BLOOD PRODUCTS AND THEIR USE

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ÚHKT

DONORS – BLOOD COLLECTIONS

- Transfusion medicine – based on voluntary, non-remunareted donors who will to donate blood or blood components

- Donors
  - eligible for collection (healthy, normal blood count, questionnaire, avoid donors with risk factors or risk behavior who are rejected)
  - each donation - evaluation of ALT(not mandatory 2009), HIV ½ - Ab Ag, HBsAg, HCV Ab(Ag), syphilis (Ab)
    - ELISA techniques, recently NAT techniques
  - Negative results – blood products can be used for transfusion

  - Blood groups – AB0, Rh, irregular antibodies against RC

- Plastic bags
- Centrifugal principle for separation of blood components
- Whole blood, red cells, plasma, platelets, granulocytes

DONORS – BLOOD COLLECTIONS

- **Whole blood collections – 450 ml blood from one donor**
- **Hemapheresis technique – cell separators (centrifugal principle) specific density**
  - **Monocomponent collections**
    - **1 product from one donor**
  - **Multicomponent collections (MCC)**
    - **1 to 3 different products from one donor – red cells, plasma, platelets**

STANDARD WHOLE BLOOD COLLECTION

- **One collection ⇒ more types of blood products**
- **Blood bags ⇒ multiple plastic bags (2, 3, 4, 5)**
- **Anticoagulating and resuspension solutions ⇒ CPD, CPD- A, SAGM (saline, glucose, adenin, mannitol - optimum conditions for red cell storage)**
- **Centrifugal technique – blood banks**


A
O
O
O
B


A Rh
A Rh
0 Rh
TROMBOCYTY
Z BUFFY - COATU Z 1 ODBERU

Transfusion Medicine
Past & Present

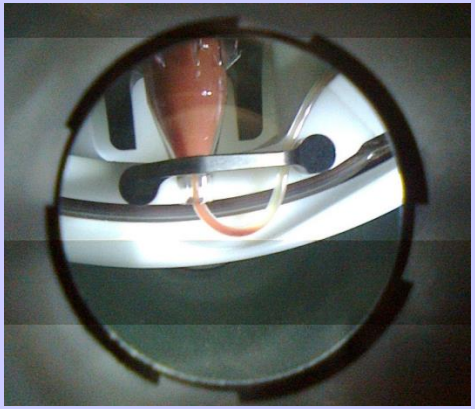
- **Development from blood group discovery**

Transformed from laboratory …..

- Donation whole blood and apheresis

- Therapeutic hemapheresis
  - hematology and other fields

- HSC – transplantation
  - PBPC
  - CB – cord blood

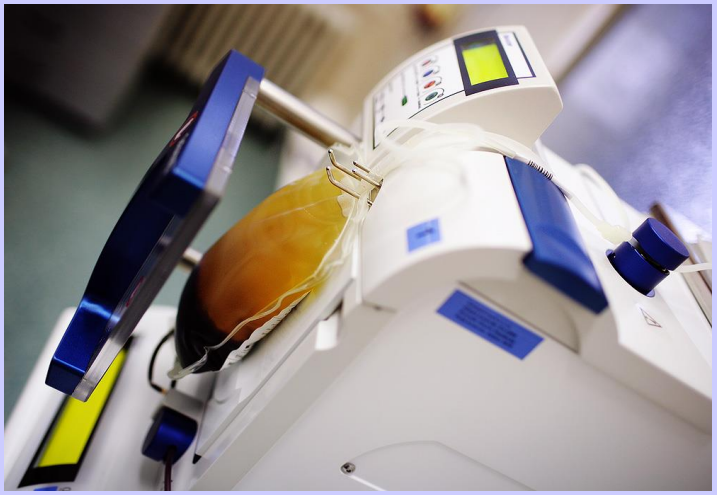


- MNC – antitumor therapy
  - new application for apheresis technology

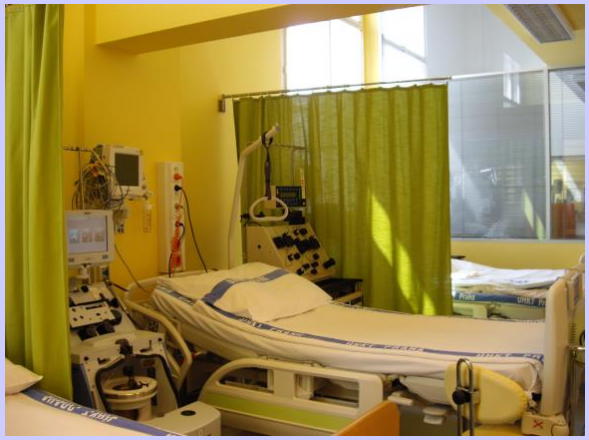
- Research – blood safety, universal blood, emergency…

Blood Donation and Blood Transfusion 1940 – 1946

Blood Bank Today…..

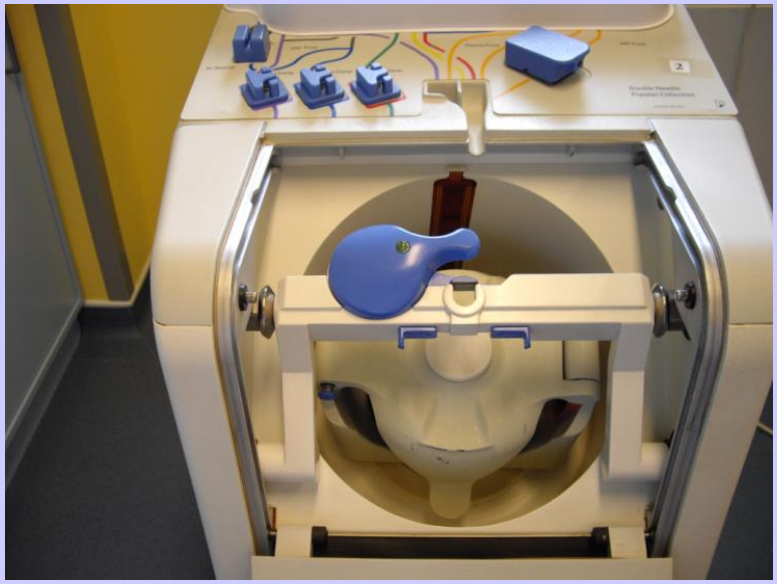


Therapeutic hemapheresis - Apheresis centre…ICU



hematology, neurology, nefphrology, kardiology, ophalmology…..

Hemapheresis & „on line“ extracorporeal separation of cells



Centrifugation
Specific Gravity

HEMAPHERESIS (APHERESIS)

Is the removal of whole blood from donor / patient

Its separation into components

Retention of the desired component

Return of the recombined remaining elements back to the donor / patient.

The Aim - Component Preparation or Therapeutic Applications

THERAPEUTIC HEMAPHERESIS

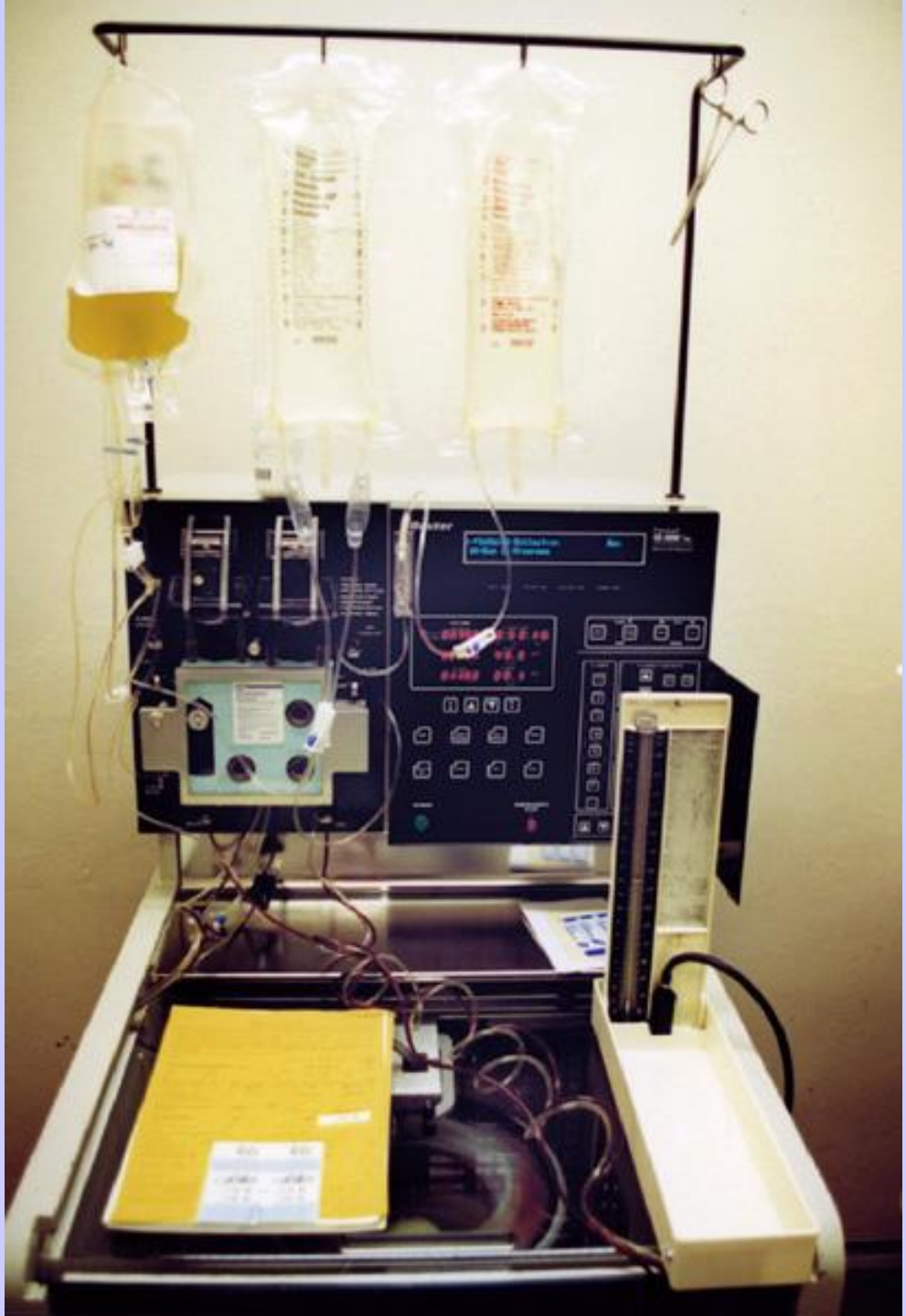
Is a procedure used for removing cells, plasma or plasma components from the circulation, to be replaced by normal plasma or solutions of electrolytes or colloids.

THE AIM :

The reduction of a pathologic substance in the patient's blood

An improvement in the course of the disease


COBE Spectra



WHOLE BLOOD DERIVED BLOOD PRODUCTS – basic products

- **„Centrifugation principle“**
  - **Red cells buffy coat removed / ”leukocytes poor”**
    - ***< 1,2 G leukocytes / bag, htk 50-70 %, hbg 43 g/bag***
    - ***storage time 42 days, T 2-6^{0}C***
  - **Red cells leukodepleted – additional leukodepletion**
    - ***< 1 M leukocytes / bag***
    - ***htk 50-70 %, hbg 40 g/bag***
    - ***storage time 42 days, T 2-6^{0}C***
  - **Platelets**
    - ***0,5 x 10^{11}/ bag, swirling effect***
    - ***storage time 5 days, T 20-24^{0}C***
  - **Plasma – fresh frozen**
    - ***storage time 36 month, T -25^{0}C***

Granulocytes

BLOOD PRODUCTS

PLATELETS

- Platelets from whole blood 0,5 $x10^{11}$/TU
- Platelets apheresis 2-3$x10^{11}$/TU
- Platelets leukodepleted <1 $x10^{6}$/TU leukocytes

THERAPEUTIC DOSE OF PLATELETS

$2x10^{11}$

BLOOD PRODUCTS – plasma products

- Plasma
- Fresh frozen – whole blood
- Source plasma - apheresis
- ”Cryosupernatant plasma“
- Cryoprecipitate

BLOOD PRODUCTS - APHERESIS

- PLATELETS
- RED CELLS
- PLASMA
- GRANULOCYTES
- LYMPHOCYTES – DLI
- PBPC
- MNC FOR ECP
- MULTICOMPONENT DONATION

BLOOD PRODUCTS

- GRANULOCYTES
- Granulocytes
  - from whole blood
  - from apheresis (rh-GCS-F+HES)
  - ethical probles
  - long term safety

RED CELLS, INDICATIONS, DOSE, EFFECT OF TRANSFUSION

- **Indications**
  - **Symptoms of anemia in normovolemic patients (clinical situation, laboratory results usually hbg< 70 g/l)**

- **Transfusion 1 TU (bag) RC➔ hb > 10g/l, htk > by 3 %**

PLATELET CONCENTRATE - INDICATIONS, DOSE, EFFECT OF TRANSFUSION

- **Indications**
  - **PREVENTION IN THROMBOCYTOPENIC PTS**
    - ***before invasive procedures at Plt < 50 × 10^9 / l***
    - ***in stable patients at Plt < 5 - 10 × 10^9 / l***
    - ***functional abnormalities Plt***
  - **THERAPY IN BLEEDING THROMBOCYTOPENIC PTS**
    - ***therapy of bleeding patients at Plt < 50 × 10^9 / l***
- **Platelets dose and effect of transfusion**
  - **1 TU (bag) from whole blood (buffy coat)**
    - ***> Plt o 5 × 10^9 / l***
    - **(terap. dose = 4-6 bags)**
  - **1 TU (bag) apheresis > Plt by 30 - 60 × 10^9 / l**

PLASMA - INDICATIONS

- Bleeding patients or patients before invasive procedure with multiple defects of coagulation factors (liver failure, DIC)
- Kongenital deficit of coagulating faktors, if concentrate (e.g f. V., f. XI) is not available

- TTP and HUS

- Dose 10 - 20 ml / kg (inrease of the faktor by 20 %)
  - alloimunization unprobable
  - transfer of CMV by plasma unprobable
  - GVHD - prevention of ioniziing irradiation – in plasma is not mandatory

LEUKODEPLETION - INDICATING CRITERIA

- Prevention of alloimmunization in recipients of repeated transfusions
- Prevention of NHFTR in patients with repeated reactions after transfusion of products buffy coat removed
- Prevention of CMV infections in immunocompromised patients (hematooncology, newborns..)

POTRANSFUSION TA – GVHD

- Rare, almost ever fatal, T lymphocytes, frekvency in 0.1 – 1 % patients, immunocompromised recipients
- TA - GVHD develops
  - differences between HLA antigens between donor and recipient
  - presence of immunocompetent cells in the product
  - recipient is not able to reject the immunocompetent cells (Billingham 1996)

PREVENTION OF POTRANSFUSION – GVHD

- **Irradiation of blood products by means of ioniziing irradiation at doses 25 – 50 Gy is the efficient prevention TA GVHD – inhibition of T lymphocytes proliferation**
  - **RC, Platelets, plasma, granulocytes, plasma not mandatory**
  - **irradiation does not prevent transfer of CMV**
  - **irradiation does not prevent alloimunization**

TRANSFUSION - TECHNIQUES

- Time limit for transfusion of blood or blood products - not longer than 4 hours

- **Blood warmers** – 37^0C
  - Rapid multiple transfusions at > 50 ml /h
  - Cold antibodies

- Blood stored at T > 10^0C should not be returned back to the transfusion department. Blood products should not be stored without continuous registration of temperature

TRANSFUSION - TECHNIQUES

- Blood products should not be mixed with drugs or solutions e.g. 5 % glucose, Ringer laktate ect.

  Only 0.9 % NaCl is allowed

- Blood transfusion through filters with pores of 170 µm
  - Always in all transfusions including leucodepleted products

- Infusion pumps, peristaltic pumps – risk of mechanical hemolysis

POTRANSFUSION REACTIONS

- Intravascular hemolysis from immune causes
- Extravascular hemolysis from immune causes
- NHFTR – nonhemolytic febrile
- Allergic
- Hypotension
- Hypervolemia
- TRALI – transfusion related acute lung injury
- Transfusion associated sepsis – microbial contamination