CARE IN PEDIATRIC ONCOLOGY

Care in Pediatric Oncology

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CONTENTS

Nursing Care: professional

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Ana Catarina Fernandes Figueredo
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All the professionals working in the healthcare network in hospitals, health centers, clinics, or emergency units, are essential in caring for children/teenagers with cancer. In this chapter, you will understand better how nursing professionals can help on the Journey to a safer and smoother treatment.

Nursing plays a fundamental role in the treatment of a hospitalized child with cancer and in supporting family because they work directly in administering medications and monitoring patients' daily routines. Thus, due to this proximity, these professionals can help guide and clarify doubts that patients and caregivers may have regarding the disease and the treatment (Instituto Nacional de Câncer – INCA, 2008).

1 NURSING CARE DURING HOSPITALIZATION

Nursing cares with the hospitalized child or teenager for cancer treatment can be divided, in short, into (1) personal care and (2) care related to medications. Besides directly participating in the care, nursing professionals can guide the patient's caregivers, so they are also aware of personal care and care with medications.

As for personal care, the caregiver must pay attention to directions given by the nurses about hygiene, which includes using the bathroom and brushing the teeth. As for care with medications, the caregiver also must pay attention to the nurses' directions about the medications the patient is using, especially about the unwanted effects and changes that might happen during and/or after their use. Thus, as the caregiver is close to the child or teenager most of the time in the hospital, they can help nurses with this care in addition to being wary of any odd signs the patient may develop due to the use of medication so that they can report uncommon or unwanted situations (INCA, 2008).

Hand washing

Brushing teeth

Below you can see some situations or information the caregiver should report to nursing if they observe something during the period of the child's/teenager's hospitalization.

ATTENTION TO SITUATIONS THAT SHOULD BE REPORTED TO NURSING

1. Inform nursing about bad reactions observed in the child/teenager after medication use. Some of these reactions after using chemotherapeutic drugs may have immediate or late effects, and even in the case of known effects, they must always be reported to nursing. Examples of immediate bad reactions a few hours after use of the medication are wounds where the chemotherapeutic drug is administered, headache or skin allergy (itching and/or rash all over the body or in the place where the drug was administered), shivering, fever, nausea, dizziness, feeling faint. As for late harmful effects, there may be all-the-time tiredness, fast weight loss, nausea, and vomiting- The caregiver must always immediately call nursing as soon as they notice any alteration or change in the clinical conditions of the child/teenager under treatment. Another vital information the caregiver must report to the nursing team is if the child shows difficulty breathing because it might mean a more severe allergy (Resende, 2017; Giavina-Bianch, 2018; Sales et al., 2012).

Weight loss

Tiredness

Rash

Wound on the skin

Headache

Dizziness

Allergy

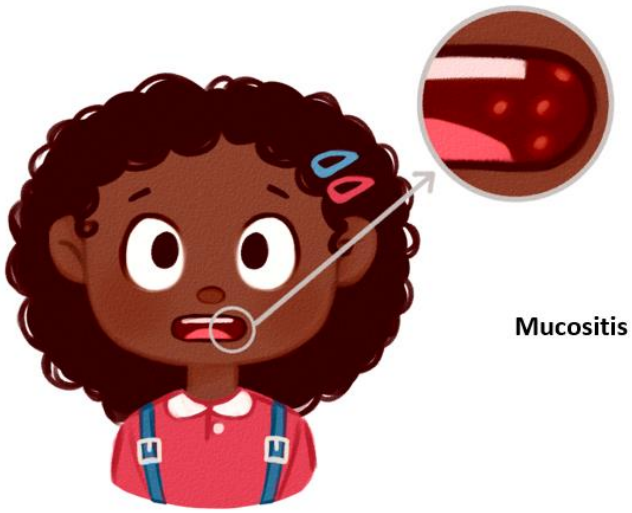
Chill

Fever

Difficulty breathing

Feeling faint

2. The caregiver must also inform if the child/teenager has been having difficulty taking the medications because of a bad reaction they might be feeling, for example. Non-adherence, that is, not taking the drug or taking it wrongly, may hinder the child's/teenager's treatment and interfere with the result and its total cure (INCA, 2008).
3. The caregiver must also inform if they have any questions about the disease, the necessary care, and the protocol of the child's/teenager's treatment. This is essential information, and the caregiver must be informed of all aspects of the treatment, which includes written information regarding bad reactions the chemotherapeutic drug may cause for many years (INCA, 2008).
4. Inform if the child is eating well, if they have any difficulty swallowing if they are urinating enough, or if the urine is foamy. It is also essential to observe the color of the poo, if it looks hard or soft, and if the child shows any diarrhea or constipation (INCA, 2008; Marques et al., 2015).
5. Inform if the child has any wound in the mouth or digestive system (the injuries might indicate a case of mucositis, which requires assistance from the health team) (Marques et al., 2015).



Mucositis

Nursing may instruct the caregiver to write a report of the child's/teenager's signs and symptoms, possible alterations, and questions that have arisen so that nothing goes unnoticed.

2 PRECAUTIONS IN THE BATHROOM

The caregiver often stays in the hospital with the child or teenager. Thus, some precautions are essential before, during, and after showering, including the common bathroom use for the caregiver and the patient (Marques et al., 2015; Universidade Federal de Minas Gerais, [2013?]).

In the case of the patient who has been using chemotherapeutic drugs, there is a need for closer attention to showering. At this moment, it is essential to follow an order for cleaning: wash (1) hands, (2) face, (3) head, (4) belly, (5) back, (6) arms, (7) legs and, if the child has a catheter, it should be the last item to be cleaned, being careful to avoid contamination (Marques et al., 2015; Universidade Federal de Minas Gerais, [2013?]).

Besides, it is essential to be careful with the bathroom used by this child/teenager on the day the chemotherapeutic drug is administered and on the two subsequent days. After using the toilet, one must flush three times with the lid down, and the toilet must be cleaned from the inside out, ending the cleaning with bleach. If the caregiver is responsible for changing the child's/teenager's diapers, it is necessary to use gloves and disposable materials. All the contaminated materials must be disposed of into two plastic bags, which must be tightly closed (Marques et al., 2015; Universidade Federal de Minas Gerais, [2013?]).

3 PRECAUTIONS WITH THE MEDICATIONS

3.1 Medications administered through a tube

Child with tube

Many times, oncologic patients are unable to swallow solid particles (such as medications and food) and need to take the medication through a tube. The tube enters through the mouth or the nose and takes the medication in liquid form to the stomach or intestine. Some extra care must be taken with patients that need to use the drugs through the tube (Moreira et al., 2004; Ministério da Saúde (BR), 2002).

It is essential to pay attention to cases in which the patient is using the tube for feeding and need to administer medication simultaneously through the same tube. In this case, the health team will check the compatibility of the drug and the food administered via tube (nutrients of enteral nutrition) to change the time for medication intake if the effect of the medication is decreased because of the food (Moreira et al., 2004; Ministério da Saúde (BR), 2002).

When the medication cannot be administered with food, the health professionals will adapt the times and procedures so that the patient gets the drug and the food through the tube safely, as described below. Feeding may be interrupted for two hours so that the medication can be administered without getting in contact with this food. Another critical point is the attention that should be given to cleaning the tube. For cleaning the tube and also keeping it from getting blocked (obstructed), it is essential that the nurse washes the inside of the tube with a syringe containing 15 to 30ml of tepid water. This step is made before and after administering the medication, to remove any residue of the food or medicine that may have gotten stuck in the tube (Moreira et al., 2004; Ministério da Saúde (BR), 2002; Williams, 2008).

When more than one medication needs to go through the tube simultaneously, cleaning must be compulsory between the administration of both drugs with 5 to 10 mL of tepid water (Williams, 2008). When there is a blockage (obstruction) of the tube, it is necessary to use 50mL of tepid water. In this case, there should be attention to the speed applied to the plunger not to damage the tube. If the blockage (obstruction) continues, the tube should be washed with carbonated water or alkaline solution (Gharib et al., 1996).

The health team needs to pay attention to the characteristics of the drug (such as PH and viscosity), for they are factors related to the formation of a solid part (precipitation) in the tube, which would be one reason for the blockage (obstruction). Besides, another point for attention is the concentration (osmolarity) because drugs with high concentration administered through a tube may cause diarrhea and colic in the patient. So, when it comes to a liquid formulation, many aspects must be observed on administration through a line, even if, apparently, it does not do any harm (Moreira et al., 2004; Ministério da Saúde (BR), 2002).

Table 1. Medicines that cannot be used through a tube

ATTENTION TO SOME PILLS* THAT SHOULD NOT BE TAKEN VIA TUBE		
Albendazole	Vitamin B Complex (Multivitamin)	Nifedipine
Amoxicilin + Clavulanate	Dexclorfeniramine	Sulfamethoxazole +Trimethroprim
Azithromycin	Dimehydrinate + Pyridoxine	Ferrous Sulfate
Calcitriol	Isosorbid	Temozolamide
Cephalexin	Levetiracetam	Mineral Oil*
Ciclosporin	Mercaptopurine	
Potassium Chloride	Mycophenolate Mofetil	

Source: White and Bradnam (2007).

Precaution with bleedings and purple spots throughout the child's body:

- Avoid medicines and teas made with plants.
- Avoid unprescribed medicines.
- Brush teeth smoothly using very soft toothbrushes.
- Wear shoes even inside the home.
- Be careful with sharp and edgy objects within the reach of the child.
- Use moisturizers for the skin and mouth to prevent cracking and dryness.
- Avoid plays, games and exercises which can cause bumping, stumbling or hitting the body.
- Do not pull the scabs of any injury.
- Do not pop the pimples.
- If your daughter has a period, ask the doctor to prescribe a highly absorbing pad.
- If there is gum bleeding, rinse the mouth with cold water or suck ice chips.
- If the nose bleeds, press one nostril at a time and block it for 5 to 10 minutes.
- If any other part of the body bleeds, press the wound with a tissue until the bleeding stops.
- Put some ice on the purple spots that appear.
- Seek medical assistance as soon as possible (ST. Jude Children's Research Hospital, 2024).

3.2 Medications sensitive to light (photosensitivity)

Some medications do not like light, i.e., they are sensitive to light and called photosensitive, and need protection to avoid their action being reduced because of light. Drugs sensitive to light need special care with storage, handling, and administration. Due to this characteristic, the bottles of some medications are of a dark color, so are colored and frosted bags and tubes to keep the light from reaching the drug and making it bad (unfit) for treatment (Greenhill; McLelland, 1990).

If a photosensitive medication gets in contact with light, it might suffer alterations visible or not to the naked eye. Among the alterations that can be seen are changes in color, consistency, or even in the formation of a solid part (precipitation) in water (solution). The alterations, be they visible or not, may mean loss in action (activity) of the medicine or the formation of substances (compounds) that may cause bad reactions (adverse effects) to the child/teenager (Greenhill; McLelland, 1990).

See below some medications used to treat cancer that need protection from the light (Greenhill; McLelland, 1990).

Table 2. Photosensitive chemotherapy drugs

ATTENTION TO PHOTOSENSITIVE MEDICATIONS		
Alemtuzumab	Bevacizumab	Carboplatin CBDCA
Carmustine BCNU	Cisplatin CDDP	Cytarabine ARA-C
Cladribine 2-CDA	Dacarbazine DTIC	Dactinomycin DACT
Daunorubicin DAUNO	Dexrazoxane	Doxorubicin ADRIA
Fluorouracil-5-FU	Idarubicin IDR	Irinotecan CPT-11
Methotrexate MTX	Mercaptopurine 6-MP	Mitoxantrone DHAQ
Nimotuzumab	Rituximab	Tioguanine 6-TG
Vinblastine VLB	Vincristine VCR	Vinorelbine

Source: Greenhill and McLelland (1990).

3.3 Patient's sensitivity to light in the use of chemotherapeutic drugs

Some drugs to treat cancer may leave the skin more sensitive to sunlight and result in bad reactions (Monteiro et al., 2016). These reactions happen because the light penetrates the body through the skin and gets in contact with substances (particles) of the medication, which may circulate throughout the blood vessels or deposit in the skin. Thus, the medication, when in contact with the light, may go through changes or generate new molecules (Greenhill; McLelland, 1990).

The bad reactions (photosensitivity) may happen because of the interaction between light and the medication in the child's/teenager's body, and they can be of two types: allergy to sunlight (photoallergic) or toxic under sunlight (phototoxic).

Photoallergic reactions generally involve the child's/teenager's defense system (immunologic), which identifies these new substances as dangerous to the body, generating an allergy. This allergic reaction usually goes away when the drug administration is interrupted. Phototoxic reactions are more common and happen because of the direct action of these new substances in the child's/teenager's body (Greenhill; McLelland, 1990; Monteiro et al., 2016).

When the child/teenager is exposed to sunlight for a long time, when sunlight is stronger (higher incidence of the sun), the cancer medicine may generate a reaction in the skin. Thus, there are burns and inflammation of the skin (eczema) (Monteiro et al., 2016; Drucker; Rosen, 2011). These wounds are generally visible in regions with more contact with light, such as the face, neck, forearms, and hands. It is essential that nursing knows about any skin lesion in the child/teenager so that a proper physical exam is made and to know if these wounds were caused by sunlight (Drucker; Rosen, 2011).

Since not all patients can interrupt the use of the drugs when a bad reaction is identified, some precautions during treatment can help in cases of sunlight exposure. Among these measures are: avoiding overexposure to sunlight in peak hours, using clothes that protect against sunlight, and wearing sunscreen against the sun's ultraviolet radiation (UVA and UVB) (Monteiro et al., 2016; Drucker; Rosen, 2011).

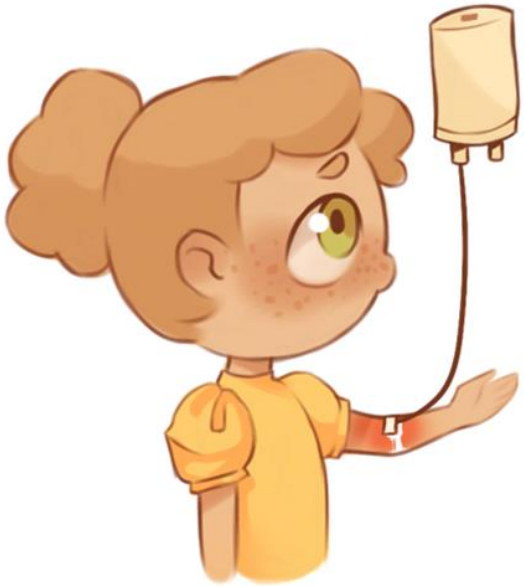
The Brazilian Society of Dermatology recommends using sunscreen with Solar Protection Factor (SPF), which is informed on the product's label, above 30, and protection against UVA radiation (Schalka; Steiner, 2014). Ideally, the sunscreen should be applied every 2 (two) hours following the "Teaspoon Rule." The idea behind this rule is that the ideal amount of sunscreen is around a teaspoon: one teaspoon for the face and head, one teaspoon for each arm, two teaspoons for each leg, and two teaspoons for the trunk (Schalka; Steiner, 2014).

It is also essential to avoid the child/teenager being exposed to sunlight if the shade is smaller than their height. Exposure to sunlight should be avoided between 10 (ten) in the morning and 3 (three) in the afternoon. Clothes that better cover the body and hats are helpful

for protection. Parasols can also help make shade – the darker and thicker the tissue of the parasol, the better (Schalka; Steiner, 2014).

Sun protection

3.4 Medicine extravasation: leakage of intravenous drugs into other parts of the body



Child with a tube and the medication leaking

Extravasation happens when the liquid, fluid, or medication accidentally goes out of the vein into surrounding tissues. This situation occurs mainly because of the incorrect

position of the venous catheter (the device inserted through a vein) or the rupture of a vein during drug administration (Giavina-Bianch, 2018; Corbett et al., 2018; Melo et al., 2020; Silva et al., 2018; Kreidieh et al., 2016; Souza et al., 2017). Extravasation can be considered an emergency since it can cause pain, inflammation, burning, and tissue death (local necrosis). Besides, some chemotherapeutic drugs can cause a lesion instantly (immediate) or after a while (late), which may hinder the recovery of the skin (scarring) (Giavina-Bianch, 2018; Corbett et al., 2018; Melo et al., 2020; Silva et al., 2018; Kreidieh et al., 2016; Souza et al., 2017).

When the extravasation is treated at the beginning, it prevents more serious problems for the child/teenager, such as reducing the patient's recovery time (Giavina-Bianch, 2018; Corbett et al., 2018; Melo et al., 2020; Silva et al., 2018; Kreidieh et al., 2016; Souza et al., 2017). Thus, when there is extravasation or its suspected occurrence, it is necessary to ask nursing for help immediately so that they can initiate the care protocol in case of extravasation. Complications from extravasation will depend on the patient's characteristics, the equipment used, the type of medication, and the nursing team's action (Giavina-Bianch, 2018; Corbett et al., 2018; Melo et al., 2020; Silva et al., 2018; Kreidieh et al., 2016; Souza et al., 2017). As for the kind of medication, attention must be given to whether it is considered vesicant or irritant, as described below.

3.4.1 What are irritant and vesicant medications?

The bad reactions caused by the extravasation depend on the kind of drug for cancer treatment being injected into the vein. For that matter, medications can be divided into three groups: vesicant, irritant, and non-irritant/vesicant. The vesicant medicines, on the other hand, are divided into DNA ligands (the molecule present in the nucleus of living beings) and non-ligands (Pérez Fidalgo et al., 2012; Freitas, 2015; Boulanger et al., 2015).

Irritant medications are those that cause burning, phlebitis (inflammation of a vein), or pain when inserted into the vein incorrectly but hardly ever cause severe injuries to the body. When they are injected in significant amounts, they can cause wounds (ulceration) where the tissue is softer (Silva et al., 2018; Kreidieh et al., 2016; Souza et al., 2017; Kameo et al., 2015).

Vesicant drugs can cause more bad reactions to the tissue, leading to pain, blistering (vesicles), and, possibly, tissue death (necrosis) (Freitas, 2015). Besides, they can cause bad effects on tendons, nerves, bones, and ligaments, hindering the movement of the area that got in contact with the drug (Freitas, 2015). Non-vesicant drugs may cause pain during the extravasation but do not cause bad reactions in the body (Freitas, 2015; Reynolds et al., 2014).

DNA-ligand vesicant drugs generate substances (free radicals) that hinder protein production (protein synthesis), deeply, painfully, and extensively destroying the tissue. These drugs are more difficult to be eliminated from the body and may continue to increase the bad

reactions for up to 28 (twenty-eight) days after the extravasation. Vesicant drugs that do not have to connect to the DNA to work connect to healthy cells and are more accessible for the body to dispose of them (degrade). Because of that, the injury (lesion) stays in just one area and causes less pain (West Midlands Expert Advisory Group for Chemotherapy, 2017; Sauerland et al., 2006).

Table 3. Examples of vesicant, irritant, and non-vesicant medications

Irritant Medications	Non-vesicant Medications	Vesicant Medications
Bendamustine Carboplatin Carboplatin Carmustine Cisplatin Dacarbazine Daunorrubicin liposomal Doxorrubicin liposomal Streptozocin Etoposide Fluorouracil Ifosfamide Irinotecan Melphalan Mitoxantrone Oxaliplatin Paclitaxel Teniposide Topotecan	Aldesleukin Monoclonal antibodies Asparaginase Bendamustine Bevacizumab Bleomycin Bortezomib Cabazitaxel Cetuximab Cyclophosphamide Cisplatin Cytarabine Cladribine Etoposide Fludarabine Gemcitabine Interferon Interleukin-2 Methotrexate Pemetrexed Raltitrexed Rituximab Temsirolimus Thiotepa Trastuzumab Arsenic Trioxide	**DNA-ligands** Dactinomycin Daunorubicin Doxorubicin Epirubicin Streptozocin Gemcitabine Idarubicin Mechlorethamine Mitomycin Mitoxantrone **Non DNA-ligands** Cabazitaxel Docetaxel Paclitaxel Vinblastine Vincristine Vindesine Vinorelbine

Source: Pérez Fidalgo et al. (2012), Freitas (2015), Boulanger et al. (2015), West Midlands Expert Advisory Group for Chemotherapy (2017), Royal Cornwall Hospitals NHS Trust (2014).

3.4.2 Identification of risk factors and preventive care by the nursing team for extravasation

Evaluating some critical points is a strategy of the nursing team to reduce the risks of medicine administration and ensure quality assistance to the patient. Among these points are: analyze if the equipment to administer the chemotherapeutic drug is the best option; if there is a vein with alterations; if the patient is well-nourished; if there are varices (sclerosis) or weak veins; if the area for inserting the needle (puncture) has any wound or swelling (edema); if the blood is flowing (venous return); and, lastly, beware of any other medication has been injected in the same area (Souza et al., 2017; Bonassa; Santana, 2012).

See below some important points that require attention from the nursing professional to avoid problems related to extravasation (Souza et al., 2017; Schneider; Pedrolo, 2011).

PAY ATTENTION TO THE GUIDELINES RELATED TO THE EXTRAVASATION OF CHEMOTHERAPEUTICS:

- Administer the medicine preferably in large and robust veins, in parts of the body which the patient moves or uses less, but where there is strong blood flow (Souza et al., 2017; Schneider; Pedrolo, 2011);
- Choose appropriate needles for the area of medication administration (Souza et al., 2017; Schneider; Pedrolo, 2011);
- Direct the patient to stay still so that the needle does not move (Souza et al., 2017; Schneider; Pedrolo, 2011);
- Check the patient's position (Souza et al., 2017; Schneider; Pedrolo, 2011);
- Be attentive during the whole time of the medicine administration into the vein (Souza et al., 2017; Schneider; Pedrolo, 2011);
- Be attentive to all the information given by the patient, during the administration, about possible signs and symptoms of extravasation (Souza et al., 2017; Schneider; Pedrolo, 2011);
- Do not administrate vesicant medications for more than one hour in veins in the extremities (peripheral) (Souza et al., 2017; Schneider; Pedrolo, 2011).

3.4.3 Directions for cases of extravasation (When the drug for cancer treatment leaks from the vein into another tissue)

The complications during extravasation may be linked to the characteristics of (1) the patient, (2) the equipment, (3) the medication, and (4) the inappropriate professional practice (iatrogenesis). Regarding the medication, the problems may be related to factors such as vesicant potential, concentration, the amount that can be extravasated to other places,

exposure time to content in the areas, the site chosen for puncturing, devices used, and insertion technique (Melo et al., 2020; Kreidieh et al., 2016; Souza et al., 2017; Otto, 202; Matsui et al., 2017).

Regarding inadequate professional practice, among the associated factors are little training, the incorrect introduction of the needle, lack of monitoring of the devices on the patient, and lack of time to monitor the patient. Depending on the area the medication extravasated, an impairment may occur if the infiltrated areas contain tendons, articulations, or vessels. Functional damage may occur if the drug goes into an area with many articulations and in a great amount (Melo et al., 2020; Kreidieh et al., 2016; Souza et al., 2017; Otto, 202; Matsui et al., 2017).

Observing physical signs shown by the patients is also important for monitoring as a protective barrier and for avoiding more serious consequences from the extravasation. Thus, it is necessary to be aware of the patient's physical aspects, monitor the area of infusion, observe the existence of patchy lesions, fibrosis (tissue formation after a lesion as part of the scarring process), pain, scaling of the skin, blistering, hyperemia (increase in blood flow in the area), and functional and sensorial impairment of tendons, articulations, and nerves (Melo et al., 2020; Souza et al., 2017; Pérez Fidalgo et al., 2012; Otto, 202; Dougherty; Oakley, 2011).

One more barrier to avoiding or managing extravasation is monitoring the characteristics of the vascular access. Choosing the area where the access will be inserted is vital for greater protection of the articulations, tendons, and nerves to prevent damage to the patient's limbs. The intravenous approach (administration of the medication in the patient's vein) is advantageous because many veins can be used to administer chemotherapeutic drugs. However, it requires extreme care when choosing the area once the chosen one must go from the distal to the proximal direction. It also requires avoiding applications where there is little subcutaneous tissue and a significant number of tendons, e.g., in the back of the hand. Thus, this place is contraindicated for the infusion of vesicant drugs because the extravasation in the area tends to be complicated (Souza et al., 2017; Brito; Lima, 2012).

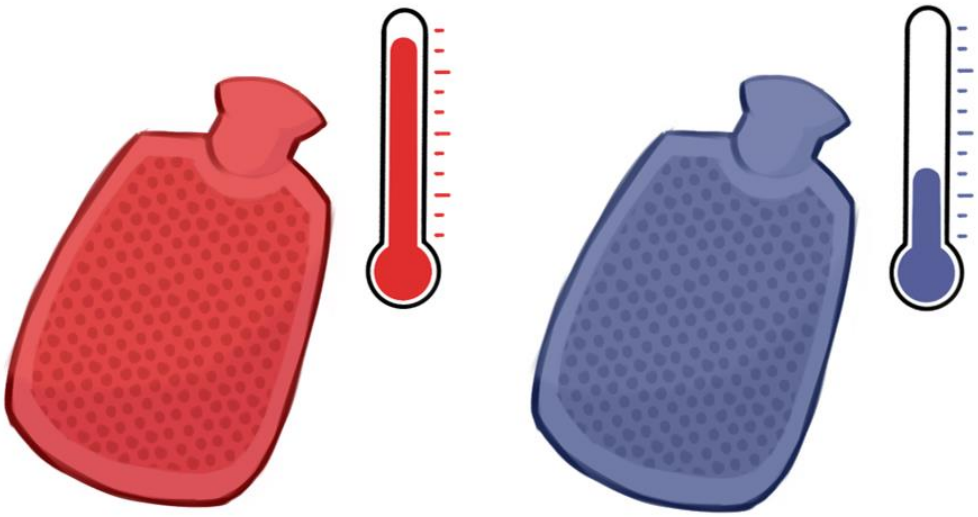
Extravasation control depends on the drug extravasated, the place of extravasation, the amount leaked, and the preparation of the nurses who will act in the event. Some ways of treating the extravasation immediately are applications of warm or cold compresses (depending on the medication extravasated), some antidotes, saline *washout*, and surgical interventions (Melo et al., 2020; Pérez Fidalgo et al., 2012; Freitas, 2015; Jackson-Rose et al., 2017; Pluschnig et al., 2015).

When the extravasation is identified, the nurse will initially try to pull the medicine through the patient's access (aspiration). Besides, the professional will put cushions under the limb with the access to elevate the area. After that, the professional may use thermal compresses (cold or warm). Depending on the medicine, the kind of compress may change because each has particularities. Then, the nurse will inform the patient about the treatments

or procedures that may be taken in case of extravasation (Melo et al., 2020; Pérez Fidalgo et al., 2012; Freitas, 2015; Jackson-Rose et al., 2017; Pluschnig et al., 2015).

3.4.3.1 Application of cold and/or warm compresses

Applying a warm compress allows the blood vessels (veins) to increase in size, i.e., dilate, facilitating absorption and distribution of the leaked medication. The technique of warm compresses is indicated in medications such as vinca alkaloids (vinorelbine, vinblastine, and vincristine), teniposide, oxaliplatin, and etoposide. The application of cold compress allows the blood vessels (veins) to decrease in size, i.e., become thinner, so there is a reduction of the extravasation speed of the medication to the tissues. The decrease in size helps reduce wounds and is indicated for anthracycline (daunorubicine, epirubicin, idarubicin, and doxorubicin). In some cases, the medication may like both warm and cold compresses without creating substantial problems for the patient (Souza et al., 2017; Schneider; Pedrolo, 2011; Gonzalez, 2013).



Warm compress **Cold compress**

See below the kinds of compresses to be used in case of extravasation of drugs for cancer treatment (Pérez Fidalgo et al., 2012; Freitas, 2015; Boulanger et al., 2015; West Midlands Expert Advisory Group for Chemotherapy, 2017; Royal Cornwall Hospitals NHS Trust, 2014).

Table 4. Hot and cold compresses – Types of compresses that can be used depending on the chemotherapy

ATTENTION TO THE TYPES OF COMPRESSES		
Warm compress		
Carmustine	Vincristine	Oxaliplatin
Vindesine	Vinblastine	Vinorelbine
Cold compress		
Aldesleukin	Cytarabine	Dactinomycin
Docetaxel	Epirubicine	Fluorouracil
Irinotecan	Methotrexate	Pemetrexed
Thiotepa	Monoclonal antibodies	Bortezomib
Cladribine	Daunorubicin	Doxorubicin
Streptozocin	Gemcitabine	Interferon
Mitomycin	Raltitrexed	Topotecan
Asparaginase	Carboplatin	Dacarbazine
Daunorubicin	Doxorubicin	Fludarabine
Idarubicin	Mechlorethamine	Mitoxantrone
Temsirolimus	Bleomycin	
Warm and cold compress		
Bendamustin	Cisplatin	Paclitaxel
Cabazitaxel	Etoposide	Teniposide
Cyclophosphamide	Ifosfamide	Arsenic Trioxide

Source: own elaboration.

3.4.3.2 Use of antidote (substance that prevents or reduces potential damage) of chemotherapy drugs

The use of antidotes may help in the reduction of the effects caused by the extravasation, so it has a neutralizing role. The antidotes used in these cases differ depending on the extravasated medicine and can be directly applied on the skin or injected into the vein uso (Melo et al., 2020; Pérez Fidalgo et al., 2012; Harrold et al., 2015). Among the antidotes used in the extravasation are dexrazoxane, dimethyl sulfoxide (DMSO), hyaluronidase, sodium thiosulfate, and subcutaneous hydrocortisone/betamethasone topical.

Table 5. Types of antidotes used for managing extravasations

Antidote	Use	Information
Dexrazoxane	• Blocks the enzyme topoisomerase II, preventing the extravasated medicine from reaching more tissues, and binds to iron, preventing the formation of free radicals. • Used in the extravasation of anthracycline (daunorubicin, epirubicin, idarubicin, and doxorubicin) (Melo et al., 2020; Pérez Fidalgo et al., 2012; Muthuramalingam et al., 2013; Drake, 2012).	• It has a protective effect and needs to be administered in large veins, away from the area where the extravasation occurred. • Do not use it with cold compresses, which make the vessel thinner, making it more difficult for the antidote to reach the extravasation site. • May cause bad reactions, such as sickness (nausea), vomiting (emesis), local pain in the insertion (infusion), and an increase in the number of liver (hepatic) enzymes. • Use must be suspended 15 minutes before the application of medication (infusion).
Dimethylsulfoxide (DMSO)	• Used in topical form. • Helps the skin absorb the medication and eliminate free radicals (Melo et al., 2020; Olver et al., 1988; Wengström et al., 2008).	• Needs the skin to be cold (15 minutes of cooling before and after). • May cause bad reactions, such as: redness (erythema), burning, and scaling of the skin (itching) (Melo et al., 2020; Olver et al., 1988; Wengström et al., 2008).
Hyaluronidase	• Changes the way the tissue absorbs the extravasated medicine by breaking down hyaluronic acid. • Used in the extravasation of the medications vincristine, vindesine, vinorelbine e vimblastine (Melo et al., 2020; Pérez Fidalgo et al., 2012; Pluschnig et al., 2015).	• Prevents the death of the skin (necrosis). • The World Health Organization (WHO) indicates 1 mL of 150 UI/mL should be used subcutaneously (Melo et al., 2020; Pérez Fidalgo et al., 2012; Pluschnig et al., 2015).

Sodium Thiosulfate	• Reduces the number of hydroxyl radicals, reducing the extravasation of the lesion (Melo et al., 2020; Souza et al., 2017).	• It is indicated to use the concentration of 10% diluted in water and inject 2 mL in the vein to each milligram of the extravasation medicine (Melo et al., 2020; Souza et al., 2017).
Subcutaneous hydrocortisone / betamethasone topical	• Helps avoid tissue death (necrosis). • Used in the extravasation of the medications vincristine, vindesine, vinorelbine, vimblastin e Epipodophyllotoxin (Melo et al., 2020; Souza et al., 2017).	• May cause bad reactions in the patient, such as the increase of the lesion after the extravasation (Melo et al., 2020; Souza et al., 2017).
Washout or with saline lavage	• Executed quickly in the extravasation area. • Aims at removing, through dispersion medium, all the medication extravasated (Melo et al., 2020; Pérez Fidalgo et al., 2012; Dougherty; Oakley, 2011; Harrold et al., 2015).	• Application of sodium chloride 0.9% with the enzyme hyaluronidase • Sometimes, application of local anesthesia during the infusion might be necessary (Melo et al., 2020; Pérez Fidalgo et al., 2012; Dougherty; Oakley, 2011; Harrold et al., 2015).

Source: own elaboration.

Table 6. Step by step to be followed by nurses in case of extravasation

In case of extravasation or suspected extravasation, the nursing team must follow a step-by-step to manage the situation and avoid more serious problems for the patient, as described below:

a) **Interrupt/stop the infusion (medicine administration):** In case of suspected or confirmed extravasation, stopping the medicine infusion immediately is necessary.
b) **Do not remove the catheter:** The device connected to the access will be disconnected. However, one cannot remove the catheter because it facilitates the aspiration of the extravasated medication and allows the administration of the antidote (when necessary).
c) **Use saline solution, when indicated:** In some cases, washing the access with saline solution is not recommended because it might dilute the medicine.
d) **Remove the catheter:** If the antidote is not used, the catheter may be removed. If the antidote is necessary, the catheter must be removed after the administration. If necessary and prescribed by the assisting doctor, the nursing team may give an analgesic to relieve the pain. After that, the nurse can make a bandage in the area if needed.
e) **Application of thermal compresses (warm or cold):** In cases of cold compresses, use a clean cloth or gauze damped with cold water for 15 to 20 minutes, 4 (four) times a day in the first 24 hours. In cases of warm compresses, use a clean cloth or gauze damped with warm water for 20 minutes, 4 (four) times a day for 1 (one) or 2 (two) days.
f) **Elevate the limb:** The area damaged because of extravasation must be elevated to avoid edemas and more serious damage after the extravasation. The nurse will direct the patient and/or caregiver about the need to keep the limb elevated for a while, according to professional evaluation.
g) **Monitor, document, and direct:** The nurse has to keep good nursing records, describing the event in detail, informing the area, size, the aspect of the skin, the medication in use at the time, and their conduct to minimize the damage. It is also necessary that the nurse directs the patient and/or the caregiver about the event and the signs that should be monitored.
h) **Situations that require special care:** In extreme cases, the patient might need to be evaluated by the assisting doctor and, if indicated to a surgical procedure, the nursing team will provide the transportation of the patient to the O.R., according to the directions given to the nursing team by the sector that will receive the patient.

It is important to emphasize that all the conducts described in this chapter are, most of the time, implemented by the nursing team since they are with the patient 24 hours daily. However, today we always work with a multi-professional team (nurse, doctor, physical therapist, pharmacist, psychologist, social assistant, nutritionist, occupational therapist), so most conducts are decided together with the team.

Source: Lacy et al. (2005).

Table 7. Medicine spill: spillage of medication on the floor or the body

The cancer medicine can accidentally fall and spill the liquid on the floor or unintentionally have contact with the body. This case is considered an environmental accident because it contaminates the environment where the spillage happened. When the medication spills on the clothes, they must be immediately taken off without touching the contaminated area. The contaminated areas of the skin must be washed with water and soap. If the medication got in contact with the eyes or other mucous membranes (mouth, nose, etc.), these must be washed, without being rubbed, with water or isotonic solution saline 0.9%) in large amounts, and after that, seek medical assistance. To decontaminate the environment, first, one must isolate the spillage area and keep other people from getting closer and contaminating themselves. The professional responsible for the decontamination will need to wear protective equipment before initiating the procedure. Liquid medications are removed with dry absorbent compresses, and the contaminated area must be washed with water and soap in abundance. All residues should be discarded in plastic bags for toxic chemical waste.

Source: Agência Nacional de Vigilância Sanitária (2004).

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