Module Six
Part Three – Providing care for the person having antineoplastic agents for cancer

Overview

The aim of this module is to develop the ability of the beginning specialist cancer nurse to demonstrate competence across all domains of practice when caring for the person receiving antineoplastic agents for cancer.

Key concepts

The key concepts associated with providing care for the person having antineoplastic agents for cancer include:

- Factors influencing selection of antineoplastic agents for treatment of cancer.
- Experience and impact of antineoplastic agents on various health domains.
- Prevention, detection, and management of common health alterations experienced by people receiving antineoplastic agents.
- EdCaN Competency Assessment Tool for Antineoplastic Agent Administration (2009) or utilisation of local competency/skills based assessment tool.

Learning activities

At times, you will have learning activities to complete. The questions will relate to the content you've just read or the video you've just watched.

Resource links

Resource links may be included throughout the module. These links lead to interesting resources, articles or websites, and are designed to encourage you to explore other available information.

Videos

You may be prompted to access EdCaN videos throughout this module.

Estimated time to complete

20 hours

Workplace learning requirements

The EdCaN TSP is designed to support learning within the context of the policies, procedures and preferences of individual workplaces. Completion of this module and assessment of competence in specific practice areas needs to be supported by appropriately qualified educators, preceptors and clinicians in the participant's practice setting. Opportunities for participants to undertake supervised practice of selected skills will be required. This support is designed to promote integration of knowledge to clinical practice.

In conjunction with this learning module, it is recommended that the EdCaN Competency Assessment Tool for Antineoplastic Agent Administration is used to both facilitate the development and assessment of competence. It is anticipated that the minimum level achieved by the beginning specialist cancer nurse will be at the performance level "*beginning competence as a specialist cancer nurse*".[1] (See Table 1)

An alternative competency/skills based assessment tool may be used, but it is recommended that such a tool is mapped to the EdCaN resource to ensure that it reflects the nationally recognized standard of care with respect to administration of antineoplastic therapy.

Table 1
EdCaN Competency Assessment Tool for Antineoplastic Agent Administration Band Level Descriptors

Performance Level	Interpretation
COMPETENT Established competence as specialist cancer nurse	Complies with legislation relevant to cancer care. Explains and justifies practice in accordance with local policy. Evaluates and appraises treatment orders. Is cognisant of individual's specific condition, needs and preferences. Performs comprehensive and ongoing assessments. Has a sound knowledge underpinning antineoplastic therapy. Confident and independent in procedures. Efficient and dexterous technique demonstrated. Is able to manage changing scenarios. Documents and reports across the care continuum. Cognisant of organisation- wide/ global cancer control issues. Practices in a way that acknowledges the impact of cancer on the culture, dignity, values, beliefs of people affected by cancer.
COMPETENT Beginning competence as specialist cancer nurse	Identifies and follows standard policy requirements with some specificity to chemotherapeutic agent or individual. Identifies and resolves unsafe situations. Nursing considerations limited to specific context but lack organisational/ global perspectives. Requires occasional prompts to carry out routine processes and practice. Evolving technique demonstrated.
NOT YET COMPETENT	Knowledge of local policy and rationales for practice limited to recall. Limited focus on task, individual or context. Requires continuous directions or prompts to carry out routine procedures. Accuracy and technique not dependable.

Objectives

On completion of this supporting resource, you should be able to:

1. Perform a comprehensive health assessment on a person prior to, during, and following antineoplastic agents.
2. Analyse clinical, psychological and social data to formulate and implement an individualised plan of care for the person having antineoplastic agents.
3. Provide effective nursing care to prevent, detect, and manage early and late effects associated with antineoplastic agents.
4. Demonstrate effective educational strategies in providing individualised information to the person having antineoplastic agents.
5. Demonstrate safe practice in the care of the person receiving cytotoxic agents.
6. Demonstrate competence in the administration of antineoplastic agents.

Factors influencing the use of antineoplastic agents

Antineoplastic agents (alone or in combination) are used in the management of cancer to achieve:[2-4]

- chemoprevention (the use of natural or synthetic products or antineoplastic agents to prevent or suppress carcinogenesis in people highly susceptible to certain cancers)
- cure (all cancer cells destroyed, life expectancy unchanged)
- control (preventing or slowing the growth of a tumour to prolong survival)
- palliation (management of symptoms).

Resource link

The key concepts of cellular kinetics were reviewed in Module 4: Cancer Treatment Principles. In the sections below, we review specific mechanisms of action of various types of antineoplastic agents. Completion of these sections assumes you have successfully completed the relevant learning activities in Module 4. If required, take some time to review the learning activities in Module 4 before completing this module.

Learning activity	
Completed ☐	Activity 1. Identify a person who is to receive antineoplastic agents. Throughout this module you will complete learning activities related to the nursing management of this person throughout their treatment trajectory. • Identify their diagnosis and proposed treatment approach. • Define the intent of the treatment. • Review relevant clinical practice guidelines and summarise the evidence which supports this treatment approach.

Classification of antineoplastic agents

A range of different antineoplastic agents are listed below.

Alkylating and alkylating-like agents

Classic alkylating agents interfere with DNA replication by crosslinking DNA strands, DNA strand breaking, and abnormal pairing of base pairs. They exert their lethal effects on cells throughout the cell cycle but tend to be more effective against rapidly dividing cells.[2, 5, 6]

Because alkylating agents are active against cells in G0, they can be used to debulk tumours, causing resting cells to be recruited into active division. At this point, those cells are vulnerable to the cell cycle-specific agents. These agents are active against lymphomas, Hodgkin's disease, breast cancer, and multiple myeloma.[2, 5, 6]

Major toxicities occur in the haematopoietic, gastrointestinal and reproductive systems. Individuals treated with these agents are also at a higher risk of developing secondary malignancies. Examples include Cyclophosphamide, Ifosfamide, Chlorambucil, Busulfan and Melphalan.[2, 5, 6]

The nitrosureas are a subgroup of the alkylating agents. They also interfere with DNA replication and repair. They are highly lipid soluble and readily cross the blood-brain barrier. An example is Carmustine.[2, 5, 6]

Another subgroup of alkylators called platinum-containing compounds include agents such as Cisplatin, Carboplatin and Oxaliplatin.[7] Their cytotoxic properties also extend to alteration of the cell membrane transport systems and suppression of mitochondrial function.

Dacarbazine and Procarbazine have alkylator-like properties whilst being dependent on metabolic activation.

Learning activity	
Completed ☐	Activity 1. Identify an alkalyting agent and discuss its: • indications in cancer treatment • mechanism of action • adverse effects • administration considerations

Antimetabolites

Antimetabolites inhibit protein synthesis, substitute erroneous metabolites or structural analogues during DNA synthesis, and inhibit DNA synthesis. Most agents are cell cycle phase specific for S phase. These agents are most effective when used against rapidly cycling cell populations and are consequently more effective against fast-growing tumours than slow-growing tumours. Major toxicities occur in the haematopoietic and gastrointestinal systems. Examples include Methotrexate, 5-Fluorourocil and Cytosine Arabinoside.[2, 5, 6]

Hypomethylating agents represent a new class of drugs that can restore normal gene function to genes responsible for cell division and differentiation.[8] Hypomethylating agents can function as biological response modifiers by affecting cytokine cell signalling.[7] These agents (including Azacytidine and Decitabine) are listed in some texts as antimetabolites .

Learning activity	
Completed ☐	Activity 1. Identify an antimetabolite and a hypomethylating agent and discuss its: • indications in cancer treatment • mechanism of action • adverse effects • administration considerations.

Antitumour antibiotics

Antitumour antibiotics (also called Anthracyclines) interfere with RNA and DNA synthesis. Most drugs are cell cycle non-specific. Major toxicities occur in the haematopoietic, gastrointestinal, cardiac and reproductive systems. Cardiac toxicity can manifest as acute changes in the electrocardiograph (ECG) and arrhythmias. Individuals with preexisting heart disease are most at risk.[7] Examples include Bleomycin, Daunorubicin, and Doxorubicin.[2, 5, 6]

Learning activity	
Completed ☐	Activity 1. Identify an anthracycline and discuss its: • indications in cancer treatment • mechanism of action • adverse effects • administration considerations

Plant alkaloids

Plant alkaloids bind to microtubule proteins during metaphase, causing mitotic arrest. The cell cannot divide and dies. This group is mainly cell cycle phase specific for M phase. Major toxicities occur in the haematopoietic, integumentary, neurologic and reproductive systems. Hypersensitivity reactions also occur during administration of these agents.[2, 5, 6] This group contains three subgroups:[2, 5, 6]

- the Vinca alkaloids e.g. Vincristine and Vinblastine
- the epipodophyllotoxins e.g. Etoposide
- the taxanes e.g. Paclitaxel and Docetaxel.

Learning activity	
Completed ☐	Activity 1. Identify an antineoplastic agent from each subgroup of the plant alkaloids and discuss their: • indications in cancer treatment • mechanism of action • adverse effects • administration considerations.

Topoisomerase inhibitors

Topoisomerase inhibitors prevent realigning of DNA strands and maintain single-strand breaks. Major toxicities occur in the haematopoietic and gastrointestinal systems. Examples include Irinotecan and Topotecan.[2, 5, 6]

Learning activity	
Completed ☐	Activity 1. Identify a Topoisomerase inhibitor and discuss its: • indications in cancer treatment • mechanism of action • adverse effects • administration considerations.

Miscellaneous agents

Miscellaneous agents have poorly understood mechanisms of action which differ from any of the major classes of cytotoxic agents. Common miscellaneous agents are L-asparaginase and hydroxyurea.[2, 5, 6]

Learning Activities	
Completed ☐	Activities 1. For the agents L-asparaginase and hydroxyurea, discuss their: • indications in cancer treatment • mechanism of action • adverse effects • administration considerations.

Hormonal agents

Hormonal agents alter the internal/extracellular environment. Most agents are cell cycle phase non-specific. Breast, thyroid, prostate, and uterine cancers are examples of tumours that can be sensitive to hormonal manipulation. With these diseases, the action of hormones or hormone antagonists (e.g. Tamoxifen, Flutamide) depends on the presence of hormone receptors in the tumours themselves (i.e. oestrogen receptors in breast cancers).[2, 5, 6]

Major toxicities occur in the gastrointestinal and sexual/reproductive systems causing mood and sleep pattern changes. Some examples of common hormonal agents are Tamoxifen, Anastrozole, and Provera.[2, 5, 6]

Learning activity	
Completed ☐	Activity 1. Identify an hormonal agent and discuss its: • indications in cancer treatment • mechanism of action • adverse effects • administration considerations.

Factors influencing agent selection and administration

The key issues to consider when planning delivery of antineoplastic agents are listed below:

- Tumour characteristics including:[9]
  - tumour burden - the larger the tumour, the greater the likelihood of the development of metastases
  - tumour growth rate - the more rapidly growing the cancer, the more responsive its cells are to cytotoxic therapy
  - tumour cell heterogeneity- increases the risk for the development of resistance
  - tumour location
  - hormone receptor status
  - blood supply to the tumour.

- Individual characteristics including:[10]
  - performance status - those with a better status may have a smaller tumour burden, and better ability to tolerate and respond to cytotoxic therapy. Cancer treatment centres use performance status as one prognostic indicator. Additional factors include stable weight, absence of concomitant illnesses, and optimal symptom management.
  - reduced immunity and weight loss decreases the individual's tolerance to treatment effects. If dose reductions and treatment delays result, tumour cells have a chance to develop resistance.
  - circadian rhythm refers to routine fluctuations in the biological functions of living creatures. These variables can affect drug absorption, metabolism, distribution, and elimination, and can be controlled to allow for intensification of drug dosages, and the reduction of side effects of cytotoxic drug treatment.[3] For example, administering 5-Fluorouracil in the evening may assist in reducing toxicities as the cells of the gastrointestinal system and the bone marrow are most actively dividing during the first half of the day.[10]

The blood-brain barrier is a cellular structure inhibiting various substances from entering the brain, protecting both the brain and the cerebro-spinal fluid from harmful agents. [11]

Single-agent therapy

Single-agent therapy was often used in the early history of cancer chemotherapy. The major disadvantages of single-agent therapy led to clinical trials (starting in the 1960s) with combinations of drugs. Some of these disadvantages were:[6]

- poor success at achieving long-term remissions
- development of resistance to further drug therapy – the most common reason for treatment failure
- severe or lethal toxicities when given in doses adequate to eradicate the tumour.

Combination therapy

With a few exceptions, combination therapy has replaced single-agent therapy in the medical management of cancer. Combinations of agents have been associated with less likelihood of resistance, increased fractional cell kill, and improved response rates. Principles underpinning the selection of agents within combination therapy include the following criteria:[2]

- all drugs used should be of proven value in the disease they are intended to treat
- agents should have different modes of cytotoxic action

- if possible, the dose-limiting toxicities of the chosen agents should be different.

Pharmacodynamic properties of antineoplastic agents, including their actions and behaviour in a body, define the therapeutic effects of the agent.[2]

The effective dose must be neither too high (side effects will be too severe) nor too little (the tumour will continue to grow and may develop resistance).

Key pharmacological factors impacting on antineoplastic actions include:[2, 10, 12]

- **Route of administration**
  Dictated by the characteristics of individual drugs and chosen to optimise drug availability. Anti-cancer effects are improved with higher concentrations at the tumour site.

- **Drug distribution**
  The distribution and transport of drugs within the body can affect the proportion of free or pharmacologically active drug in the bloodstream.

- **Biotransformation**
  The metabolic biotransformation of antineoplastic agents includes oxidation, reduction, hydrolysis, or configuration which is done mainly in the liver.

- **Excretion**
  Agents are commonly excreted via the kidneys or liver.

- **Drug interactions**
  Agents can either inhibit or potentiate the action of another, thus modifying the therapeutic or toxic effects, or its enzyme inhibition or induction.

- **Drug resistance**
  Primary resistance refers to the lack of tumour response when agents are administered. Secondary resistance occurs after initial tumour regression. Factors contributing to secondary resistance include:
  - variations in drub bioavailability
  - drug metabolism or elimination
  - tumours possibly located in 'sanctuary sites'
  - changes in cell kinetics
  - drug-related toxicity in the recipient
  - reduced blood supply to the tumour.

  Multidrug resistance (MDR) refers to the phenomenon whereby exposure to a single drug is followed by cross-resistance to other apparently unrelated drugs.

Learning activity	

Completed ☐	Activity
	1. Review the proposed treatment protocol for the individual assessed earlier. For each agent:
	• Summarise the pharmacodynamic properties:
	  ○ route of administration
	  ○ drug distribution
	  ○ excretion
	  ○ drug interactions
	• Discuss the rationale for this treatment protocol for this person
	• Outline the potential adverse effects associated with these drugs
	• Identify any administration considerations.

Professional responsibilities associated with administration of antineoplastic agents

There are a number of key professional issues which must be considered in the administration of antineoplastic agents including:

- nurse competency
- health professional roles and responsibilities
- policy and procedure.

Any educational program to develop and assess competency in this area requires both theoretical and supervised clinical experience.[13] Regular reassessment of nurses' competence should occur to ensure theory and practice remains evidence based, and to help prevent errors in administration.[14]

An example of a nationally endorsed tool is the EdCaN *competency assessment tool for antineoplastic agent administration*[1] for evaluating a nurse's competence in administering antineoplastic agents.

Risk assessment and quality assurance are key elements of safe practice associated with antineoplastic agents. Systems, policies and procedures are required to support the reporting of adverse events, incidents and near misses. Identification of 'error prone' practices can indicate the need for practice modification.[13]

Guidelines for the Safe Prescribing, Supply and Administration of Cancer Chemotherapy[13] is a national document developed to provide guidance on the safe prescribing, dispensing and administration of antineoplastic agents used in the treatment of cancer. This document should be used as a guidance tool to inform local practice and be adapted according to local service needs.

Learning activity	
Completed ☐	Activity 1. Access the *EdCaN Competency assessment tool for antineoplastic agent administration*[1] and COSA's *Guidelines for the Safe Prescribing, Supply and Administration of Cancer Chemotherapy*[13] and current state or territory guidelines. • Summarise the roles and responsibilities of the nurse in antineoplastic agent administration. • Appraise your facility's current antineoplastic agent administration practices in light of the recommendations within these documents. • Describe how you would manage an administration error involving an antineoplastic agent.

Pre-treatment considerations

Assessment of the individual before starting treatment is necessary to identify and prevent treatment effects, provide a baseline measure to compare response, and ensure correct dosage and administration processes.[1]

Individual assessment involves:[13, 15]

- relevant diagnosis, medical and medication history
- drug allergies
- body parameters and laboratory values
- questions regarding compliance, treatment tolerance, and adverse events
- risk assessment of anaphylaxis or extravasation
- venous access.

Treatment protocol considerations:[3,13]

- medication such as antiemetics should be given as per protocol to ensure effective therapeutic levels
- cytoprotectants are used to prevent or reduce specific system toxicities while safeguarding the antineoplastic effects
- drug sequencing
- test dosing.

Dose calculation considerations:[13]

- the dose of a drug is generally based on the individual's body surface area (BSA) or weight
- a standardised method of *calculation of the BSA*[16] should be used by all clinicians within a healthcare facility
- the use of printed tables and slide-rules for the calculation of the BSA is not recommended
- dose adjustments can be made in consideration of toxicities and factors affecting drug elimination.

Learning activities	
Completed	Activities
☐	1. Complete a comprehensive health assessment on the person you are following. In your assessment, include the components of an individual's pre-treatment assessment using the framework provided in table 14 of the *Guidelines for the Safe Prescribing, Supply and Administration of Cancer Chemotherapy.*[13]
☐	2. Review the treatment protocol for the person you are following and consider your workplace's policies and procedures. • Appraise its content in light of recommendations in the *Guidelines for the Safe Prescribing, Supply and Administration of Cancer Chemotherapy.*[13] • Calculate the body surface area • Calculate dose requirements • Outline any individual and protocol pre-treatment considerations for the individual.
☐	3. Describe your responsibilities as a beginning nurse and the actions you would take to respond to assessment findings indicating the need for dose adjustments.
☐	4. Discuss specific pre-treatment considerations associated with administration of the following agents: • Bleomycin • L-asparaginase • Paclitaxel • Doxorubicin.
☐	5. Identify two agents used as cytoprotectants and discuss the indications for their use.

Providing information and supportive care

A key role of the nurse is to meet the informational needs of people affected by cancer receiving antineoplastic agents. Education of people receiving antineoplastic agents can:[17]

- provide support and knowledge to empower them to manage self-care effectively
- reduce fear
- increase self-confidence
- improve compliance.

Before administering antineoplastic agents, valid informed consent is required.[2]

Education for the person receiving antineoplastic agents should involve:[13]

- a coordinated multidisciplinary approach
- timely documentation
- verbal and written information providing the aims, effects and likely outcomes of treatment
- a list of appropriate websites
- information reinforced on subsequent visits
- medication guides and diaries.

Resource link

Refer to Module 5: Cancer supportive care principles, and the section *Information provision/education*, for more information about principles for education.

Learning activities	
Completed	Activities
☐	1. Access pp. 12-14 of the *Guidelines for the Safe Prescribing, Supply and Administration of Cancer Chemotherapy*[13] and document a detailed education plan for the person you have assessed based on their circumstances, preferences and treatment approach.
☐	2. Use the principles of effective information provision in a pre-treatment education session with the person assessed earlier. Take some time to reflect on how well you applied the principles and what could be improved.
☐	3. Outline the process of obtaining and documenting informed consent prior to administration of antineoplastic agents in your setting.
☐	4. Discuss your responsibilities as a beginning nurse to obtain informed consent prior to administration of antineoplastic agents.

Principles of administering antineoplastic agents

Occupational health and safety guidelines, and local policy and procedures must be adhered to throughout the administration process.

Antineoplastic agents can be administered via various routes including:[2]

Intravenous	• Peripheral venous access • Central venous access – percutaneous lines – peripherally inserted central catheters (PICC) – implantable devices (Port-a-caths) – tunnelled venous access devices (Hickman catheter).
Oral	• Enables shorter treatment time, greater independence of the individual, and improved tolerability. Disadvantages are that the individual is not monitored as intensively, there is a risk of noncompliance, possibility of under- or over-dosing, and inconsistency of absorption from the gastrointestinal tract.
Intrathecal/ intraventricular	• Antineoplastic agents are administered directly into the cerebrospinal fluid, usually as prophylaxis in leukaemia or lymphoma.
Intraperitoneal	• Direct administration of antineoplastic agents into the peritoneal cavity
Intrapleural	• To treat malignant effusions, complications of a number of cancers, including lung, breast, prostate, gastrointestinal and ovarian.
Intravesical	• Administration of antineoplastic agents directly into the bladder to treat superficial cancer of the bladder.
Topical	• Made up as ointments; usually used to treat sun cancers.
Subcutaneous and intramuscular	• Very few antineoplastic agents may be administered by these routes as the drugs are usually very irritating or may be a vesicant.

Learning activities	
Completed	Activities
☐	1. For the person you have assessed, discuss which factors were considered when choosing the most appropriate venous access method for their therapy.
☐	2. Access the following document and complete the activities below: *Guidelines for the Safe Prescribing, Supply and Administration of Cancer Chemotherapy*[13] • Outline the risks associated with oral administration of antineoplastic agents. • Summarise the information you would provide to a person going home with oral antineoplastic agents.
☐	3. Access a current text and local policy and procedures relevant to intrathecal administration of antineoplastic agents and: • Outline the key steps in preparing a person for intrathecal administration of an antineoplastic agent. • Discuss common adverse effects which may occur during and after intrathecal drug administration and strategies to prevent and manage these issues.
☐	4. Outline the indications, adverse effects and nursing considerations associated with the following routes of administration for antineoplastic agents: • intraperitoneal • intrapleural • intravesical • topical • subcutaneous • intramuscular • intraventricular.

Management of responses to antineoplastic agents

While antineoplastic agents are designed to target the cancer cell, these agents are unable to distinguish between normal and cancer cells. Some temporary damage will occur to normal cells, especially those cells that are rapidly dividing such as bone marrow, gonads, gastrointestinal mucosa and hair follicles.

Some drugs have an affinity to certain organs in the body (e.g. bleomycin and lung tissue), and toxicity can occur in these organs over time.

Responses to antineoplastic therapy can be classified as:

- anticipatory
- immediate
- short-term
- long-term.

Anticipatory responses

Anticipatory nausea and vomiting is a learned response after prior episodes of antineoplastic agent-induced nausea and vomiting.

The symptoms occur when individuals are reminded of a prior emetic experience.[2]

Learning activity	
Completed ☐	Activity 1. Access a current text or evidence review, and: • Discuss the pathophysiology of anticipatory nausea and vomiting. • Outline strategies to minimise anticipatory nausea and vomiting.

Immediate responses

A number of immediate effects may occur within 30 minutes of the start of treatment including:[2]

- hypersensitivity reaction
- extravasation
- pain at insertion site
- venous pain
- cold sensation along vein
- red flush along the vein
- facial and bodily flushing
- hypotension
- abnormal tastes or smells.

Hypersensitivity reaction

Some antineoplastic agents are associated with hypersensitivity reactions such as flushing, bronchospasm and hypotension. It is also important to consider that individuals can be allergic to other substances in the medical environment such as latex, other supportive drugs, blood transfusions, or food.[17]

Extravasation

Extravasation occurs when a drug accidentally leaks into the surrounding subcutaneous or subdermal tissues rather than into the intravenous compartment during administration. The degree of tissue destruction is directly related to the properties of the drug extravasated, duration of tissue exposure, and amount of infiltrate.[2]

Extravasation of vesicant drugs can have devastating consequences for individuals in terms of pain, tissue necrosis and possible limb dysfunction.

Resource links

GONG Cancer Care Guidelines. Assessment, prevention and management of extravasation of cytotoxic agents[18]

Cancer Institute NSW: Management of Cytotoxic Drug Extravasation[19] (free resource, but you must register and click 'Remember me' to bypass the login page in future).

Learning activities	
Completed	Activities
☐	1. Identify three agents associated with hypersensitivity reactions.
☐	2. Outline how you would prepare the individual and your work environment prior to administration of agents associated with hypersensitivity reactions.
☐	3. Access the *eviQ's Extravasation management resources*[19] website (free resource, but you must register and click 'Remember me' to bypass the login page in future) and: • Identify common vesicant, irritant and non-irritant agents used in your health care setting. • Read the current policy and procedure in your health care facility for managing extravasation of antineoplastic agents. • Discuss immediate actions you would take to manage a vesicant extravasation.
☐	4. Identify agents associated with pain at administration and discuss strategies to prevent and manage discomfort during and after their administration.

Short-term responses

Short-term effects occur between 3 and 7 days after therapy begins.[2] These may include:

- nausea and vomiting
- anorexia
- mucositis
- myelosuppression
- possible recall of radiation skin reactions
- pain at tumour site or jaw area
- flu-like syndrome, including fever
- chemical cystitis
- haematuria
- malaise
- diarrhoea
- constipation
- cold-induced paraesthesia (oxaliplatin).

Nausea and vomiting

- Acute nausea and vomiting develops within the first 24 hours after administration of antineoplastic agents.
- Delayed nausea and vomiting occurs more than 24 hours after administration of antineoplastic agents and may persist for a week.
- The emetogenic potential of an antineoplastic agent and the individual's response determines the best approach to management of nausea and vomiting.[20]

Resource links

National Cancer Institute Nausea and Vomiting PDQ.[21] PDQ cancer information summary provides comprehensive, peer-reviewed information for health professionals about the pathophysiology and treatment of nausea and vomiting.

National Comprehensive Cancer Network NCCN Clinical Practice Guidelines in Oncology Antiemesis.[20] (Free resource, but you need to register and log in to access it).

Multinational Association for Supportive Care in Cancer MASCC Antiemesis Tool (MAT)[22]: The MASCC Antiemesis Tool (MAT) was developed by members of MASCC. The concept of the MAT is to offer an easy-to-use and easy-to-evaluate tool to assist in providing the best individual care to people affected by cancer and help assess the effectiveness of antiemetic strategies.

Putting Evidence Into Practice: Evidence-Based Interventions to Prevent, Manage, and Treat Chemotherapy-Induced Nausea and Vomiting.[23]

Mucositis

- Mucositis is an inflammation of the lining of any part of the gastrointestinal tract, including the oral mucosa. This lining is highly vulnerable to treatment-related toxicity because of its rapid cell turnover. Individuals affected often present with pain, difficulty eating, and ulceration or erythema in the mouth.
- Agents known to induce mucositis include bleomycin, doxorubicin, daunorubicin, docetaxel, 5-FU, and methotrexte, as well as high dose therapy with busulphan, etoposide, melphalan, and thiotepa.[2]
- Combining antineoplastic agents and radiation modalities usually increases the normal tissue reactions.

Resource links

National Cancer Institute Oral Complications of Chemotherapy and Head/Neck Radiation (PDQ) [24]: This summary describes oral complications caused by antineoplastic agents and radiation therapy, and various methods of prevention and treatment.

Multinational Association for Supportive Care in Cancer Mucositis Guidelines[25]: Links to publications of the evidence based clinical practice guidelines for the prevention and treatment of mucositis.

Myelosuppression

- Myelosuppression is the most frequent dose-limiting toxicity of antineoplastic agents, and is potentially life-threatening.[2]
- Infections, anaemia and thrombocytopenia are related to bone marrow suppression.

Resource links

National Comprehensive Cancer Centre (NCCN) Clinical Practice Guidelines in Oncology Cancer- and Chemotherapy- induced anaemia[26] (Free resource, but you need to register and log in to access it). Consensus guidelines on the prevention and management of cancer and chemotherapy-induced anaemia.

National Comprehensive Cancer Centre NCCN Clinical Practice Guidelines in Oncology Myeloid Growth Factors[27] (Free resource, but you need to register and log in to access it). Consensus guidelines on the use of myeloid growth factors in cancer control.

National Comprehensive Cancer Centre NCCN Clinical Practice Guidelines in Oncology Prevention and treatment of cancer-related infections[28] (Free resource, but you need to register and log in to access it). Consensus guidelines on the prevention and management of cancer-related infections.

Constipation

Constipation can result from disease, nutritional deficits, and medications including antineoplastic agents, analgesics, and antiemetics.[2]

Resource link

Putting Evidence Into Practice: Evidence-Based Interventions for the Prevention and Management of Constipation in Patients With Cancer[29]

Learning activities	
Completed	Activities
☐	1. For the person you have assessed: • Identify the short term effects they are at risk of or experience. • Summarise current evidence based strategies to prevent and manage these effects. • Document a nursing care plan to meet the needs of this individual.
☐	2. Provide an education session with a person to prevent or manage at least two treatment related effects in the community. Take some time to reflect on how effective your education session was and how it could be improved.

Long-term responses

Long-term effects may create significant problems as they can cause lasting damage to the body and affect the person's quality of life. These effects – which are often cumulative–include physical effects, second primary malignancies, and sexuality and psychological issues. Specific effects include:[2]

- alopecia
- skin reactions
- nail ridging
- thrombophlebitis
- organ damage, e.g. renal, hepatic, pulmonary and cardiac
- neurological problems and CNS toxicity
- sexual dysfunction
- psychological issues.

Fatigue

- Fatigue may be related to the disease and/or treatment effects such as pain, nutritional problems, and myelosuppression.
- Associated with feelings of tiredness, lack of energy and inability to continue, fatigue has been suggested to affect 60-90% of individuals receiving antineoplastic agents.[2]

Resource link

Putting Evidence into practice: evidence-based interventions for fatigue during and following cancer and its treatment.[30]

Nutritional deficits

- These include taste changes, pain from mucositis, nausea and vomiting, and reduced hunger sensations.[2]

Resource links

Self-Care Strategies to Cope With Taste Changes After Chemotherapy[31]

National Cancer Institute: Nutrition in Cancer Care.[32] This PDQ cancer information summary provides comprehensive, peer-reviewed information for health professionals about nutrition before, during, and after cancer treatment.

Nerve damage

- Peripheral neuropathy induced by antineoplastic agents impacts on physical functioning and quality of life.
- Antineoplastic agents associated with peripheral neuropathy include platinum compounds, taxanes, vinca alkaloids, thalidomide, and bortezomib.[33]

Resource link

Putting Evidence into Practice: Evidence Based interventions for Chemotherapy-induced peripheral neuropathy.[33]

Alopecia

- Hair loss can be apparent 1-2 weeks after administration of antineoplastic agents and reaches a peak in 1-2 months.
- Agents associated with hair loss include: amsacrine, bleomycin, busulfan, cyclophosphamide, cytarabine, dactinomycin, daunorubicin, dacarbazine, doxorubicin, etoposide, 5-FU, hydroxyurea, ifosfamide, interleukin-2, methotrexate, nitrosureas procarbazine, vinblastine, and vincristine.
- Distress and anxiety related to altered body image and self-concept may occur.[2]

Sexual and reproductive issues

- Women can experience amenorrhoea with hot flushes, insomnia, and vaginal dryness as well as decreased fertility or permanent infertility.
- Actual and potential gonadotoxic agents include nitrogen mustard, cyclophoshamide, L-phenalalanine mustard, busulfan, and chlorambucil.[2]
- Men can experience decreased or absent production of sperm which may recover over a period of years.
- Sperm production is affected by alkylating agents, cisplatin, vinblastine, and bleomycin.[2]

Resource links

National Cancer Institute Sexuality and Reproductive Issues (PDQ®).[34] This PDQ cancer information summary provides comprehensive, peer-reviewed information for health professionals about sexuality and reproductive issues that individuals may experience during or after treatment.

The psychosexual care of women affected by gynaecological cancers (PSGC).[35] These learning modules will help all health professionals develop the knowledge and skills to support women and their partners experiencing psychosexual concerns following gynaecological cancer. This resource can be used for self-directed learning or by educators in both clinical and academic settings as part of a facilitated learning program.

Cardiac effects

- Cardiotoxicities can develop as intermediate to late effects after treatment with antineoplastic agents.
- Agents associated with cardiotoxic effects include doxorubicin, epirubicin, mitoxantrone, idarubicin, trastuzumab, bleomycin, high dose cyclophosphamide, 5-FU, ifosfamide, mitomycin-C, and paclitaxel.[2]

Pulmonary effects

- Pulmonary toxicities occur due to damage to the endothelial cells of the lungs and result in pneumonitis or fibrosis.
- Agents associated with pulmonary effects include bleomycin, BCNU and CCNU, busulfan, carmustine, chlorambucil, cyclophosphamide, cytarabine, docetaxel, fludarabine, lomustine, melphalan, methotrexate, mitomycin C, and paclitaxel.[2]

Second primary malignancies

- Secondary malignancies can be categorised as treatment-related, syndromic, or due to shared etiologic influences (lifestyle, environment, individual factors or genetic or other influences).[36]
- Secondary malignancies are most commonly related to the use of alkylating agents, the duration of therapy and the use of antineoplastic agents in people aged over 40.[36]
- The most common antineoplastic agent-induced second malignancy is acute leukaemia. Secondary cancers have distinctive chromosome abnormalities, and survival after antineoplastic agent-related leukaemia is generally quite poor. Non-Hodgkin's lymphomas or solid tumours also can occur as secondary malignancies.[36]

Resource link

Secondary Malignancies: What, When, Why, in Whom?[36] (free resource, but you must register and click 'Remember me' to bypass the login page in future).

Learning activity	
Completed ☐	Activity 1. Identify a person with cancer for whom you have recently cared. For this person: • Identify the long-term effects they are at risk of or experience. • Summarise current evidence based strategies to prevent and manage these effects.

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