease

c. Abnormal bleeding tendencies

d. Unexplained weight loss

e. Diabetes - controlled on Insulin

f. Hepatitis B/ C infection

g. Chronic renal disease/ failure

h. Signs and symptoms, suggestive of AIDS

i. Liver disease

j. Tuberculosis

k. Polycythemia Vera

l. Asthmatics on steroids

m. Epilepsy

n. Leprosy

o. Schizophrenia

p. Endocrine disorders

q. It is important to ask donors if they have been engaged in any risk behaviour. Allow sufficient time for discussion in the private cubicle.

Physical Examination

The physical examination begins by observing the prospective donor's generable appearance. The donor should be in good health, mentally alert and physically fit.

The interviewer decides whether the donor is obviously in need of sleep or not.

Hemoglobin, blood pressure, temperature, donor weight, height and local skin examination on phlebotomy site is checked by designated person.

Hemoglobin: -Hemoglobin level for blood donation must be 12.5g/dl (125 g /l) or greater and hematocrit must be 38 per cent (0.38).

Pulse:The pulse of donor should be between 60 and 100 beats per minute and regular. If the donor is an athlete a lower pulse may be accepted. Pulse should be taken for at least 30 second.

Blood Pressure: -Systolic and diastolic blood pressure should be within normal limits with or without medication (systolic – 100 to180 mm of Hg& Diastolic –50 to100 mm of Hg)

Temperature:

- Oral temperature must not exceed 37.5º c (99.5º F).
- Donor weight: To avoid acute hypovolemic reaction from donation the potential donor must weight a minimum of 45 Kg.
- The arm and forearm of donor should be free from skin disease at the site of phlebotomy.
- The arm and forearm of the donor should be free from skin punctures or scars indicative of professional donor or addiction of self injected narcotics.
- Examination of Respiratory system, Cardiovascular system and per abdomen should be carried out if necessary.