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MARZENA KAMIŃSKA, TOMASZ CISZEWSKI, AGNIESZKA BRONIKOWSKA, MARIA FERAŃSKA, AGNIESZKA PAWLAK-WARSZAWSKA, ELŻBIETA STAROSŁAWSKA

The nurse's role in preventing and diminishing side effects after chemotherapy

Abstract

Chemotherapy is one of the basic methods of cancer treatment. The methods of treatment used in oncology have recognized therapeutic value, but each of them is related to the possibility of side effects.

Ensuring the effectiveness and safety of the use of anticancer drugs as well as prevention of symptoms occurring as side effects is a fundamental principle of the treatment team.Careful monitoring of the course of treatment can significantly reduce the incidence of side effects.

Keywords: cancer, chemotherapy, side effects.

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INTRODUCTION

Chemotherapy is a treatment method that consists in administering to a patient of cytotoxic drugs that destroy cancer cells or inhibit their proliferation. Chemotherapy is one of the methods of cancer treatment next to surgery, radiotherapy, immunotherapy and targeted therapy.

Cytostatic effect is non-specific. It means that drugs have the same effect on all living cells of various organs of human, in proportion to their growth and sharing. The side effects are primarily the result of cytostatics on those organs, the cells of which divide extensively. These include the alimentary canal, skin, hair and bone marrow.

The risk of adverse effects is related to the type of cytotoxic drug, its dosage, frequency of administration and individual sensitivity of the patient as well as the presence of concomitant diseases. Chemotherapy has many side effects. Cytostatic effect is noticeable after several days of therapy and sometimes even after several hours. The toxicity symptoms include: immediate effects (nausea and vomiting, radiation reactions), early complications (hematologic toxicity, inflammation of the mucous membranes of the alimentary canal and alopecia), delayed (cardiomyopathy, peripheral neuropathy) and distant complications (gonadal failure, secondary malignancies) [1-4].

Typical side effects associated with cancer chemotherapy are nausea and vomiting (NaV). The vomiting reaction depends on the applied emetic drugs and individual sensitivity of patients. In the majority of cases, symptoms are mild but sometimes can lead to dehydration, disturbance in water and electrolyte balance, nutrition disorders and can result in the loss of body weight.

Vomiting and nausea can also significantly worsen the general condition of patients by impairment of physical condition, may also negatively affect the mental state, and consequently lower quality of life. NaV are the effects of chemotherapy that patients frequently complain of and are afraid of most often [5].

Frequent vomiting were observed after: cisplatin, doxorubicin, dacarbazine, dactinomycin, rarely after cyclophosphamide, procarbazine, N-nitrourea derivatives and occasionally after the alkaloids, bleomycin, methotrexat, melphalan hydrochloride, busulfan [6,7].

NaV mechanism by chemotherapy is not fully understood. It is likely that it is specific for each cytotoxic drugs.

NaV by chemotherapy can be divided into the following types:

1. NaV- acute type, develops within the first 24 hours after chemotherapy administration. The symptoms usually begin between 1 and 2 hours (programs with cisplatin, dacarbazine, nitrgranulogen, melphalan in high doses).
2. NaV-delayed type appears after 24 hours and can last from a few to several days:
   - delayed,
   - extended.
3. NaV-predicted type occurs in approximately 20-25% of patients administered multiple courses of chemotherapy. It occurs immediately prior to the chemical treatment.

The use of anti-emetic therapy should be based on an assessment of the potency of emetic chemotherapy, individual assessment of patient characteristics (age, sex, general condition, concomitant diseases, previously used treatment), excessive alcohol intake history or car-sickness.

Proceedings of nurses in the prevention of NaV have a great importance because they determinate the effectiveness of pharmacological treatment. They involve the provision of a range of guidelines and rules regarding the transmission

Clinical Oncology Ward, St. John's Cancer Center, Lublin, Poland

of daily living of patients. These procedures include such elements as:

- nutrition: selection of a proper diet – easily digestible meals at moderate temperatures often taken in small quantities, receiving an increased amount of fluid (but small sips), the need to consume foods with a higher than usual salt content;
- control and monitoring of vital signs (blood pressure, heart rate, body temperature, weight, fluid balance);
- observing and documenting the incidence and severity of NaV;
- transferring the principles of personal hygiene and the surroundings;
- ensuring proper sleep and rest of the patient;
- the impact on the mental sphere of patients by the use of "non-pharmacological" methods (psychotherapy, relaxation techniques, acupuncture) [8,9].

Chemotherapy often leads to the damages of the intestine mucous membrane, which results in diarrhea, which in turn has a negative impact on the overall condition of patients and quality of life, as well as hinders continuity of systemic treatment. Most often diarrhea occurs after the application of anti-metabolites: 5-fluorouracil, methotrexate, cytosine arabinoside and camptothecin derivatives such as irinotecan and topotecan [10]. The immediate complications are dehydration, water-electrolyte and acid-base imbalance, and impaired nutrition. Damaged intestine mucous membrane is the gateway for local bacterial, fungal and viral infections [11].

High intensity diarrhea can be associated with cramp stomachache and the massive damage of the intestinal mucosa accompanied by erosions and ulcers that may result in bleeding from the lower alimentary tract. Assessment of the stool culture may exclude bacterial etiology of diarrhea or confirm bacterial infection. An important element of nursing care is to prevent patient from dehydration by controlling the balance of fluids and their possible replenishment, monitoring as well as correcting electrolyte levels. Activities of nurses should focus on observation of the patient, administering an increased amount of fluids to 3000 ml per day including the high-electrolyte fluids. It is important to observe the nature and frequency of defecation and the introduction of a high protein diet [12].

Sometimes a chemical, antiemetic treatment or opioid usage may be accompanied by constipation. The nurse proceedings in case of constipation are diet modification by increasing fluid supply and high-fibre products consumption, motivating the patient to increased activity and helping with proper laxatives application [13].

Another side effect of chemotherapy is the damage of mouth mucous membranes. Inflammation of the mucous membranes in the oral cavity may lead to the erosion, ulceration susceptibile to the infection and bleeding. These changes are most often observed on the buccal mucosa, lips, tongue and on the surface of the soft palate. These changes are often accompanied by pain in the oral cavity, impeding chewing and oral food intake, taste disturbance and decreased quality of life [14]. The incidence and severity of changes in the oral cavity depends on the type of cancer, duration and intensity of the applied chemical treatment [15]. Other factors affecting the occurrence of damage and inflammation in the oral cavity include age, sex, and nutritional status of the patient. The studies show that the symptoms associated with inflammation of the oral mucosa are more common in women, younger patients and elderly (>65 years). Another risk factor may be low body mass index and the presence of neutropenia [16]. Drugs that cause inflammation of the oral mucosa include methotrexate, 5-fluorouracil, cytosine arabinoside, vinblastine and etoposide. The nurse establishing a care plan should consider the preventive methods that may reduce the risk of severe reaction of the mucous membranes of the mouth and its complications [17]. One of the important actions is the exact sanitation of the oral cavity (cure or elimination of dental caries seized, treatment of periodontal disease). When it is necessary to remove teeth, this procedure should be performed at least 2 weeks before the start of chemotherapy.

Compliance with such recommendations as to maintain proper oral hygiene, avoidance of irritants (nicotine, alcohol, hot spices), sometimes can be helpful to the preparation of artificial saliva. During therapy, frequent oral rinse solution of 0.9% saline, the use of ready rinses containing calcium-phosphate ions (Caphosol) or lotions containing lactoperoxidase, lactoferrin and lysozyme (Biotene), are recommended [18]. The use of local anesthetics (such as lidocaine or benzocaine gel) is also possible. Daily oral check for signs of inflammation initial symptoms (dryness, pain, mucosal fine cracks, which cannot be white wash spots) can prevent or substantially reduce the discomfort on the part of the oral cavity. It is important to educate patients on proper oral hygiene, even when there are strong pains associated with inflammation of the oral mucous membrane [19]. Painful inflammation of the oral mucosa and gums may be due to a direct effect of cytostatics epithelium, as well as fungal, bacterial or viral neutropenic infections. Therefore, the occurrence of this complication is always an indication for peripheral blood counts.

Gonadal damage is a common side effect of chemotherapy. Most of the cytostatics result in complete inhibition of spermatogenesis in men and disappearance of ovulation in women. Infertility in most cases is reversible and does not preclude the subsequent parenting. However, the return of the reproductive function can take many months and even years after cancer treatment. After high doses of cytostatics used before bone marrow transplantation, infertility may be permanent; especially in those women who have such treatment it can cause early menopause. Chemotherapy only slightly has testicular- hormonal influence and has a slight effect on impotence. Sexual drive is observed during and after treatment with chemotherapy. The nurses should implement patient education about the adverse effects of cytostatic treatment on sexual function [20-22].

One of the most undesirable symptoms associated with chemotherapy is hair loss. It occurs usually in the first weeks after the administration of cytostatic drugs. With long-term chemotherapy it always comes to total alopecia involving the scalp, armpits, genitals and limbs. Hair loss results from damage to the cells of hair follicles, which are due to the rapid sharing and are particularly sensitive to the effects of cytostatics. Hair loss is associated with administration

of adriamycin, etoposide, lomustine, cisplatin, ifosfamide and cyclophosphamide vinblastyny in high doses. Some cytotoxic drugs, 5-fluorouracil, dacarbazine, methotrexate can cause photosensitivity and patients receiving these drugs should avoid the sun. In the case of some cytostatic, the problem may be various types of dermatitis.

Activities of nurses should be based on informing patients about the possibility of alopecia and the belief that the regrowth of hair often begins even during treatment. To reduce the trauma for the duration of the treatment, patients should obtain the wig. It is also important to help patients accept their appearance [23,24].

In the application of cytostatic treatment there are often local reactions due to extravasation. The severity of these complications may have different degrees – from mild redness, pain and swelling to ulceration , necrosis and deep damage to surrounding tissues and venous patency disorders. The mechanism of tissue damage varies depending on the extravasated cytostatic. Factors that play a role in preventing extravasation comprise adequate insertion site, the method of cannulation and injection technique, forearm optimum place visible due to the wide conductor, and the absence of a well-developed arthritis of subcutaneous tissue against damage of nerves and tendons. Bending the elbow and the inside of the wrist should be avoided. It is important to avoid injection under pressure and to observe the insertion site and paying attention to the patient's feelings is indicated. In the case of extravasation of cytostatics, we should refer to the possibility of local toxicity of the drug, discontinue the drug, remove the cannula from the vessel, try aspirating of liquid remaining in the vessel. If there is a drug that is used as cytostatic antidote, it should be given by the same route in order to achieve the most effective destruction. Limb immobilization and elevation during the first 2 hours after extravasation is also important [25,26].

The consequences of damage to bone marrow hematopoietic function most often are in the form of: leukopenia , thrombocytopenia. Anemia is a complication that occurs during the use of almost all of cytostatics. One of the most serious clinical problems in cancer patients are infections. This is particularly true of patients undergoing chemotherapy. It is estimated that of all the deaths in cancer patients approximately one third are deaths that are a direct cause of bacterial or fungal infections.

Factors that predispose to the formation of infections are:

- state of reduced number of granulocytes (neutropenia);
- disorders of cellular and humoral immunity;
- obstruction of the natural body resistance;
- tearing of the coating;
- the combination of chemotherapy and radiotherapy [27].

Neutropenia is assessed as a major risk factor for severe, life-threatening infectious complications. Generally, it occurs within 5-10 days after administration of chemotherapy and usually takes about 7-14 days. Neutropenia is reversible, but when there is a decrease in the number of granulocytes below 500/mm, infection develops, and by the drop below 100/mm^3 very often sepsis occurs. Particularly in the treatment of infections in neutropenic patients, the essential element of treatment is the use of broad-spectrum bactericidal antibiotic therapy [27-29].

The treatment of choice is administration of hematopoietic growth factors (G-CSF-granulocyte colony-stimulating factor). Using G-CSF, an increase in the number of granulocytes and leukocytes in peripheral blood after 24-48 hours after their administration can be quickly achieved. The granulocytes that are produced in response to cytokines, prove a build-up of chemotaxis and phagocytosis, adhesion, cytotoxicity. Neutropenia causes changes in the intensity and duration of chemotherapy regimen, which influence the overall effectiveness of treatment [28,29].

It is important to take proper care by nurses to patients treated for infections in the course of chemotherapy. Daily observation of the patient and early response to infection symptoms (cough, stomatitis, cystitis symptoms, perianal abscess) is necessary. Patients with chronic neutropenia are indicated to carry on systematic estimation of the oral mucosa and the use of topical preventative measures (oral rinse: chamomil, sage, Tantum Verde, decontamination of the oral cavity and throat disinfectant – Betadine, Corsodyl). It is also important to maintain proper hygiene and prophylaxis of bedsores. The patient should be ensured with proper nutrition and a diet. Patients should be isolated from other patients, the visits should also be limited, sanitary regime should be used. An important role of nurses in the infections treatment should be emphasized. A careful observation of the patient, responding to symptoms that may be a sign of patient aggravation is important. Preventive action can be crucial to achieve positive treatment effects [30,31].

Anemia often accompanies cancer and the use of cancer treatment may intensify it. The incidence and severity of cancer depends on the type of cancer, tumors staging system and disease duration, presence of complications (especially in the form of hemorrhage, occupied by a tumor of bone marrow or spleen), and the methods and intensity of therapy. The symptoms of anemia, such as fatigue, depression, decreased pain tolerance, impaired intellectual function adversely affect the quality of life and the course of the planned anti-cancer treatment. The scale of the problem is large, because in 50% of patients with hematopoietic tumors and in 41% of patients with solid tumors anemia is observed [32].

Treatment of anemia depends on the individual condition of the patient, on the pathogenesis, and the severity of this complication. Even mild form of anaemia has a negative impact on both the patient functioning and deteriorates the effectiveness of cancer treatment. In the case of anemia, there are three courses of action: patient observation, transfusion of packed red blood cells and the use of human recombinant epoetin alfa and beta or alpha darbepotin. Obtaining an immediate therapeutic effect is possible due to red blood cells transfusion. Apart from the difficulties in the supply of blood, transfusion adversely affects the homeostasis of the body, allergic reactions, infections, and immunosuppressive activity [33].

Thrombocytopenia is also a serious clinical problem in oncology patients, who are undergoing chemotherapy. Often it requires dose cytostatic reduction or is the reason for the

chemotherapy delay, which correlates with a worse outcome. Thrombocytopenia as well as neutropenia, may lead to a change in chemotherapeutic regimens (duration and intensity of dosing), which affects the overall performance of the treatment of the patient. Currently, the standard treatment of thrombocytopenia is a blood cells concentrate transfusion [34].

One of alternative methods of treatment of thrombocytopenia is the administration of growth factors stimulating megakaryopoesis (megakaryocytesis). The main controller of megakaryopoesis is Thrombopoietin (TPO), which stimulates the proliferation and differentiation of precursor cells in megakaryocytes series, maturation of megakaryocyte and blood cells [35].

An important element in the prevention of the above complications is nursing care. Reducing the number of blood cells, which are responsible for the proper coagulation, may cause bleeding from the nose, gums, vagina, easy extravasation of blood outside the blood vessel and the development of numerous "bruises" even after minor injury. The sudden decline in the number of platelets can cause bleeding and hemorrhage, which may constitute a direct threat to the patient's life [36].

Another issue is the possible appearance of long-term complications associated with cytostatic therapy. Here you can include organ damage, caused by some cytostatics. After application of chemotherapy in high-dose, leukemia may develop. Its development is probable after treatment with alkylating agents such as cyclophosphamide, topoisomerase inhibitors or etoposide [37].

Heart failure after treatment with anthracyclines is a relatively rare complication in patients who received them in an adjuvant chemotherapy. This complication is more frequent after escalation the cumulative dose of doxorubicin (above 550 mg/m²), and most of the programs of adjuvant therapy end before overdrafting the dose. It was found that the combination of trastuzumab and anthracyclines leads to a particularly high prevalence of systolic heart failure [38].

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Informacje o Autorach
Dr n. med. Marzena Kamińska – Pielęgniarka Oddziałowa, I Oddział Onkologii Klinicznej; dr n. med. Tomasz Ciszewski – asystent, Oddział I Onkologii Klinicznej; mgr Agnieszka Bronikowska – Dział Rozwoju Naukowego COZL; mgr Maria Ferańska – kierownik, Dział Nadzoru Sanitarno-Epidemiologicznego; mgr Agnieszka Pawlak-Warszawska – Pielęgniarka, I Oddział Onkologii Klinicznej; prof. dr hab. Elżbieta Starosławska – Konsultant Wojewódzki w dziedzinie onkologii klinicznej, Lekarz Kierujący I Oddziałem Onkologii Klinicznej, Dyrektor Naczelny COZL w Lublinie.

Corresponding Author
Marzena Kamińska
Centrum Onkologii Ziemi Lubelskiej
tel. 607-234-462
E-mail: mkaminska0@vp.pl