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Does the preference of peripheral versus central venous access in peripheral blood stem cell collection/yield change stem cell kinetics in autologous stem cell transplantation?

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ABSTRACT

Central venous access is often used during apheresis procedure in stem cell collection. The aim of the present study was to evaluate whether central or peripheral venous access has an effect on stem cell yield and the kinetics of the procedure and the product in patients undergoing ASCT after high dose therapy. A total of 327 patients were retrospectively reviewed. The use of peripheral venous access for stem cell yield was significantly more frequent in males compared to females ($p = 0.005$). Total volume of the product was significantly lower in central venous access group ($p = 0.046$). As being a less invasive procedure, peripheral venous access can be used for stem cell yield in eligible selected patients.

1. Introduction

Hematopoietic stem cells derived from the peripheral blood have been frequently used in recent years both in allogeneic and autologous stem cell transplantation. Autologous hematopoietic stem cell transplantation (ASCT) has gradually become an important treatment option for patients particularly those with multiple myeloma and non-Hodgkin lymphoma [1–4]. The purpose of mobilization is to increase the stem cell content of the peripheral blood. The drugs used for this purpose are called induced mobilization regimens. A sufficient amount of stem cells must be collected by a minimum number of apheresis procedures in order to support hematopoietic reconstruction with an optimal mobilization regimen and ensure rapid and sustained recovery after transplantation. The place of mobilization agents and strategies in reducing the failure of mobilization attempts have become more important in recent years with accumulating data suggesting the efficiency and safety of ASCT in patients aged 65 years or older [5,6].

In stem cell mobilization, growth factors can be used alone or in combination with chemotherapeutic agents. There are many studies in this field that compared different regimens for this purpose [7,8]. Apart from this, the use of CXCR-4 chemokine receptor antagonists plerixafor has also increased gradually [9]. This agent has found utility together with G-CSF or combined chemotherapy regimens in patients in whom mobilization regimens have failed using standard protocols [10]. The amount of stem cells need to be collected for successful engraftment after ASCT is 2×10^6 CD34+ cell/kg, and this target value cannot be reached in 30% of the patients, which is defined as mobilization failure [11]. In ASCT, peripheral blood is preferred over bone marrow

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as the source of hematopoietic stem cell [12]. Central venous access is often used during apheresis procedure in stem cell collection; however, peripheral venous access can be preferred in selected patients. The aim of the present study was to evaluate whether central or peripheral venous access has an effect on stem cell yield and the kinetics of the procedure in patients undergoing ASCT after high dose therapy.

2. Patients and methods

2.1. Patients

This retrospective study was conducted in Bone Marrow Transplantation Units of Pamukkale University Faculty of Medicine, Ankara Oncology Hospital, and Inonu University Faculty of Medicine. A total of 327 patients, who underwent stem cell mobilization for ASCT, were retrospectively reviewed. The patients with ECOG (Eastern Cooperative Oncology Group) performance status of 0-2, who did not have a proven cardiac disease, renal or hepatic insufficiency and who were eligible for ASCT after peripheral stem cell mobilization, were included in the study.

2.2. Mobilization and stem cell apheresis

G-CSF alone, G-CSF in combination with chemotherapy, and plerixafor plus G-CSF in combination with/without chemotherapy were used as stem cell mobilization regimens. During stem cell apheresis procedure, the preference of central or peripheral venous access was based on the suitability of the peripheral veins for cannulation. Both antecubital veins were assessed to install a peripheral vascular access. Central venous catheterization was performed if both antecubital veins were deemed unsuitable for cannulation. The total amount of product collected after apheresis procedure was assessed in milliliters and the amount of CD34 positive cells was expressed as number/kg. With regards to procedure kinetics, total blood volume processed, and total number of days of apheresis and the amount of anticoagulant ACD solution were determined.

2.3. Statistical analysis

The data were analyzed using SPSS version 17.0. Parametric or non-parametric tests were used depending on the range. P values of less than 0.05 were regarded as significant.

3. Results

A total of 327 patients (203 males, 124 females), who underwent peripheral stem cell mobilization for ASCT, were included in the study. Central venous access was preferred in 194 patients (59.3%) and peripheral venous access was preferred in 133 patients (40.7%) for peripheral stem cell collection. Demographic and clinical characteristics of patients were summarized in Table 1. The two groups were comparable in terms of age, height, weight, blood and plasma volume. The use of peripheral venous access for stem cell collection was significantly more frequent in males compared to females (p = 0.005).

In stem cell mobilization, 205 patients (62.7%) received chemotherapy and G-CSF, 96 patients (29.4%) received G-CSF alone, and 26 patients (8%) received plerixafor plus G-CSF. Data regarding mobilization kinetics and stem cell yield were presented in Table 2. Two groups were comparable in terms of number of apheresis days, total blood volume processed, total volume of anticoagulant ACD solution and number of mobilized CD34+ cells. Total volume of the product collected was significantly lower in central venous access group (p = 0.046).

Table 1
Demographic and clinical characteristics of patients.

	Central venous access n (%)	Peripheral venous access n (%)	p value
Gender			
Female	86 (44.3%)	38 (28.6%)	p = 0.005
Male	108 (55.7%)	95 (71.4%)	NS
Age	49.8 (±14.2)	48.1 (±13.8)	NS
Height (cm)	165.9 (±8.5)	167.7 (±8.7)	NS
Weight (kg)	72.2 (±12)	72.3 (±14)	NS
Blood volume (ml)	5079 (±748)	5016 (±861)	NS
Plasma volume (ml)	3203 (±536)	3183 (±645)	NS
Diagnosis			
Multiple myeloma	94 (48.5%)	65 (48.9%)	
Non-Hodgkin lymphoma	49 (25.3%)	34 (25.6%)	
Hodgkin lymphoma	35 (18%)	17 (12.8%)	
Acute leukemia	15 (7.7%)	9 (6.8%)	
Testis tumor	1 (0.5%)	8 (6%)	

NS (not significant).

Table 2
The kinetics of the procedures and products.

	Central Venous Access n[a]	Peripheral Venous Access n[a]	p value
Number of days of apheresis (days)	1.6 (±0.6)	1.6 (±0.6)	NS
TVBP (L)	22.56 (±11.17)	21 (±9.93)	NS
ACD solution (ml)	1643 (±802)	1501 (±818)	NS
CD 34 × 10^6/kg	6.86 (±4.44)	6.76 (±3.25)	NS
Total volume of product (ml)	474.1 (±264.3)	532.1 (±245.1)	**p = 0.046**

Bold value indicates statistically signifant.
[a] mean; TVBP: total volume of blood processed.