Autologous Hematopoietic Stem Cell Transplantation in Hematological Malignancies

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By

TAMER SHAABAN ABDEL MOHSEN ELMERGAWY

(M.B., B.ch. 1999)
Ain Shams University

Supervised by

Professor Dr. / Manal Hashem Ahmed

Professor of Clinical and Chemical Pathology
Faculty of Medicine
Ain Shams University

Professor Dr. / Soha Ezzel Arab Abdul Wahab

Assistant Professor of Clinical and Chemical Pathology
Faculty of Medicine
Ain Shams University

Dr. / Dina Aziz Khattab

Lecturer of Clinical and Chemical Pathology
Faculty of Medicine
Ain Shams University

Faculty of Medicine
Ain Shams University
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بسم الله الرحمن الرحيم

"وما أوتيتم من العلم الا قليلا"

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*Thanks **Allah** for giving me the power and strength to carry out this work.*

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Glossary

ACD-A	Anticoagulant-citrate-dextrose, Formula A
AHSCT	Autologous hematopoietic stem cell transplantation
ALDH	Aldehyde dehydrogenase
ALL	Acute lymphoblastic leukemia
AML	Acute myeloblastic leukemia
APC	Antigen presenting cell
BM	Bone marrow
BMT	Bone marrow transplantation
CAM	Cell adhesion molecule
CD	Cluster of differentiation
CFC	Colony-forming cell
CLL	Chronic lymphocytic leukemia
CML	Chronic myelocytic leukemia
CR	Complete remission
CXCR4	CXC receptor 4
DMSO	dimethyle sulfaoxide
Flt3-L	fms-like tyrosine kinase 3 ligand
G.CFC	Granulocyte colony forming cell
G.CSF	Granulocyte-colony stimulating factor
GM.CFC	Granulocyte-macrophage colony forming cell
GM.CSF	Granulocyte-macrophage colony-stimulating factor
GVHD	Graft versus host disease
HD	Hodgkin disease
HLA	Human leukocyte antigens
HSC	Hematopoietic stem cell
HSCT	Hematopoietic stem cell transplantation
IL	Interleukin
INF	Interferon
LFA-1	Leukocyte Function-associated Antigen-1
Lin	lineages (lin) markers

LTC	Long-term culture
LTC-IC	long term culture initiating cells
LVL	Large volume leukapheresis
m- AB	Monoclonal antibodies
MDS	Myelodysblastic syndrome
MHC	Major histocontability complex
MIP-1	Macrophage inflammatory protein 1α
MM	Multiple myloma
NHL	Non hodgkin lymphoma
NOD/SCID	Non-obese diabetic/severe combined immunodeficient mice
PCR	Polymerase chain reaction
PB	Peripheral blood
PBPC	Peripheral blood progenitor cell
PML/RARα	Promyelocytic Leukemia/Retinoic Acid Receptor- a
RBCs	Red blood cells
Sca-1	Stem cell antigen
SCF	Stem cell factor
SDF-1	Stromal drived factor-1
SRC	Severe combined immunodeficient repopulating cell
t-	Translocation
TNH	Tissue necrotizing factor
Thy-1	Thymocytes antigen
VCAM	Vascular cell adhesion molecules
WBCs	White blood cells

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INTRODUCTION AND AIM OF THE WORK

Introduction

During the past two decades bone marrow transplantation has become a standard tool for the management of hematopoietic malignancies **(Roy et al., 2000).** Autologous bone marrow transplantation involves the use of patient's own hemopoietic progenitor cells to reestablish into mature blood lineage, such as leukocytes, platelets, and erythrocytes after the administration of high-dose chemotherapy and/or radiation therapy (**Fliedner, 1998).**

The reinfused hematopoietic progenitors may come from the patient's marrow or more recently peripheral blood. Generally, before peripheral stem cell harvest, the stem cell content of the blood is augmented by treating the patient with chemotherapy and cytokines. Cytokines may decrease binding forces between stem cells and components of the stromal microenvironment, thus facilitating the migration of stem cells into the peripheral blood **(Lapidot and Petit, 2001).**

Most of the stem and progenitor cell compartment bear the cell surface antigen CD34. Enumeration of CD34 cells allows for more accurate assessment of engraftment potential provided by a given number of mononuclear cells, (**Ronald et al., 2004). The** Processing of stem cell is a cornerstone in success of transplantation process which includes isolation, and purification procedures **(Kenneth et al., 2000).**

Autologous stem cell transplantation has few post transfusion complications comparable to allogeneic stem cell transplantation. A concern related specifically to autologous transplantation is the possible presence of

contaminating tumor cells in the graft **(Ritchard, 1999).** A number of approaches have been employed to rid the graft off tumor cells, including purging tumor cells with antibody plus complement, or the use of peripheral stem cell techniques for both positive and negative purging to reduce tumor cell contamination **(Davood et al., 2001).**

Autologous stem cell grafting has been used with varying degrees of success for hematopoietic malignancies (acute and chronic leukemia, Hodgkin's and non Hodgkin's disease multiple myeloma and myeloproliferative disorders). It can improve the duration of remission and provide a better quality of life **(John et al., 2002).**

Aim of the work

The aim of our essay is to review the general procedures of autologous hematopoietic stem cell transplantation and its role in the treatment of hematopoietic malignancies. Our objectives are to understand the basic concept of autologous stem cell transplantation and to build knowledge to enable an understanding of its future progression.

REVIEW OF LITERATURE

HEMATOPOIETIC STEM CELL (HSC)

INTRODUCTION

Throughout life, human own cells need to be replaced. The cells responsible for this normal turnover and repair are described as stem cells. A stem cell is the "mother cell" that leads to production of all various types of cells. The stem cells inside an embryo will eventually give rise to every cell, organ and tissue in the fetus's body, unlike other regular cells, that only can replicate to create more of its own kind of cells **(Petzer et al., 1996).**

There are two types of stem cells: embryonic stem cells and adult stem cells. Embryonic stem cells come from an embryo. Embryonic stem cells form the mass of cells in the earliest stage of human development, which will eventually grow into a fetus. When the embryo is between three and five days old, it contains stem cells, which are busily working to create the various organs and tissues that will make up the fetus **(Tavian et al., 1996).**

Adults also have stem cells in the heart, brain, bone marrow; lungs and other organs. They are built-in repair kits, regenerating cells damaged by disease, injury and everyday wear and tear **(Tavian et al., 1996).**

A fundamental character of stem cells is the lasting ability to multiply when called upon to differentiate into specialized cells that can no longer divide **(Petzer et al., 1996).**