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Anticancer and Immunosuppressive Drugs

Pharmacology

Antineoplastic drugs, chemotherapy principles, immunosuppressive agents, adverse effects and nursing care during treatment.

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CHAPTER 21 / PHARMACOLOGY 21. Anticancer and Immunosuppressive Drugs

1. Introduction

Antineoplastic medicines aim to destroy malignant cells, inhibit their growth or interfere with specific tumour pathways. Treatment may be curative, adjuvant (after primary treatment), neoadjuvant (before primary treatment), disease-controlling or palliative. Drug selection is based on cancer type, stage, molecular markers, previous treatment, organ function and patient goals. Cytotoxic chemotherapy also damages rapidly dividing normal cells, particularly bone marrow, gastrointestinal mucosa and hair follicles.

2. Classification of cytotoxic chemotherapy

Class / examples	Mechanism	Characteristic toxicities
Alkylating agents - cyclophosphamide, ifosfamide	Damage/cross-link DNA	Myelosuppression, haemorrhagic cystitis, infertility; ifosfamide neurotoxicity.
Platinum compounds - cisplatin, carboplatin, oxaliplatin	DNA cross-linking	Cisplatin renal/ear toxicity; carboplatin marrow suppression; oxaliplatin neuropathy.
Antimetabolites - methotrexate, fluorouracil, cytarabine	Interfere with nucleotide synthesis or DNA replication	Mucositis, marrow suppression, agent-specific hepatic or neurological injury.
Anthracyclines - doxorubicin, daunorubicin	DNA intercalation, topoisomerase II inhibition and other effects	Cardiotoxicity, myelosuppression, serious vesicant extravasation.
Vinca alkaloids - vincristine, vinblastine	Inhibit microtubule assembly	Neuropathy, constipation/ileus, variable marrow effects.
Taxanes - paclitaxel, docetaxel	Stabilize microtubules and disrupt mitosis	Neuropathy, myelosuppression and hypersensitivity.
Topoisomerase inhibitors - etoposide, irinotecan	Interfere with DNA strand processing	Marrow suppression; irinotecan can cause severe diarrhoea.

Bleomycin may cause pulmonary toxicity, while many other agents have cumulative organ-specific risks. Do not assume every chemotherapy drug produces the same pattern of adverse effects.

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3. Targeted, hormonal and immunological cancer therapy

Group	Example and action	Important nursing considerations
Endocrine therapy	Tamoxifen, aromatase inhibitors; hormone-sensitive cancers	Thrombosis/endometrial effects or bone loss; agent-specific monitoring.
Tyrosine kinase inhibitors	Imatinib and others; inhibit selected signalling pathways	Drug-specific hepatic, skin, cardiac and haematological effects.
HER2-targeting antibody	Trastuzumab	Monitor cardiac function and infusion reactions.
Anti-CD20 antibody	Rituximab	Infusion reactions, infection, hepatitis B reactivation risk.
Immune checkpoint inhibitors	Pembrolizumab, nivolumab; PD-1 blockade	Immune-related pneumonitis, colitis, hepatitis, endocrinopathies and other organ inflammation.

Targeted therapy is not free of toxicity. Immune-related adverse events may occur during or after immunotherapy and require early reporting. Molecular testing may determine eligibility.

4. Principles of chemotherapy and supportive treatment

Many regimens are given in planned cycles to allow recovery of normal tissues. Dose intensity, sequence, route and timing depend on the authorized protocol. Some regimens use BSA or body-weight calculations; renal, hepatic and marrow status may require specialist modifications. Assess treatment intent and consent, verify laboratory eligibility and confirm the current cycle/day. Antiemetics, hydration, growth factors and other supportive medicines may be prescribed. Mesna reduces urothelial exposure to selected toxic metabolites; leucovorin rescue is used in selected methotrexate protocols. These supportive agents have exact timing and indication requirements.

5. Common toxicities and nursing management

Toxicity	Nursing assessment and intervention
Myelosuppression	Monitor CBC and infection/bleeding signs; fever during neutropenia is an emergency.
Mucositis	Assess oral mucosa, pain and intake; gentle oral care and prescribed symptom relief.
Nausea and vomiting	Administer prophylaxis as ordered; monitor hydration and electrolytes.
Peripheral neuropathy	Assess sensation, gait, fine motor function and fall risk.
Extravasation	Stop infusion; do not flush; retain access for approved aspiration or antidote pathway; contact oncology team.
Tumour lysis syndrome	Monitor urate, potassium, phosphate, calcium and renal function; urgent management for abnormalities.

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6. Immunosuppressive drugs

Class	Examples	Major monitoring
Calcineurin inhibitors	Tacrolimus, ciclosporin	Drug levels, kidney function, potassium, BP, interactions.
Antimetabolites	Azathioprine, mycophenolate	CBC, hepatic function, infection; reproductive safety and interactions.
mTOR inhibitors	Sirolimus, everolimus	Lipids, marrow counts, wound healing, interactions.
Glucocorticoids	Prednisolone, methylprednisolone	Glucose, infection, bone and adrenal effects.
Biologics	Selected monoclonal antibodies and fusion proteins	Infection screening, infusion monitoring, agent-specific risks.

Immunosuppressants are used for transplant rejection prevention and autoimmune diseases. Tacrolimus formulations are not automatically interchangeable. Severe infections may require treatment review, but transplant medicines must not be stopped without urgent specialist guidance. Live vaccines may be unsuitable during significant immunosuppression.

7. Occupational and administration safety

Hazardous medicines require trained personnel, appropriate engineering controls, protective equipment, dedicated handling procedures, safe spill management and disposal [13]. Verify exact route and formulation: vincristine is for IV use only; intrathecal administration is fatal. Follow institutional segregation and route safeguards. Check identity, protocol, BSA/weight, dose, cycle, access, infusion rate, compatibility and required independent verification. Monitor infusion reactions and never administer chemotherapy outside an authorized specialist process.

8. Examination questions

Long answer questions

1. 1. Classify antineoplastic drugs and explain their mechanisms and adverse effects.
2. 2. Describe chemotherapy nursing care and prevention of occupational exposure.
3. 3. Discuss immunosuppressive agents with monitoring requirements.

Short answer questions

- Myelosuppression; vesicant extravasation; tumour lysis syndrome; anthracycline cardiotoxicity; tacrolimus; checkpoint inhibitors.

Very short answer questions

- Which drug must never be given intrathecally? - Vincristine.
- Main concern with fever during neutropenia? - Serious infection requiring urgent assessment.
- Name a calcineurin inhibitor. - Tacrolimus.

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9. Quick revision

Cytotoxic and targeted drugs have different mechanisms and toxicities. Check protocol, cycle, route, counts and organ function. Neutropenic fever and vesicant extravasation demand immediate escalation. Immunosuppression increases infection risk.

Conclusion

Oncology nursing combines protocol verification, close monitoring, patient education, hazard control and rapid response to potentially life-threatening treatment complications.

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Practice questions

Choose one best answer. The answer key and explanations follow the questions.

1. Why can cytotoxic chemotherapy cause marrow suppression and mucositis?

A. It permanently stimulates all normal stem cells
B. It only reduces blood flow to tumours
C. It also damages rapidly dividing normal cells
D. It acts exclusively on malignant cells

2. Which finding during chemotherapy requires emergency assessment?

A. Stable expected hair loss alone
B. Mild controlled nausea after treatment
C. Unchanged chronic nail discoloration
D. Fever during neutropenia

3. What is the immediate infusion-related action for suspected chemotherapy extravasation?

A. Stop the infusion and do not flush
B. Increase the rate to clear the line
C. Flush forcefully with saline
D. Continue until the prescribed dose is complete

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Answer key and explanations

1. C - It also damages rapidly dividing normal cells

Cytotoxic chemotherapy affects rapidly dividing normal tissues, including marrow and gastrointestinal mucosa.

2. D - Fever during neutropenia

Fever with neutropenia is an emergency because of serious infection risk.

3. A - Stop the infusion and do not flush

Stop the infusion, avoid flushing and follow the oncology aspiration or antidote pathway.

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