Review Article

Nursing care for patients undergoing hematopoietic stem cell transplantation

Cuidados de enfermagem com pacientes submetidos a transplante de células-tronco hematopoiética

Cuidados de enfermería de pacientes sometidos a trasplante de células madre hematopoyética

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How to cite:
Izu M, Silvino ZR, Santos LM, Balbino CM. Nursing care for patients undergoing hematopoietic stem cell transplantation. Acta Paul Enferm. 2021;34:eAPE02892.

DOI
http://dx.doi.org/10.37689/acta-ape/2021AR02892

Keywords
Nursing care; Hematopoietic stem cell transplantation/nursing; Bone marrow transplantation

Descritores
Cuidados de enfermagem; Transplante de células-tronco hematopoiéticas/enfermagem; Transplante de medula óssea

Descriptores
Atención de enfermeira; Trasplante de células madre hematopoyéticas/enfermería; Trasplante de médula ósea

Submitted
October 12, 2019

Accepted
June 24, 2020

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Abstract

Objective: To map nursing studies that address nursing care for patients submitted to hematopoietic stem cell transplantation.

Methods: Scoping review, whose search was carried out in the MEDLINE, CINAHL and LILACS bases, from June to August 2019, in Portuguese, English and Spanish. We selected 18 publications on the theme.

Results: The nursing care was related to the phases of the transplantation, namely: conditioning, infusion, harvest, and post-transplantation.

Conclusion: The specific knowledge of nursing care for patients submitted to hematopoietic stem cell transplantation allows the nurse to recognize complications of this clientele, favoring early interventions and aiming to restore the patient, thus contributing to evidence-based nursing care.

Resumo

Objetivo: Mapear estudos de enfermagem que contemplem os cuidados de enfermagem com pacientes submetidos ao transplante de células-tronco hematopoiética.

Métodos: Revisão de escopo, cuja busca foi realizada nas bases MEDLINE, CINAHL e LILACS, no período de junho a agosto de 2019, em português, inglês e espanhol. Foram selecionadas 18 publicações que contemplavam a temática.

Resultados: Os cuidados de enfermagem estiveram relacionados às fases do transplante, a saber: condicionamento, infusão, pega e pós-transplante.

Conclusão: O conhecimento específico do cuidado de enfermagem com o paciente submetido ao transplante de células-tronco hematopoiética permite ao enfermeiro o reconhecimento de complicações dessa clientela, favorecendo intervenções precoces e visando ao restabelecimento do indivíduo, contribuindo, assim, para uma assistência de enfermagem baseada em evidências.

Resumen

Objetivo: Mapear estudios de enfermería que contemplen los cuidados de enfermería de pacientes sometidos al trasplante de células madre hematopoyética.

Métodos: Revisión de alcance, cuya búsqueda fue realizada en las bases MEDLINE, CINAHL y LILACS, en el período de junio a agosto de 2019, en portugués, inglés y español. Fueron seleccionadas 18 publicaciones que contemplaban la temática.

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Conflicts of interest: nothing to declare.

Resultados: Los cuidados de enfermería estuvieron relacionados con las fases del trasplante, a saber: acondicionamiento, infusión, injerto y postrasplante.

Conclusión: El conocimiento específico sobre los cuidados de enfermería de pacientes sometidos al trasplante de células madre hematopoyética permite al enfermero reconocer las complicaciones de esta clientela, favorece intervenciones precoces en busca de la recuperación del individuo y, de esta forma, contribuye para una atención de enfermería basada en evidencias.

Introduction

Hematopoietic stem cell transplantation is used as a way to treat in malignant diseases and consists of the intravenous infusion of hematopoietic stem cells to reconstitute the medullar and immune function of patients being treated for hematological, oncological, hereditary and immunological diseases.[1]

As a preparation for receiving the infusion of hematopoietic stem cells, the patient receives chemotherapy and/or radiotherapy, to eradicate his underlying disease, triggering medullar aplasia, aiming for the reconstitution of a new medulla.[1-3] This therapy consists of four phases: conditioning, infusion, aplasia and medullar recovery. In this period, the patient is constantly exposed to invasive technologies, complex medical procedures, and treatments that increase his state of immunosuppression and antimicrobial resistance.[1,2]

When performing hematopoietic stem cell transplantation, the professional team needs to pay attention to the prevention and early detection of the main complications, which correspond to infections, veno-occlusive liver disease, graft-versus-host disease, mucositis, nausea and vomiting, diarrhea, hematological changes and pulmonary complications.[2]

Nursing care for patients undergoing hematopoietic stem cell transplantation is complex and requires a high level of competence. The nurse care provided throughout the procedure strongly influences the success of the transplantation. The nurse is responsible for customizing this care task in all stages of the transplantation.[4]

Qualifications and technical expertise are required from the nursing team active in hematopoietic stem cell transplantations, and the nursing care should be assessed in depth. The nursing activities need to be listed and analyzed to clearly establish their objectives and functions, and the quality of care can also be assessed, based on the functions performed.[4]

The Systematization of Nursing Care is fundamental in the optimization and management of nursing care, and its implementation is essential in the operationalization of the Nursing Process.[3]

Thus, the research problem was developed with the following question: What are the characteristics of nursing care in patients undergoing hematopoietic stem cell transplantation?

The objective was to map the evidence available in the literature on nursing care for hematopoietic stem cell transplantation in the hospital environment.

In a bibliometric study on nursing publications about hematopoietic stem cell transplantation, from 1997 to 2011, the authors found little production and socialization of knowledge in this area.[5,6]

Methods

A *scoping review* was undertaken, which permits summarizing existing studies and reaching conclusions based on a theme of interest. The scoping review aims to map the existing evidence on a given topic and to identify gaps in the existing evidence, without analyzing the methodological quality of the included studies, as its objective is to map the existing scientific evidence, and not to find the best evidence.[7,8]

Using the PCC strategy (acronym for Participant, Concept and Context), we included in this review studies in which the participants had received hematopoietic stem cell transplantation; addressed the concept of nursing care in the transplantation stages; in the context of onco-hematology, regardless of the transplantation stage or type (autologous or allogeneic); published in the last 10 years (2009-2019). Articles on the use of hematopoietic stem cell transplantation in autoimmune diseases were excluded.

The six methodological steps for a scoping review were followed: identification of the research question;

identification of relevant studies; selection of studies; extraction of data; separation, summarization and reporting of results; and dissemination of results.[5,6]

The search for articles was carried out from June to August 2019, in the databases Latin American and Caribbean Health Sciences Literature (LILACS); *Medical Literature Analysis and Retrieval System* (MEDLINE) and *Cumulative Index to Nursing and Allied Health Literature* (CINAHL). In addition, we also checked the bibliographic references of the selected studies to locate as many publications as possible.

An experienced librarian elaborated the search strategy (Chart 1), which was exported to an *online* bibliographic management tool.

Then, two reviewers repeated the search separately and read the selected articles, extracting the data and using the synthesis matrix. For the sake of better illustration, we present the PRISMA diagram with the summary of the search, in Figure 1.

Chart 1. Strategy and search limiters, applied by database, and the respective search results, by database

Database	Search strategy	Number of publications
MEDLINE via PubMed®	"nursing care"[All Fields] AND "bone marrow transplantation "[All Fields] AND (("2000/01/01"[PDAT] : "3000/12/31"[PDAT]) AND (English[lang] OR Portuguese[lang] OR Spanish[lang]))	16
CINAHL (via EBSCO)	"bone marrow transplantation"AND "nursing care" OR "nursing"	20
LILACS	"tw:(cuidados de enfermagem AND transplante de medula ossea) AND (instance:"regional") AND (db:("LILACS") AND type:("article"))	34

MEDLINE - Medical Literature Analysis and Retrieval System; CINAHL - Cumulative Index to Nursing and Allied Health Literature; EBSCO - Elton B. Stephens Company; LILACS – Latin American and Caribbean Health Sciences Literature

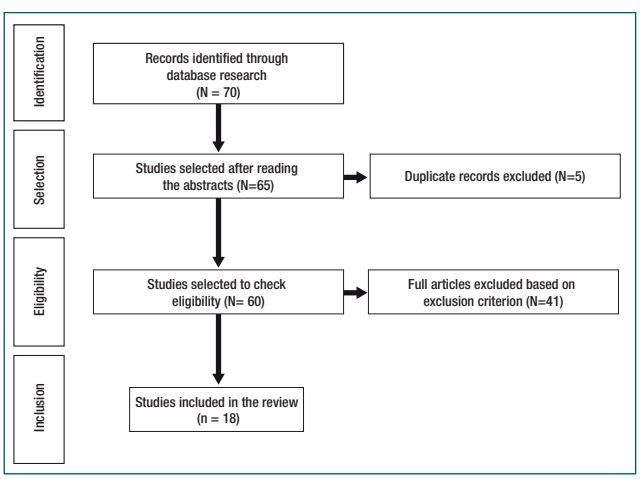

Figure 1. Study selection diagram according to the *Preferred Report Items for Systematic Reviews and Meta-Analyses* (PRISMA)

Results

The analysis of the articles was based on critical and detailed reading, extracting the most relevant factors about nursing care for patients undergoing hematopoietic stem cell transplantation.

The sample consisted of 18 studies (Chart 2) that met the inclusion criteria proposed for this review. Regarding the year of publication, two were published in 2019, four in 2018, three in 2017, two in 2016, two in 2015, two in 2014, one in 2013, one in 2012 and one in 2011. Eight were published in international and ten in Brazilian journals.

The nursing care that was revealed in the review was classified according to the phase of transplantation: conditioning, thawing of stem cells and infusion; and to the nursing process and specialized care, which includes infection prevention, care for the central venous catheter, mucositis and graft-versus-host disease, as presented in Chart 2.

Discussion

The restoration of the immune system may take several months after the infusion of the hematopoietic stem cells, due to the slow recovery of lymphocytes. During this period, the patients may develop complications. Nurses should be trained to prevent and manage early and late complications arising from hematopoietic stem cell transplantation, such as transfusion reactions, safe medication administration, infection prevention, central venous catheter management, patient and family education, and complications of the conditioning regimen.[2]

Conditioning is the use of high doses of chemotherapy, associated or not with total body irradiation, aiming to eradicate residual malignant cells, create a space for grafting new cells and induce immunosuppression of the receptor to reduce the risk of graft rejection.[2] This increases the risk of side effects, requiring special nursing care to control for toxicity in the or-

Chart 2. Nursing care for patients submitted to hematopoietic stem cell transplantation

Nursing care	Articles
Control of cardiological, renal, hepatic, neurological and hematological toxicity due to conditioning Monitor vital signs Determine fluid balance Daily weighing Administer uroprotective and diuretic agents during cyclophosphamide infusion (prevention of hemorrhagic cystitis) Measure abdominal circumference daily	Lima et al.,[9] Cruz et al.,[10] Figueiredo et al.[11] and Rodrigues et al.[12]
Thawing of hematopoietic stem cells Use sterile distilled water in the water bath to thaw the hematopoietic stem cells Keep the water bath temperature at 37ºC Maximum thawing time of 5 minutes Clean the bag connections with 70% alcohol, with thorough rubbing and at least three rotational movements	Cruz et al.[10]
During the hematopoietic stem cell infusion Placing an emergency cart near the patient's bed Administer antihistamines, antiemetics, corticosteroids, antipyretics and diuretics 30 minutes before infusion Dress up with apron, mask and cap Wear sterile gloves Place the fenestrated sterile drape under the route to be used Check ABO compatibility of hematopoietic stem cells and receiver *Flush* with saline solution before and after the infusion Infuse hematopoietic stem cells using equipment for blood components, without leukoreduction filter Infuse in exclusive catheter route Infuse with maximum time of 10 minutes for each bag Monitor vital signs during infusion Clean connections with 70% alcohol Watch out for signs of hypersensitivity to dimethylsulfoxide (tremors, cough, chills, fever, vomiting, dyspnea and edema of the glottis) Homogenize the bag with hematopoietic stem cells Monitor urine volume and appearance	Cruz et al.,[10] Figueiredo et al.[11] and Tormey et al.[13]
Nursing Process Perform the process (interview, physical examination, nursing diagnosis, nursing prescription, care check and registration) Evaluate since pre-transplantation stage Develop customized care plans	Lima et al.,[9] Rodrigues et al.,[12] Young et al.[14] and Castro et al.[15]
Specialized care Central venous catheter (Hickman catheter) Standardize care related to catheter insertion, manipulation and maintenance Change the dressing and fix the catheter Maintain catheter patency (heparinized saline solution) Measure catheter length Train catheter handling routinely Prevent thrombotic obstruction of the central venous catheter	Lima et al.,[9] Cruz et al.,[10] Young et al.,[14] Castanho et al.,[16] Pontes et al.[17] and Pereira et al.[18] and Gavin et al.[19] and Rodrigues et al.[20]
Infection prevention (protective isolation) Guarantee the use of facial mask, room with HEPA filter and room cleaning routine Hand hygiene before and after entering the patient's room	Lima et al.,[9] Rodrigues et al.,[12] Biagioli et al.[21] and Vokurka et al.[22]
Mucositis Use standard oral cavity care protocol Clean teeth using soft brush Control pain by administering analgesics Monitoring of nutritional *status*	Rodrigues et al.[12] and Siefker et al.[23]
GVHD Know criteria for the evaluation of acute and chronic GVHD Assess the skin for rash, texture, joint mobility Inform the patient about skin care Know the side effects of treatment due to steroid use (infection, microvascular damage, renal dysfunction and steroid myopathy) Gastrointestinal GVHD	Santos et al.[24] and Neumann et al.[25]
Patient and family education Self-care instructions at hospital discharge	Lima et al.,[9] Cruz et al.,[10] Rodrigues et al.,[12] Young et al.,[14] Castro et al.[15] Mazza et al.[26]
Intravenous therapy care (preparing medications in laminar flow cabinet)	Lima et al.,[9] Cruz et al.[10]

HEPA - *high-efficiency particulate air*; GVHD - Graft-Versus-Host Disease

ganic systems, such as control of cardiological, renal, hepatic, neurological and hematological toxicity.[10,11,13,14,16]

Hyperhydration with forced diuresis during and up to the next day. The administration of alkylating agent is one of the most effective measures in the

prevention of hemorrhagic cystitis,[2] as well as the use of uroprotective and diuretic agents, shortening the time of exposure of the bladder to drugs, such as cyclophosphamide, and avoiding toxic effects.

The Nursing Process is a scientifically based work method that guides care and its implementation provides customized and excellent care, valuing nursing work[27]; and that appears in some studies included in the review.[9,12,14,15]

The use of the central venous catheter for hematopoietic stem cell infusion prevents damage to the peripheral venous network, due to the high osmolarity of cryopreserved hematopoietic stem cells, and serves to infuse a large number of solutions (saline solution, antibiotics and hemotherapeutic agents, and hypertonic solutions) and the collection of blood samples for laboratory tests. The Hickman catheter is the pioneer and is used to the present day.[16,24] The complications of the Hickman catheter include arrhythmia, poor positioning, gas embolism, pneumothorax, hemorrhage, dehiscence, infection, fracture, embolization and its migration, justifying the recommended care.[11,17,19] Infection related to the central venous catheter leads to increased mortality, as well as increased hospitalization time in the first six months after the implantation.[18,20,21,23,25]

The use of an exclusive route for infusion is due to the incompatibility of hematopoietic stem cells with other fluids and drugs (except 0.9% saline solution), which could damage them.[10]

The daily dressing of the catheter insertion ostium permits the inspection of the surrounding skin for signs of infection or irritation, by traction and fixation of the catheter, while measuring is a parameter to identify its exteriorization.[11]

Stem cells in autologous or umbilical cord blood transplantation are cryopreserved, and thawing in a water bath, at a temperature of 37ºC to 40ºC, ensures cell viability.[10]

Drug administration prior to infusion prevents the occurrence of adverse reactions related to the presence of dimethylsulfoxide in the case of cryopreserved haematopoietic stem cells, as well as in the presence of incompatibility in the ABO system between the recipient and the donor.[16,24] Due to the possible reaction, the emergency trolley needs to be close to the patient for rapid care.

The incompatibility of the ABO system does not impede the transplantation, but the nurse should know this before the infusion to plan the patient's care, as the incompatibility is linked to adverse reactions, such as acute (at the moment of or shortly after the infusion) and late hemolysis (5 to 15 days after the infusion).[16]

Infection is one of the major causes of morbidity and mortality in patients undergoing hematopoietic stem cell transplantation. A qualified nursing team is very important to prevent, detect and treat infections through precautions such as hand hygiene, use of mask, gloves, aprons, individual rooms with filter.[9,12,21,22]

The use of the *high-efficiency particulate air* (HEPA) filter is intended to prevent fungal infections, which can be lethal in these clients.[2,22] Patients submitted to allogeneic hematopoietic stem cell transplantation were monitored for 100 days post-transplantation, and low incidence of pneumonia was observed in patients in which the rooms had a HEPA filter.[22]

In immunosuppressed and neutropenic patients, oral hygiene is important to prevent mucositis, to prevent lesions on the mucous barrier, leading to infections, pain, malnutrition and bleeding.[26]

Nursing care included the control of vital signs, assessment of food intake, catheter care, control of laboratory tests, evaluation of body systems functioning, drug and transfusion administration, measures to control the transmission of micro-organisms, health/in-service education and integrated communication with the interdisciplinary team.[11,15,22]

Patient and family education[9,12,14] in a clearly comprehensible manner for lay people and coming from a reliable and consistent source among the care providers can serve as a facilitator in the self-care of patients undergoing HSCT.[28]

Conclusion

Hematopoietic stem cell transplantation has evolved considerably in recent decades, includ-

ing the development of mobilization and thawing techniques for hematopoietic stem cells. As a result of the administered drugs, intense adverse effects affect the transplanted patients, who require specialized and properly structured nursing care. The specific knowledge of nursing care for patients undergoing hematopoietic stem cell transplantation allows the nurse to recognize complications in this clientele, favoring early interventions and aiming to restore the patient, besides contributing to evidence-based nursing care. Hematopoietic stem cell transplantation involves many and complex nursing activities. The patient has a complex and dynamic clinical *status*, and the drug therapy is complex, due to the toxicity and adverse events. Therefore, the nurse needs to be knowledgeable for the sake of proper care, as demonstrated in this review.

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