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RESEARCH

DAY ZERO OF HEMATOPOIETIC STEM CELL TRANSPLANTATION: NURSE'S CARE

DIA ZERO DO TRANSPLANTE DE CÉLULAS-TRONCO HEMATOPOÉTICAS: CUIDADOS DO ENFERMEIRO

DIA CERO DEL TRASPLANTE DE CÉLULAS MADRE HEMATOPOYÉTICAS: CUIDADOS DEL ENFERMERO

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ABSTRACT

The aim of the study was to identify the care provided by nurses on the Day Zero of Transplantation of hematopoietic stem cells and identify the adverse reactions presented by patients on this day. A descriptive study of qualitative approach was conducted at the inpatient unit of a bone marrow transplant service of a university hospital in the southern region of Brazil. Eleven nurses participated in the study. The data collection period was between July and September of 2016 during a total of ten days of transplantations and 72 hours of passive observation. Data were recorded in a previously prepared instrument and analyzed in pre-established categories. Related and unrelated allogeneic transplantations were observed, in which the hematopoietic stem cells used were bone marrow, peripheral blood, and umbilical and placental cord blood. The infusion modalities observed were cryopreserved and fresh. ABO compatibility in the fresh modality consisted in the categories ABO-compatible, major ABO-incompatible and minor ABO-incompatible. Adverse reactions were observed in eight out of the ten transplantations, and the most prevalent was systemic arterial hypertension. Nursing care consisted in actions implemented before, during and after the infusion of hematopoietic stem cells, among them: administration of medications prescribed by the physician previously to infusion of hematopoietic stem cells (before); monitoring of vital signs (during), monitoring of appearance and volume of diuresis and water balance (after). The conclusion was that care provided to patients by nurses on Day Zero of Hematopoietic Stem Cell Transplantation aims at early prevention, detection and intervention in adverse reactions related to the hematopoietic stem cell infusion procedure.

Keywords: Nursing; Nursing Care; Hematopoietic Stem Cell Transplantation.

RESUMO

O estudo objetivou identificar os cuidados do enfermeiro no Dia Zero do Transplante de células-tronco hematopoéticas e identificar as reações adversas apresentadas pelos pacientes neste dia. Realizou-se pesquisa descritiva com abordagem qualitativa na Unidade de Internação de um Serviço de Transplante de Medula Óssea de um hospital universitário da região sul do Brasil. No total, 11 enfermeiros fizeram parte da pesquisa. A coleta de dados ocorreu entre julho e setembro de 2016, em dez dias de transplantes, e totalizou 72 horas de observação passiva. Os dados foram registrados em instrumento previamente elaborado e analisados em categorias preestabelecidas. Foram observados transplantes alogênicos aparentados e não aparentados, os quais utilizaram como fonte de células-tronco hematopoéticas medula óssea, sangue periférico e sangue de cordão umbilical e placentário. As modalidades de infusão observadas foram criopreservada-descongelada e fresca, e para esta, classificou-se a compatibilidade do sistema ABO em compatível, incompatível ABO maior e incompatível ABO menor. Observou-se reações adversas em oito dos dez transplantes, sendo a mais prevalente hipertensão arterial sistêmica. Os cuidados do enfermeiro foram agrupados em antes, durante e após a infusão de células-tronco hematopoéticas, entre eles: administração de medicações prescritas pelo médico pré-infusão de células-tronco hematopoéticas (antes); aferição de sinais vitais (durante), monitoramento de aspecto e volume de diurese e balanço hídrico (após). Concluiu-se que os cuidados prestados ao paciente no Dia Zero do Transplante de células-tronco hematopoéticas pelo enfermeiro visam prevenir, detectar e intervir precocemente em reações adversas relacionadas ao procedimento de infusão das células-tronco hematopoéticas.

Palavras-chave: *Enfermagem; Cuidados de Enfermagem; Transplante de Células-Tronco Hematopoéticas.*

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RESUMEN

El objetivo de este estudio fue identificar los cuidados del enfermero el día cero del trasplante de células madre hematopoyéticas e identificar las reacciones adversas presentadas por los pacientes ese mismo día. Se realizó una investigación descriptiva con enfoque cualitativo en la unidad de internación del servicio de trasplante de médula ósea de un hospital universitario de la región sur de Brasil. En total, 11 enfermeros formaron parte de la investigación. La recogida de datos se realizó entre julio y septiembre de 2016, en diez días de trasplantes, con un total de 72 horas de observación pasiva. Los datos fueron registrados en un instrumento previamente elaborado y analizados en categorías preestablecidas. Se observaron trasplantes alogénicos emparentados y no emparentados, cuya fuente de células madre hematopoyéticas fue la médula ósea, la sangre periférica y la sangre del cordón umbilical y placentario. Las modalidades de infusión observadas fueron criopreservada-descongelada y fresca y, para ésta, se clasificó la compatibilidad del sistema ABO en compatible, incompatibilidad ABO mayor e incompatibilidad ABO menor. Se observaron reacciones adversas en ocho de los diez trasplantes, siendo la más prevalente la hipertensión arterial sistémica. Los cuidados del enfermero fueron agrupados en antes, durante y después de la infusión de las células madre, entre ellos: administración de medicamentos indicados por el médico antes de la infusión de células madre (antes); medición de las señales vitales (durante); monitoreo de aspecto y volumen de la diuresis y balance hídrico (después). Se concluyó que los cuidados prestados por el enfermero al paciente el día cero del trasplante de células madre hematopoyéticas buscan prevenir, detectar e intervenir precozmente en las reacciones adversas relacionadas al procedimiento de infusión de dichas células.

***Palabras clave**: Enfermería; Atención de Enfermería; Transplante de Células Madre Hematopoyéticas.*

INTRODUCTION

Hematopoietic stem cell transplantation is used to treat patients with benign or malignant hematological disorders. The goal of this treatment is to obtain a period of long-term remission, and in some cases, it represents the only hope for of cure.[1] This treatment consists of the infusion of hematopoietic stem cells (HSC) or hematopoietic progenitor cells (HPC) which after engraftment promote the reconstitution of the hematopoietic and immunological systems of the patient or recipient. HSC may be obtained from bone marrow (BM), peripheral blood (PB) or placental and umbilical cord blood (PUCB),[2] and correspond to the product infused into the recipient on the day of transplantation.

As to the origin of the HSC donor, HSCT can be classified into autologous, when the donor is the patient himself, and allogeneic, when the donor is another individual. Allogeneic HSCT is further divided into related donors (RDs), if this donor is a relative, and unrelated donors (UDs), if the donor is not a relative of the recipient.[1]

Regardless of the source of HSC used or the type of transplant, patients undergo three phases in HSCT. The pre-HSCT phase corresponds to the period before the infusion of HSC, and the post-HSCT phase, to the period after it. The day of infusion or transplant is called Day Zero.[1]

In all HSCT phases, patient care is provided by a multiprofessional team, including physicians, a nursing staff, nutritionists, social workers, among others. The nursing team, in special, keeps in contact with patients throughout the HSCT process and is considered one of the most important elements of the treatment.[1,3] Among the various activities that nurses perform in HSCT, including education, collaboration, coordination and supervision, the provision of care is considered the most evident.[3]

The nursing care on the Day Zero of HSCT is very relevant. Resolution nº 200 of 1997 of the Federal Nursing Council, which deals with the role of nursing professionals in hemotherapy and bone marrow transplantation, addresses HSC infusion as a competence of nursing professionals.[4]

Nurses must hold specific knowledge and skills in order to promote high-quality care on this specific day of the HSCT. Besides knowledge related to the process of HSC collection and preparation, and ABO compatibility, nurses must be prepared to prevent, detect and intervene as early as possible in eventual complications or adverse reactions related to the infusion of HSC.[5]

Fresh or cryopreserved and thawed HSC are infused via a central venous catheter (CVC). Adverse reactions related to infusion may be mild or severe,[6] and may affect the cardiovascular, gastrointestinal, neurological, renal and respiratory systems, besides some reactions classified as dermatological or allergic.[2,7-9] These reactions may be linked to the characteristics of the infused product, such as volume, total number of nucleated cells and granulocytes, plasma and/or red blood cell volume in cases of ABO incompatibility, toxicity of the preservation medium Dimethyl sulfoxide (DMSO), and product contamination; or may be linked to the patient, such as sex, age, weight, disease and clinical condition.[6,7,9,10]

Nurses must be prepared to provide care on Day Zero, with adequate knowledge, competence and ability, which includes not only the time of infusion of HSC, but also, moments before and after this procedure.[1,2,7,11]

The present research is justified by the still incipient production on the nurses' performance on Day Zero of Hematopoietic Stem Cell Transplantation. HSCT is extensively covered in the literature especially in the area of hematology, but there is a gap in the knowledge on specific care provided on Day Zero. The following questions guided the study: what are the patient care measures implemented by nurses on the Day Zero of HSCT? And, what are the most common adverse re-

actions presented by patients in result of HSC infusion? To answer these questions, this study had as objectives to identify the care provided by nurses on Day Zero of HSCT; and to identify the adverse reactions in patients on Day Zero of HSCT.

METHODOLOGY

This was an exploratory and descriptive study with qualitative approach. It was carried out at the Inpatient Unit of a Bone Marrow Transplantation Service (BMTS) of a university hospital in the southern region of Brazil. This research was developed after approval by the Research Ethics Committee of the hospital, under CAAE 55116016.5.0000.0096. All participants signed the Informed Consent Form (ICF), where they were informed about the measures to ensure the anonymity and confidentiality of the data obtained. The present study obeyed the norms of research with human beings, according to Resolution nº 466/2012 of the National Health Council.[12]

In order to select the participants, the inclusion criteria were: being a nurse directly involved with care and assigned to work in the BMTS Inpatient Unit; being assigned to provide patient care on Day Zero of HSCT. The exclusion criterion was: being on sick leave, maternity leave or any other kind of leave.

Data were collected between July and September of 2016 in the morning, evening and night shifts. The criteria for suspending data collection were the observation of the infusion of the three types of HSC sources (BM, PB and PUCB); of the two HSC infusion modes (fresh and cryopreserved-thawed); and types of ABO compatibility (ABO-compatible, major ABO-incompatible and minor ABO-incompatible).

The nurses were approached the day before to data collection and invited to participate in the study. The research objectives were presented, and no constraints were noticed on the part of the participants during the observation process. An observation scenario between researcher and collaborative participants was established. During the observation, it was noticed that the participants developed their work process without concern with the presence of the researcher. The characterization of participants was obtained by completing an instrument with items such as sex, age, time elapsed after conclusion of undergraduate professional training, time working in the area of HSCT, and data on postgraduate training.

The nurses' activities were identified through the passive observation technique. Data were recorded in an instrument prepared by the researchers with the following items: data on type of HSCT, HSC source, infusion modality, ABO compatibility, start and end time of HSC infusion, patient care provided by nurses, adverse reactions in patients during and/or after HSC infusion, observation time by the researcher. All information was noted in the instrument for further analysis.

As for the analysis, the care observed was first described and then analyzed through a rapid reading of the text produced. In a second moment, the information was gathered and a comparative analysis of the data was carried out based on relevant scientific literature. In a third moment, the care was sorted into thematic groups - before, during and after HSC infusion - in order to show the areas of compatibility and incompatibility of the data. The analysis was concluded with the distribution of care measures into the predefined categories.

RESULTS

Eleven nurses, ten female and one male, participated in the study. The time elapsed after undergraduate training varied between five and 25 years and the time of performance in the HSCT area ranged from ten months to 25 years. Ten participants had specialization, and in the case of one participant, the subject of specialization was related to HSCT. Two of the 11 participants were masters in HSCT related topics; and four were enrolled in master courses, all related to the HSCT area.

Observations occurred through 10 days of transplantation, totalling 72 hours of observation (before, during and after HSC infusion). The classification of transplants is shown in Table 1.

Table 1 - Characterization of HSCT type, HSC source, infusion modality and ABO compatibility of the transplants observed. Curitiba/Paraná, 2017

HSCT Number	HSCT Type	HSC source	Infusion modality	ABO Compatibility
1	Allogeneic UD	BM	Cryopreserved-thawed cells	Not applicable
2	Allogeneic UD	BM	Fresh cells	ABO Compatible
3	Allogeneic UD	BM	Cryopreserved-thawed cells	Not applicable
4	Allogeneic UD	BM	Fresh cells	ABO Compatible
5	Allogeneic UD	BM	Fresh cells	ABO Compatible
6	Allogeneic RD	BM	Fresh cells	Major ABO-incompatible
7	Allogeneic UD	BM	Fresh cells	Minor ABO-incompatible
8	Allogeneic UD	BM	Fresh cells	Minor ABO-incompatible
9	Allogeneic RD	SP	Fresh cells	ABO Compatible
10	Allogeneic UD	PUCB	Cryopreserved-thawed cells	Not applicable

Source: Researcher's production.

In the case of infusion of fresh cells, the duration of HSC infusions ranged from 03h50 to 09h44. In the case of infusion of cryopreserved-thawed cells this time ranged from 12 to 30 minutes.

The adverse reactions manifested by patients are presented in Table 2.

Table 2 - Adverse reactions in patients resulting from HSC infusion. Curitiba/Paraná, 2017

HSCT Number	Adverse reaction	Moment of the event[a]
1	Bad taste in the mouth	During
	Systemic arterial hypertension	During
	Hemolysis	After
	Oxygen saturation drop	After
	Nausea	After
2	Systemic arterial hypertension	During and after
	Emesis	During and after
3	Nausea	During
	Abdominal pain	During
	Being sick	During
	Systemic arterial hypertension	During and after
4	Systemic arterial hypertension	During
5	Systemic arterial hypertension	During and after
6	Systemic arterial hypertension	During
7	Systemic arterial hypertension	During and after
8	Tremors	During
	Systemic arterial hypertension	During
	Nausea and emesis	During and after
9	None	–
10	None	–

[a] The moment of the event refers to moments during or after HSC infusion.

As to the nursing care provided to patients on Day Zer of the HSCT, the measures were grouped and categorized into before, during and after HSC infusion, as shown in Table 3.

Table 3 - Care provided by nurses on Day Zero of HSCT. Curitiba/Paraná, 2017

Moment[a]	Nursing care
Before	Checking of equipment such as multiparameter monitor emergency cart;
	Collecting and forwarding blood samples;
	Explanation of the procedure to patients and family members;
	Implementation of NPb steps: History, Diagnosis, Planning;
	Preparation of materials required for HSC infusion, as blood transfusion devices;
	Preparation of materials required for HSC thawing;
	Preparation of material for administration of oxygen;
	Measurement of vital signs;
	Administration of medications prescribed by the physician before HSC infusion;
	Calculation of the dripping rate.

Continue...

...continued

Table 3 - Care provided by nurses on Day Zero of HSCT. Curitiba/Paraná, 2017

Moment[a]	Nursing care
Before	Realization of double checking immediately before the beginning of the infusion;
	Realization of NP step: Implementation;
	HSC infusion through CVC, in exclusive via, by gravity, through blood transfusion device, after flushing with saline solution 0.9%;
During	Measurement of vital signs;
	Patient monitoring (pulse oximetry);
	Control of HSC infusion dripping rate;
	Homogenization of the bag containing the HSC;
	Monitoring of diuresis volume and water balance;
	Administration of medications prescribed by the physician to minimize the effect of adverse reactions;
After	Washing the CVC with 0.9% saline solution in flushing;
	Measurement of vital signs;
	Monitoring of diuresis volume and water balance;
	Administration of medications prescribed by the physician after HSC infusion;
	Registration of the procedure including the last step of the NP: Evaluation

[a] Before, during or after HSC infusion. [b] Nursing Process.

DISCUSSION

All transplants observed were of the allogeneic type: two related and eight unrelated. This is because the institution where the research was conducted is a reference in this type of transplant in Brazil. BM was the source of HSC in eight of ten transplants. This is due to two factors: MO is the source of cells used for HSCT in the institution and, in addition, there were no autologous transplantation in the period studied, in which the most common source is the PB. PUCB is currently rarely used at the institution. Study in southeastern Brazil showed equal use of BM and PB as sources: among 52 allogeneic transplants, 26 used PB and 26 BM.[5] in this study, the 114 autologous transplants described used PB as source.[5] A systematic review showed that BM has been gradually replaced by PB in allogeneic transplants, especially in the context of malignant diseases. Advantages such as shorter time to engraftment and a tendency to reduce the incidence of relapses of the disease have been demonstrated; however, the incidence of chronic Graft-versus-host disease (GVHD) was higher.[13]

In this research, PUCB was used in the case of a child, for low number of HSC of this source relative to the weight of the recipient, and thus indicated for low weight patients.[2]

As for the infusion modality, seven infusions used fresh cells and three, cryopreserved-thawed. In the case of cryopre-

served PUCB, this source is actually only used in this infusion mode. For the other two transplants, there was incompatibility between availability of donor and recipient, making it necessary to use cryopreserved cells. Fresh HSC must be stored at temperatures between 1 and 6°C until the moment of infusion. However, if the time exceeds 48 hours, it is necessary to proceed to the cryopreservation of these cells.[2,14]

As for ABO compatibility, four of the seven fresh HSC infusions were classified as compatible, two as minor ABO-incompatible, and one as major ABO-incompatible. Incompatibility of the ABO system does not impede the HSCT. Minor incompatibility occurs when the donor's plasma has antibodies against erythrocytes of the recipient; major incompatibility occurs when the recipient has plasma antibodies against the donor's red blood cells; and bidirectional, when major and minor incompatibilities are present.[15,16]

Among the related allogeneic transplants of fresh HSC, one was ABO compatible and the other, major ABO-incompatible. ABO incompatibility is present in approximately 30% of this type of transplant.[16] In turn, among the unrelated allogeneic transplants of fresh HSC, three were ABO-compatible and two, minor ABO-incompatible. In this scenario, the incompatibilities occurred in 40 to 50% of the transplants. In this research no transplant had bidirectional ABO incompatibility. Study that evaluated 52 related allogeneic transplants and all found 7.7% of bidirectional incompatibility, 11.5% of minor incompatibility and 11.5% of major incompatibility.[5] A study that sampled major incompatible and bidirectional cases found that 84% corresponded to the first and 16% to the second.[17]

Learning ABO compatibility/incompatibility is a must for nurses who provide care on Day Zero of HSCT. Infusions with ABO incompatibilities are linked to the occurrence of adverse reactions, with hemolysis as the most frequent event. In case of ABO incompatibility, acute and late hemolysis may occur, being the late hemolysis (five to 15 days after transplantation) more common. In major ABO incompatibility, acute hemolysis (at infusion or immediately after the infusion) is more frequent.[15,16]

Hemolysis is an adverse reaction also commonly seen in infusion of cryopreserved-thawed cells. However, in this case, this occurrence is not linked to ABO incompatibilities, but to hemolysis resulting from cryopreservation and thawing of HSC. Hemolyzed red blood cells are excreted via the kidney, leading to haemoglobinuria,[18] what can be detected by the nurse by monitoring of urine output (diuresis). In this research, this care was performed during and after HSC infusion, and hemolysis occurred in one case, a transplant of cryopreserved-thawed HSC.

In the first transplant observed, besides hemolysis, oxygen saturation drop and systemic arterial hypertension (SAH) were observed, which can also be linked to the occurrence of hemolysis.[7,8,19] The nursing care observed in this research for early intervention in cases of dyspnea and oxygen saturation drop consisted in the preparation of material for oxygen therapy.

Nausea and bad taste in mouth also occurred in this transplant. These reactions may be associated with the presence of the cryoprotectant dimethyl sulfoxide (DMSO). Nausea, emesis and complaints of bad taste in the mouth are the most common reactions associated with infusion of cryopreserved-thawed HSC.[11,19] To ease these reactions, nurses must be attentive to the medications prescribed by the doctor before infusion. Study that aimed to determine if intravenous administration of the antiemetic Ondansetron before infusion of cryopreserved-thawed HSC could decrease the incidence of nausea and emesis concluded that if administered from 30 to 60 minutes before the infusion, the medication can significantly reduce the occurrence of these reactions.[11]

Another care measurethat may lessen the occurrence of these reactions, not observed in this research, is to offer candies to the patient to suck during infusion of cryopreserved-thawed HSC. Study that aimed to edit an educational video about the collection and infusion procedures of cryopreserved-thawed HSC, showed that the institution offered candies to patients at the infusion moment.[20] With the same intention to ease the discomfort in relation to odor and halitosis, which generate the bad taste in mouth, a randomized trial divided patients into three groups: the first ate orange, the second made aromatherapy with orange, and the third was the control group. The study confirmed the effectiveness of intake of slices of orange to soften the reactions associated with DMSO.[21]

In the third observed transplant, also in the cryopreserved-thawed HSC modality, besides nausea, emesis and SAH, abdominal pain was observed. This reaction may be associated with the presence of DMSO or the occurrence of hemolysis.[7,19] For this reaction, nurses used pharmacological and non-pharmacological measures for pain control. Analgesic medication may also be prescribed and administered before the infusion in order to prevent this reaction, as it was done in the study addressing HSC infusion with bidirectional and major ABO incompatibility, in which acute hemolysis is frequent.[10]

In addition to antiemesis and analgesic medication, other commonly used drugs prior to the HSC infusion are antihistamines, corticosteroids, antipyretics and diuretics.[2, 9, 11,19] These medications help reduce febrile or allergic reactions associated with infusion of HSC, and the recommendation is to administer them 30 to 45 minutes before the infusion.[2] in this study, these classes of medications were also the most widely used.

SAH was the most recurrent adverse reaction in the present research and may be linked to hemolysis (hemolyzed erythrocytes in the process of cryopreservation-thawing or hemolysis due to ABO incompatibility).[18] in addition to this factor, the volume of the product can also contribute to the oc-

currence of SAH.[6,8,9] The nursing care measures observed in this research aimed at detecting the occurrence of SAH and provision of early intervention is the measurement of blood pressure and monitoring of the patient during and after the infusion. The measurement of vital signs (VS) before the infusion of HSC aims to determine the normal parameters of the patient, so as to facilitate the detection of changes.[6] During the infusion, it is recommended to measure VS every 10-15 minutes.[2,9]

The reactions linked to the cardiovascular and respiratory systems are those that occur more frequently, such as bradycardia, tachycardia, hypotension, hypertension, precordial pain, dyspnea and hypoxia.[8,9] Other reactions detected by VS measurement and monitoring such as fever, hypothermia, headache, backache and abdominal pain are also common.[8,9] These reactions were expressive in a study that found a list of adverse reactions, namely: SAH (3rd more frequent), hypotension (5th), hypoxia (6th), pain (9th) and bradycardia (10th).[19]

Another nursing care measure consists in checking and preparing the emergency cart. This can be used in case of serious adverse reactions, which although rare, may occur. In a study that found 35 occurrence of adverse reactions, 30 were minor and five were clinically significant.[10] In study that ranked the reactions by degree of seriousness from 1 to 5, 17.8% of the reactions were classified as level 3 (severe) and 0.43% as level 4 (disabling or adverse reaction with risk of death).[9] examples of severe reactions are micropulmonar embolism, chest pain, acute renal failure, precordial pain, severe anaphylactic reaction, change in level of consciousness, cerebrovascular accident, convulsion, peripheral neuropathy, and cardiac or respiratory arrest.[2,9]

In the 9th and 10th observed transplants, patients showed no adverse reactions. In the ninth transplant, this was probably related to the use of fresh ABO compatible PB. The fresh infusion modality does not present the reactions associated with the cryoprotectant DMSO. Furthermore, ABO compatibility spared the patient from adverse reactions related to this cause. PB volume collected by apheresis is smaller in relation to BM volume,[16] which also preserved the patient from reactions related to the volume of the product. In the case of the 10th transplant, the non-occurrence of adverse reactions can be associated to the dilution of PUCB after thawing. This technique consists of adding a solution composed primarily of albumin right after thawing the HSC; the solution promotes the dilution of DMSO, resulting in lower chance of adverse reactions related to this cryoprotectant.[18,22]

Before HSC infusion, the nursing care observed in this research consisted in collection and forwarding of blood samples to the blood bank and explanation of the procedure to patients and family members. The first care measure is established in the national legislation and consists in repeated evidence of compatibility of HSC, including ABO and Rh typing, cross tests and search for irregular antibodies.[14] the explanation of the procedure helps to minimize the anxiety of patients regarding HSC infusion. Nurses must demonstrate knowledge and communication skills, as these comforts the patients and strengthen the relationship between the nurse, the patient and the family.[23] Nursing guidelines consist of explanation of frequent VS measurements and monitoring, use of medications before thawing (in cases of cryopreserved HSC), the act of HSC infusion and potential adverse reactions.[1]

Nurses must be attentive to the care related to the blood transfusion device to infuse HSC via CVC, respecting the time of infusion. The realization of flushing with saline solution 0.9% before and after the infusion is important. The choice of CVC ensures the infusion of the cells in the circulatory system; prevents damage to the peripheral venous system, as cryopreserved products have high osmolarity; and is ideal for high-volume infusions, such as fresh BM HSC.[2,6] The blood transfusion device has between 170 and 260 microns, in order to reduce the risk of infusing clots and aggregated cellular components.[2,6] Nurses perform the homogenization of the product contained in the bag before and during infusion of cells.[6] The use of 0.9% saline solution prior to the beginning and at the end of the infusion prevents damage to the HSC, since these could be damaged by contact with other fluids or medications. Saline solution 0.9% is the only one that does not cause damage to HSC.[2,6]

Infusion time of HSC varies according to the modality. For cryopreserved-thawed HSC, infusion should be initially slow (2 to 4 ml/min), so that nurses can monitor adverse reactions. If well tolerated, the infusion rate goes to 5 to 20 ml/min.[2] Other authors have recommended the rate of 10 ml/min,[5,19] and there are authors who work only with the time varying from -5 to 20 minutes.[11] In this research, the infusion time for cryopreserved-thawed HSC ranged from 12 to 30 minutes. It is recommended that after thawing, the infusion does not exceed 30 minutes, for the toxicity of DMSO to the HSC after thawing.[2,22]

In the modality of fresh HSC, mode some authors claim that these can be infused in up to 4 hours;[2] others argument that the rate should be controlled, based on the characteristics of the product to be infused (source, presence of incompatibility, preparation of the HSC) associated with the clinical conditions of the recipient.[5]

A study that aimed to determine what red blood cell volume can be safely infused in children in the context of allogeneic HSCT using fresh BM HSC with major ABO-incompatibility and bidirectional incompatibility found that the infusion rate varied depending on the volume to be infused and the weight of the child; the average time length was 4.5 hours.[10] In this research, the infusion time for fresh HSC ranged from 03h50 to 09h44; the long infusion time is justified by the clinical condition of the recipient.

At the end of the infusion, the nursing care included CVC washing with 0.9% saline solution, continuous measuring of VS and monitoring of the appearance and volume of diuresis and water balance; administration of medications after infusion and record of the procedures. The post-infusion medications used were diuretics, for minimizing the effects of the adverse reactions SAH and hemolysis. The nursing record consisted of annotation of VS and estimation of water balance, checking the infusion procedure in the medical prescription and the patient's evolution, including manifestations of adverse reactions. The documentation of information and the organization of clinical data promotes rational and objective decision-making, besides being essential for the analysis and understanding of major complications.[5,8]

FINAL CONSIDERATIONS

This research addressed the patient care provided by nurses on the Day Zero of HSCT. Care measures were grouped according to the moment into before, during and after the infusion. The results showed that nursing care is not restricted only to the moment of infusion of cells, it is rather provided throughout the Day Zero. The study allowed to infer the relationship between care and prevention, detection, and early intervention of nursing professionals in the case of adverse reactions related to the infusion of HSC, as can be seen in the care of administrating medications prescribed by the physician before HSC infusions, and the calculation of the dripping rate (prevention); VS measurement and monitoring of the patient (detection), preparation of material for the administration of oxygen and preparation of the emergency cart (early intervention).

We reaffirm, therefore, that the care provided this day is an exclusive duty of nurses, since these professionals hold scientific knowledge and technical skills to provide quality assistance.

One of the limitations of this research was the scarcity of studies carried out by nurses in the theme of care on this specific day of HSCT. Other limitation was the observation in a single service. The observation technique used in this research is not regarded as a limitation, but rather as a strong point, because it was able to portray the reality of the nursing care provided on this specific day of HSCT. Observational studies are not frequent in the nursing field, but this technique is relevant when considering the care in real time, of nurses in their field.

Moreover, many studies have focused attention on the occurrence of adverse reactions, but none has addressed the nursing care and the practice of the prevention, detection and intervention in cases of reactions. The importance of studies focused on the care provided by nurses is therefore stressed, to promote evidence-based nursing practice.

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