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PHARMACOLOGY - III

UNIT 4

TOPIC :

- m. Chemotherapy of malignancy.



Chemotherapy of Malignancy (Cancer)

- Cancer (malignancy) is a disease characterized by the abnormal, uncontrolled growth and division of cells. These abnormal cells invade surrounding tissues and may spread to distant organs through the blood or lymphatic system, a process called metastasis.
- Chemotherapy is the treatment of cancer using anticancer (cytotoxic) drugs that destroy or inhibit the growth of rapidly dividing cancer cells. It is often used alone or in combination with surgery, radiotherapy, immunotherapy, or targeted therapy for better treatment outcomes.

Definition

- Chemotherapy of malignancy is the treatment of cancer using drugs that selectively destroy or inhibit the growth and multiplication of malignant cells while causing minimum damage to normal healthy cells.

Objectives of Chemotherapy

- Destroy cancer cells.
- Prevent cancer cell multiplication.
- Reduce tumor size before surgery (Neoadjuvant therapy).
- Eliminate remaining cancer cells after surgery (Adjuvant therapy).
- Prevent recurrence of cancer.
- Relieve symptoms and improve quality of life in advanced cancer (Palliative chemotherapy).

Classification of Anticancer Drugs

1. Alkylating Agents

→ These drugs damage DNA by adding alkyl groups, preventing cancer cell replication.

Examples

- Cyclophosphamide
- Chlorambucil
- Melphalan
- Ifosfamide
- Busulfan

Mechanism of Action

- Alkylate DNA.
- Form DNA cross-links.
- Inhibit DNA replication and transcription.
- Cause cancer cell death.

Uses

- Leukemia
- Lymphoma
- Breast cancer
- Ovarian cancer
- Multiple myeloma

2. Antimetabolites

→ These drugs resemble normal cellular metabolites and interfere with DNA or RNA synthesis.

Examples

- Methotrexate
- 5-Fluorouracil (5-FU)
- Cytarabine
- Gemcitabine

- Mercaptopurine

Mechanism of Action

- Block synthesis of DNA and RNA.
- Inhibit rapidly dividing cells.

Uses

- Leukemia
- Breast cancer
- Colorectal cancer
- Gastric cancer

3. Plant Alkaloids

→ These drugs are obtained from plants and interfere with mitosis.

Examples

- Vincristine
- Vinblastine
- Paclitaxel
- Docetaxel

Mechanism of Action

- Inhibit microtubule formation or function.
- Arrest mitosis.
- Prevent cell division.

Uses

- Leukemia
- Lymphoma
- Breast cancer
- Lung cancer
- Ovarian cancer

4. Antitumor Antibiotics

→ These are antibiotics with anticancer activity.

Examples

- Doxorubicin
- Bleomycin
- Daunorubicin
- Mitomycin

Mechanism of Action

- Intercalate into DNA.
- Inhibit Topoisomerase II.
- Generate free radicals.
- Cause DNA strand breaks.

Uses

- Breast cancer
- Lung cancer
- Leukemia
- Lymphoma
- Ovarian cancer

5. Hormones and Hormonal Antagonists

→ These drugs inhibit hormone-dependent growth of certain cancers.

Examples

- Tamoxifen
- Flutamide
- Anastrozole
- Prednisone

Mechanism of Action

- Block hormone receptors.
- Reduce hormone production.
- Prevent hormone-stimulated tumor growth.

Uses

- Breast cancer
- Prostate cancer
- Endometrial cancer

6. Miscellaneous Agents

Examples

- Cisplatin
- Carboplatin
- Oxaliplatin
- Hydroxyurea
- Procarbazine

Mechanism of Action

- Damage DNA.
- Inhibit DNA synthesis.
- Cause cancer cell death.

Uses

- Testicular cancer
- Ovarian cancer
- Lung cancer
- Head and neck cancers

Important Anticancer Drugs

1. Cyclophosphamide

Drug Class

- Alkylating agent

Definition

→ Cyclophosphamide is a nitrogen mustard derivative used in the treatment of many cancers.

Mechanism of Action

- Alkylates DNA.
- Produces DNA cross-links.
- Prevents DNA replication.
- Leads to apoptosis (cell death).

Uses

- Leukemia
- Lymphoma
- Breast cancer
- Ovarian cancer
- Autoimmune diseases

Adverse Effects

- Bone marrow suppression
- Hemorrhagic cystitis
- Nausea
- Vomiting
- Hair loss

2. Methotrexate

Drug Class

- Antimetabolite

Definition

- Methotrexate is a folic acid antagonist.

Mechanism of Action

- Inhibits **Dihydrofolate Reductase (DHFR)**.
- Prevents tetrahydrofolate formation.
- Inhibits DNA synthesis.

Uses

- Acute leukemia
- Lymphoma
- Choriocarcinoma
- Osteosarcoma
- Psoriasis
- Rheumatoid arthritis (low dose)

Adverse Effects

- Bone marrow suppression
- Hepatotoxicity
- Mucositis
- Kidney toxicity

3. 5-Fluorouracil (5-FU)

Drug Class

- Antimetabolite

Definition

- 5-FU is a pyrimidine analogue.

Mechanism of Action

- Inhibits thymidylate synthase.
- Prevents thymidine formation.
- Stops DNA synthesis.

Uses

- Colorectal cancer
- Breast cancer
- Gastric cancer
- Pancreatic cancer

Adverse Effects

- Bone marrow suppression
- Diarrhea
- Mouth ulcers
- Hand-foot syndrome

4. Vincristine

Drug Class

- Plant Alkaloid (Vinca Alkaloid)

Definition

- ▲ Vincristine is obtained from *Catharanthus roseus*.

Mechanism of Action

- Binds tubulin.
- Prevents microtubule formation.
- Arrests mitosis in metaphase.

Uses

- Leukemia
- Lymphoma
- Neuroblastoma
- Wilms tumor

Adverse Effects

- Peripheral neuropathy
- Constipation
- Mild bone marrow suppression

5. Doxorubicin

Drug Class

- Antitumor Antibiotic

Definition

- ▲ Doxorubicin is an anthracycline antibiotic.

Mechanism of Action

- Intercalates into DNA.
- Inhibits Topoisomerase II.
- Produces free radicals.
- Causes DNA strand breaks.

Uses

- Breast cancer
- Ovarian cancer
- Lung cancer
- Leukemia
- Lymphoma

Adverse Effects

- Cardiotoxicity
- Bone marrow suppression
- Hair loss
- Nausea
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