

**Peripheral Blood Stem Cell Collection
by Apheresis: Experience at
Armed Forces Bone Marrow Transplant
Centre Rawalpindi**



MAJ KISHWAR SULTANA
B.Sc Nursing, OJT Bone Marrow Transplant (UK)

INTRODUCTION

Haematopoietic stem cell transplantation is an established therapy for a number of malignant and non-malignant disorders of the blood and bone marrow

INTRODUCTION

HAEMATOPOIETIC STEM CELLS

have the capacity of both self renewal and differentiation

Sources:

Bone marrow

Peripheral blood

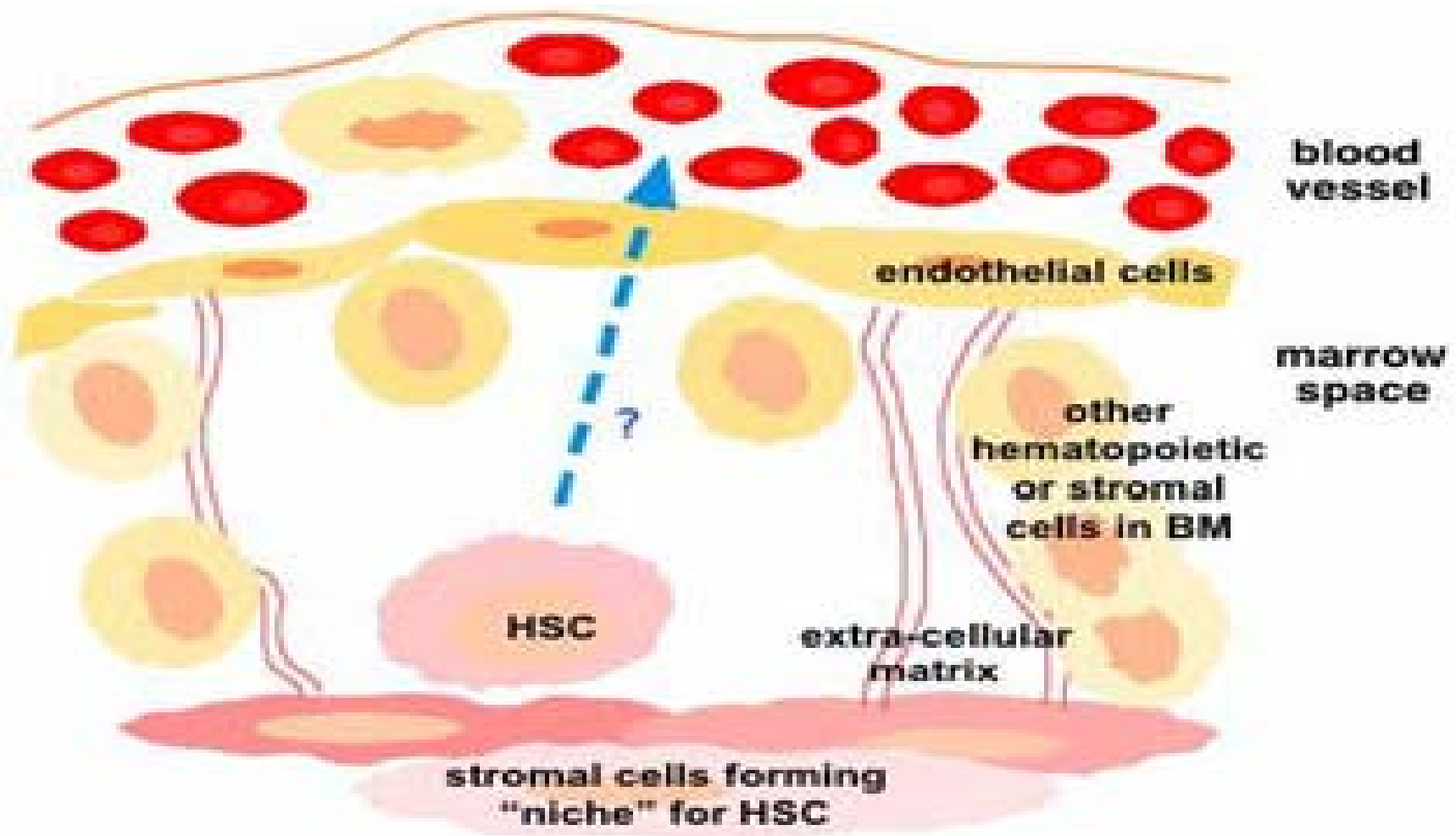
Cord blood

INTRODUCTION

Peripheral blood stem cells:

- . Normal blood concentration 0.01-0.1%
- . Can be mobilized by using growth factors with or without chemotherapy

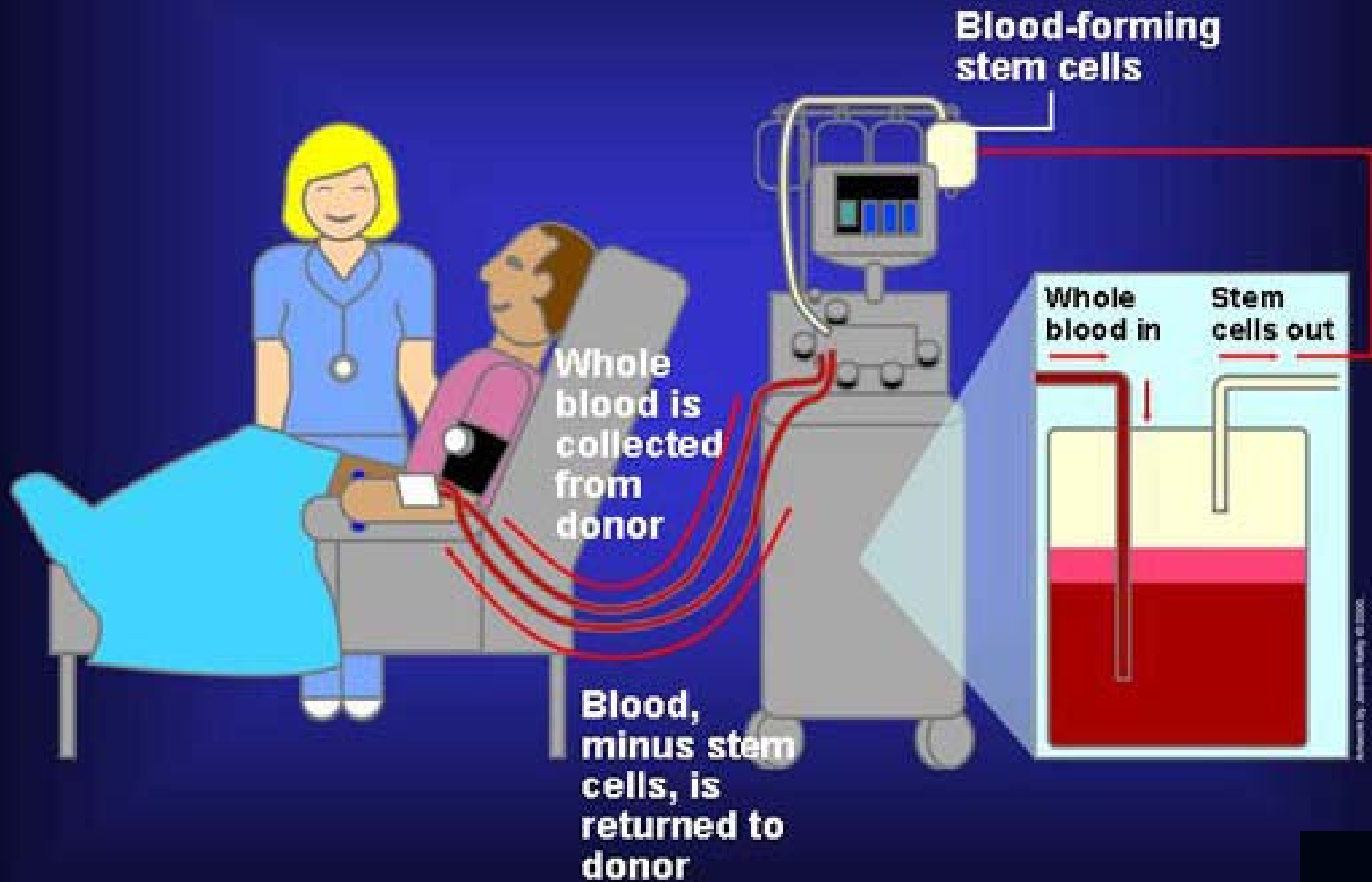
HAEMATOPOIETIC STEM CELL MOBILIZATION



APHERESIS

Removal of whole blood from a patient or donor into a machine that uses centrifugal force to separate the components. The required cells are collected and the remaining components are re-transfused into the patient or donor

Apheresis: Harvesting Stem Cells From Peripheral Blood



THERAPEUTIC APHERESIS

To remove a component of the blood which contributes to a disease state

Plasmapheresis:

- . Waldenstrom's macroglobulinemia
- . Myasthenia gravis
- . Guillain-Barré syndrome
- . Hyperviscosity Syndromes
- . Paraproteinemia
- . Cryoglobulinemia
- . Goodpasture's syndrome

Plateletpheresis:

Leukapheresis:

DONATION BY APHERESIS

To provide blood components

- . Plateletpheresis
- . Plasmapheresis
- . Leukapheresis
- . **Stem Cell Harvesting**

ADVANTAGES OF USING PBSC FOR TRANSPLANTATION

Donor:

- **Anaesthesia is not needed**
- **Discomfort involved in multiple bone marrow aspirations avoided**
- **Multiple procedures can safely be carried out to achieve adequate cell yield**

ADVANTAGES OF USING PBSC FOR TRANSPLANTATION

Recipient:

- **Shorter duration of post transplant aplasia**
- **More rapid haemopoietic and immune reconstitution**
- **Potentially more pronounced GVL effect**

PBSC FOR TRANSPLANTATION

- **Data from Centre for International Blood and Marrow Transplant Research (CIBMTR) show that between 2001-2004, 70% of adult allogeneic transplant recipients received PBSC graft**
- **PBSC grafts are currently the most common choice for both autologous and allogeneic transplantation world wide**

PERIPHERAL BLOOD STEM CELL COLLECTION BY APHERESIS

Study: Retrospective analysis of data
generated from 310 allogeneic
PBSC procedures from Apr 2003 to
date

Statistical analysis: SPSS 13.0

DIAGNOSIS

(n = 203)

| | |
|-------------------------------|-----|
| Aplastic Anemia | 103 |
| Chronic Myeloid Leukaemia | 41 |
| β -Thalassemia Major | 30 |
| Acute Lymphoblastic Leukaemia | 11 |
| Fanconia's Anaemia | 02 |
| Acute Myeloid Leukaemia | 04 |
| MDS | 05 |
| NHL | 03 |
| PNH | 02 |
| Others | 04 |

MATERIALS AND METHODS

| | Total | Male | Female |
|-----------------|------------|------------|-----------|
| Patients | 203 | 154 | 49 |
| Donors | 203 | 124 | 79 |

MATERIALS AND METHODS

DONOR CHARACTERISTICS

Age:

Mean Age of Donor: 20 yrs

Minimum Age: 02 yrs

Height:

Mean Height of Donors: 153 cm

Minimum Height: 84 cm

Weight:

Mean Weight of Donor: 49 kg

Minimum Weight: 10 kg

STEM CELL MOBILISATION PROTOCOL

- **G-CSF 5-10 $\mu\text{g}/\text{kg}$ body weight for 5-6 days**
- **Blood counts and mononuclear cell (MNC) counts daily**
- **Stem Cell apheresis on day 6 and / or 7 of G-CSF administration**

APHERESIS PROCEDURE

Priming:

- For children weighing $\leq 30\text{kg}$ extra corporeal

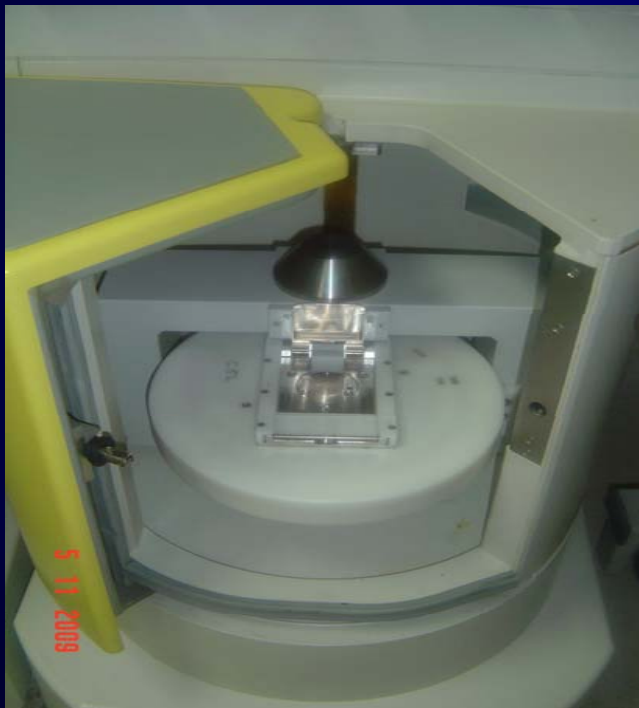
line was primed with leucocyte - depleted

irradiated blood after regular priming with

saline

CONTINUOUS FLOW BLOOD SEPARATOR

Fresenius blood
separator
(Germany)

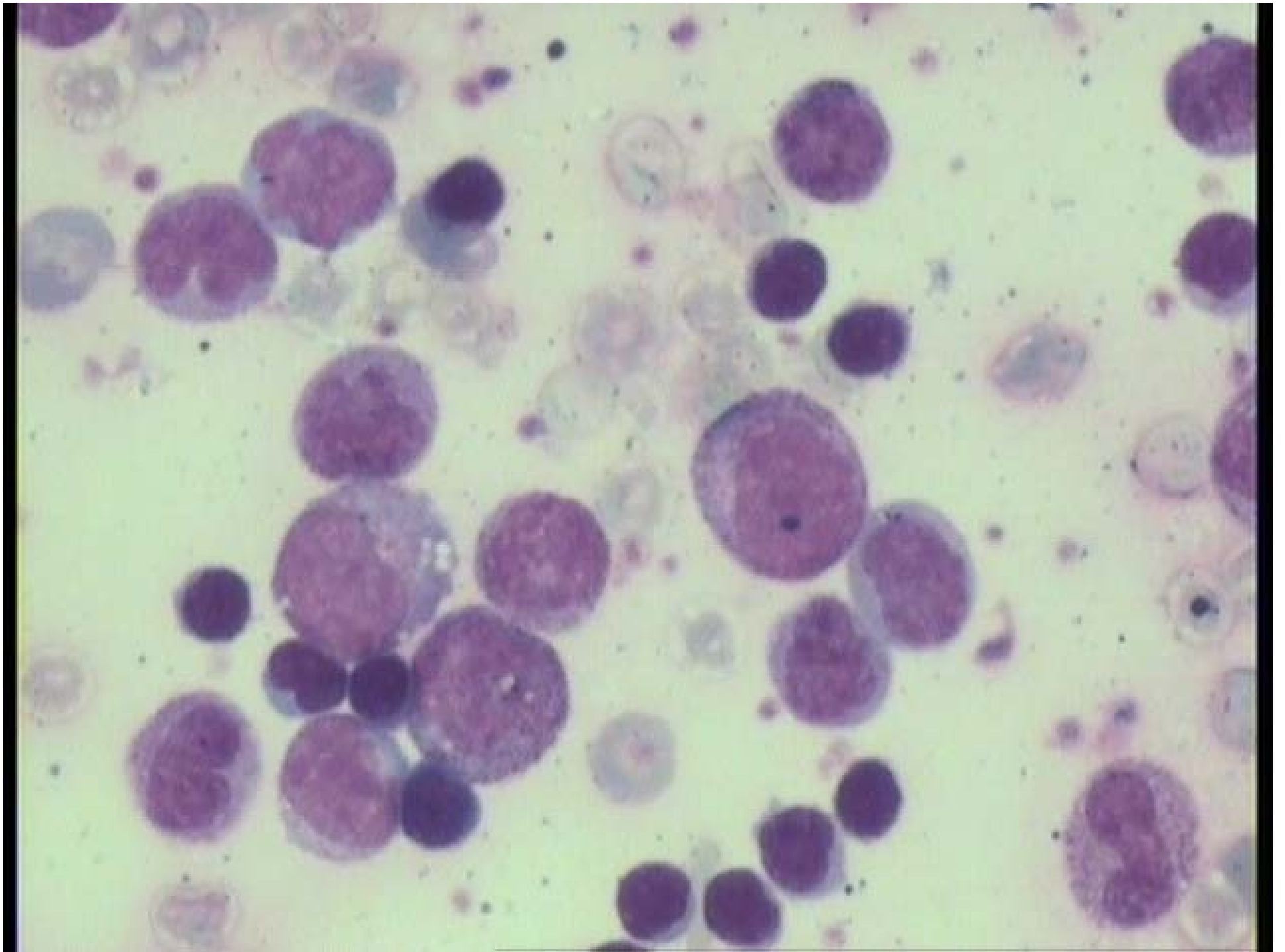




29 14:58

CALCULATION OF YIELD

- **Complete blood counts of the PBSC harvest using a haematology analyser**
- **Morphological examination of smear to determine lymphocyte and monocytoid cell percentage**



CALCULATION OF MNC DOSE

$$\frac{\text{WBC} \times 10^9 \times \text{volume}}{1000} \times \frac{\text{MNC}\%}{100} / \text{Weight of recipient}$$
$$= \text{MNC} / \text{kg body weight of recipient}$$

NUMBER OF APHERESIS PROCEDURES

Total number of donors **203**

Total number of apheresis procedures **310**

Number of donors **Number of Procedures** **% of Total**

| | | |
|-----|----|-------|
| 110 | 01 | 54.5% |
| 82 | 02 | 40% |
| 10 | 03 | 5% |
| 01 | 04 | 0.5% |

MODE OF VASCULAR ACCESS

**Fistula Needle +
I/V Cannula**

256

CV Line + I/V Cannula

54

PRE-PROCEDURE DONOR VALUES

Mean Blood Vol: 3510 ml

Mean WBC Count: $40.11 \times 10^9/l$

Mean MNC Count: $8.54 \times 10^9/l$

PBSC HARVEST

Mean Procedure Time: 248 mins

Mean Volume of Harvest: 251 ml

Range: 60 - 402 ml

Mean WBC Count: 113 x10⁹/l

Range: 11 – 308 x10⁹/l

Mean MNC Count: 45 x10⁹/l

Range: 3.4 - 96x10⁹/l

MNC YIELD / KG BODY WEIGHT OF RECIPIENT

Mean MNC Yield : $2.68 \times 10^8 / \text{kg}$

Minimum MNC Yield : $0.1 \times 10^8 / \text{kg}$

Maximum MNC Yield: $12 \times 10^8 / \text{kg}$

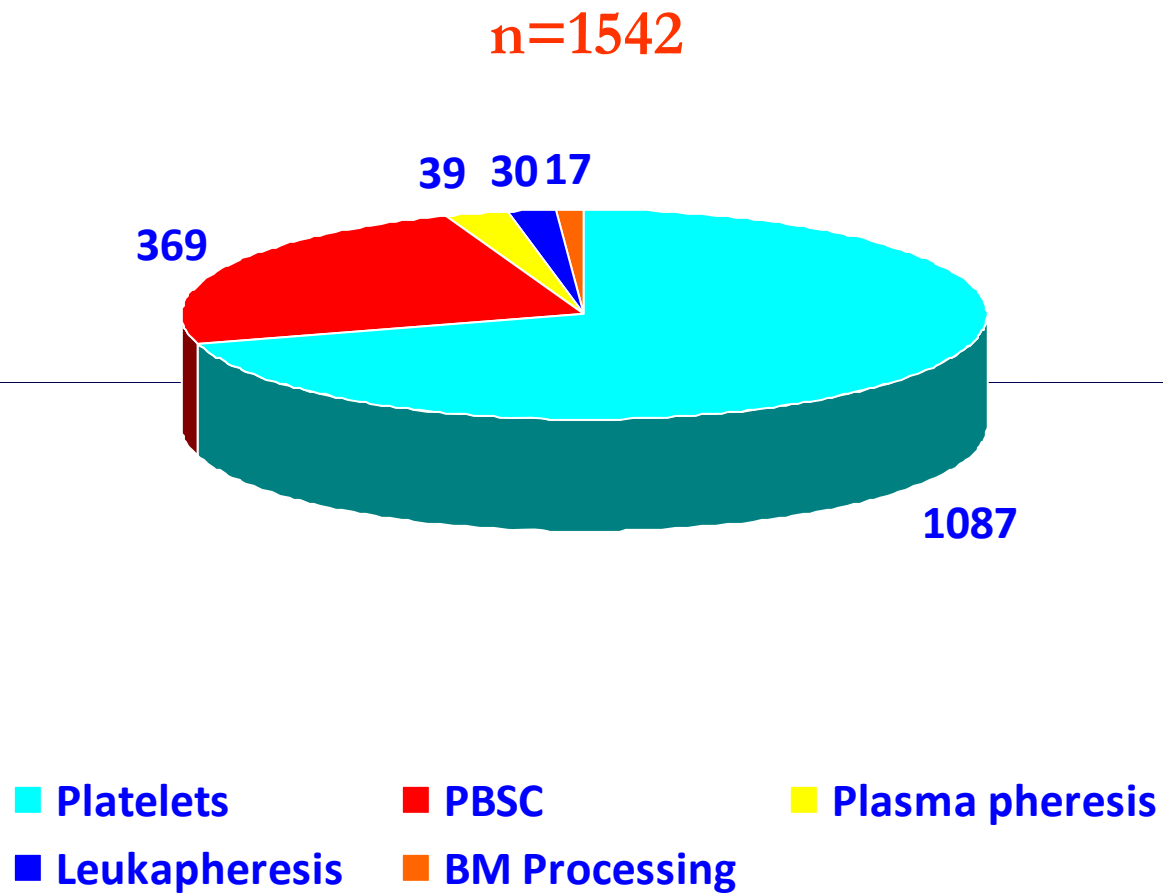
ADVERSE EVENTS WITH PBSC APHERESIS PROCEDURES

| Events | Number of PBSC (n=310) |
|-------------------------------|---------------------------|
| Peri-oral numbness | 85 |
| Paresthesias | 53 |
| Nausea | 40 |
| Carmo-pedal spasm | 30 |
| Bruising at venepuncture site | 26 |
| Vomiting | 11 |
| Chills | 15 |
| Headache | 22 |

SERIOUS ADVERSE EVENTS FOLLOWING PBSC DONATION

- **Spontaneous splenic rupture Nil**
- **Chest pain, myocardial infarction Nil**
- **CV line associated pneumothorax,
hemorrhage, infection Nil**

Apheresis at AFBMTC: An Overview



CONCLUSION

Peripheral blood haemopoietic stem cell

collection using apheresis is a safe and

convenient procedure that can be carried out in

even very young donors with relative ease

Thank you

