APHON Principles of Chemotherapy and Biotherapy Practice Test (Sample)

Study Guide

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Questions

1. Cell cycle non-specific drugs are most effective when administered how?

A. As a continuous infusion

B. In divided doses

C. As a bolus

D. In low, frequent doses

2. Which of the following is not categorized as an antimetabolite agent?

A. Mercaptopurine

B. Fluorouracil

C. Cyclophosphamide

D. Thioguanine

3. Which is a characteristic of cell cycle specific chemotherapy drugs?

A. They work best in the G0 phase

B. They have the greatest effect on actively dividing cells

C. They are effective in any cell cycle phase

D. They are predominantly used in non-dividing cells

4. Monoclonal antibodies (MoAbs) are classified as what type of therapy?

A. Targeted therapy

B. Radiation therapy

C. Biotherapy

D. Chemotherapy

5. What is the mechanism of biological response modifiers?

A. They function solely through cytotoxic effects

B. They provide an anti-cancer effect that is not clearly understood

C. They are always used in combination with other drugs

D. They are ineffective without cell cycle specificity

6. One method of drug resistance involves which mechanism?

- **A. Increased drug uptake by the cancer cells**
- **B. Alterations to the metabolism of healthy cells**
- **C. Increased removal of the drug from the cell**
- **D. Development of beneficial functions in tumor cells**

7. Doubling time refers to which of the following?

- **A. The cycle time for a cell to replicate**
- **B. The required time for a tumor mass to double in size**
- **C. The rate at which cancer cells die**
- **D. The time frame for treatment effectiveness**

8. Neoadjuvant chemotherapy is used in what context?

- **A. To treat advanced metastatic disease**
- **B. Before surgery to reduce tumor size**
- **C. As a follow-up after surgery**
- **D. To manage side effects of chemotherapy**

9. What is the main side effect of the antimetabolite methotrexate?

- **A. Hypotension**
- **B. Bone marrow suppression**
- **C. Weight loss**
- **D. Hypoglycemia**

10. In which phase is cellular DNA duplicated?

- **A. Resting phase**
- **B. Synthesis (S) Phase**
- **C. Palliation phase**
- **D. Postmitotic phase**

Answers

1. C
2. C
3. B
4. C
5. B
6. C
7. B
8. B
9. B
10. B

Explanations

1. Cell cycle non-specific drugs are most effective when administered how?

A. As a continuous infusion

B. In divided doses

C. As a bolus

D. In low, frequent doses

Cell cycle non-specific drugs are designed to target cancer cells regardless of which phase of the cell cycle they are in. These drugs can act on both dividing and non-dividing cells, meaning their therapeutic effect is not limited to a particular time when the cells are actively proliferating. Administering such drugs as a bolus allows for a concentrated dose to be delivered quickly to the body, potentially overwhelming the cancer cells and maximizing their exposure to the drug. A bolus administration can lead to a higher peak concentration of the drug in the bloodstream, which is crucial for effectively eradicating cancer cells. In contrast, continuous infusion or low, frequent doses might not achieve the high peak concentrations that are often necessary to ensure that the drugs exert their maximum effect on the tumor. While divided doses can help maintain drug levels, cell cycle non-specific drugs benefit from a rapid and substantial presence in the system to effectively reduce tumor burden.

2. Which of the following is not categorized as an antimetabolite agent?

A. Mercaptopurine

B. Fluorouracil

C. Cyclophosphamide

D. Thioguanine

Cyclophosphamide is not categorized as an antimetabolite agent because it belongs to the class of alkylating agents. Alkylating agents work by directly damaging the DNA of cancer cells through the addition of alkyl groups, which leads to cross-linking of DNA strands and ultimately inhibits DNA replication and cell division. This mechanism of action differs from that of antimetabolites, which mimic the building blocks of DNA and RNA and interfere with nucleic acid synthesis. In contrast, Mercaptopurine, Fluorouracil, and Thioguanine are classified as antimetabolites. These agents disrupt normal metabolic processes, primarily in rapidly dividing cells, by mimicking natural substrates involved in DNA and RNA synthesis, thereby inhibiting cell growth and replication. This distinct mechanism sets antimetabolites apart from alkylating agents like cyclophosphamide.

3. Which is a characteristic of cell cycle specific chemotherapy drugs?

A. They work best in the G0 phase

B. They have the greatest effect on actively dividing cells

C. They are effective in any cell cycle phase

D. They are predominantly used in non-dividing cells

Cell cycle specific chemotherapy drugs are designed to target particular phases of the cell cycle, primarily focusing on actively dividing cells. These drugs exert their maximum effects during specific stages, such as the S phase (where DNA synthesis occurs), the M phase (where mitosis happens), and sometimes the G2 phase (preparation for mitosis). By attacking cells that are in these phases, these drugs enhance their efficacy since cancer cells often grow and divide more rapidly than normal cells. Consequently, the greatest effect is observed when these agents are administered during periods when a higher proportion of tumor cells are actively dividing. In contrast, the G0 phase represents a quiescent state where cells are not actively dividing, making them less susceptible to specific chemotherapy drugs. Similarly, drugs that are effective in any cycle phase or predominantly used in non-dividing cells would not be classified as cell cycle specific, as such characteristics define the broader category of cell cycle non-specific chemotherapeutics. Thus, the focus of cell cycle specific drugs on actively dividing cells clearly establishes why this option is the most appropriate choice.

4. Monoclonal antibodies (MoAbs) are classified as what type of therapy?

A. Targeted therapy

B. Radiation therapy

C. Biotherapy

D. Chemotherapy

Monoclonal antibodies (MoAbs) are classified as biotherapy because they are derived from living cells and are designed to interact with specific targets in the body, such as cancer cells or immune system components. The mechanism of action for MoAbs typically involves binding to specific antigens on the surface of target cells, which can trigger various immune responses or deliver cytotoxic agents directly to the cancer cells. Biotherapy encompasses a wide range of treatments that utilize biological agents or living organisms to treat disease, particularly cancer. This includes not only monoclonal antibodies but also other immune-based therapies, vaccines, and cytokines. The concept behind biotherapy is to harness the body's own biological mechanisms to fight disease. In contrast, targeted therapy refers specifically to drugs designed to precisely target molecular changes in cancer cells, and while monoclonal antibodies can function as targeted therapies, the broader classification leans towards biotherapy. Radiation therapy involves the use of high-energy particles or waves to destroy or damage cancer cells, which is distinctly different from the action of monoclonal antibodies. Chemotherapy generally refers to the use of drugs to kill rapidly dividing cells and does not encompass the biological nature and specificity of monoclonal antibodies. Thus, classifying monoclonal antibodies

5. What is the mechanism of biological response modifiers?

A. They function solely through cytotoxic effects

B. They provide an anti-cancer effect that is not clearly understood

C. They are always used in combination with other drugs

D. They are ineffective without cell cycle specificity

Biological response modifiers, also known as immunotherapy agents, work by enhancing the body's natural immune response to cancer. These agents can activate immune cells, increase the body's production of interferons and interleukins, and create a more favorable environment for the immune system to target and destroy cancer cells. The exact mechanisms of how these modifiers exert their effects are complex and often not fully understood, which is why the correct answer notes that they provide an anti-cancer effect that is not clearly understood. This uncertainty reflects the intricacies of immune system interactions and tumor biology. Other options present specific attributes or limitations that are not characteristic of biological response modifiers. They are not limited to cytotoxic effects, do not necessarily require combination with other drugs to be effective, nor do they rely on cell cycle specificity to function. This highlights the unique nature of biological response modifiers as a distinct therapeutic approach in oncology.

6. One method of drug resistance involves which mechanism?

A. Increased drug uptake by the cancer cells

B. Alterations to the metabolism of healthy cells

C. Increased removal of the drug from the cell

D. Development of beneficial functions in tumor cells

One prominent mechanism of drug resistance in cancer cells is the increased removal of the drug from the cell. This often occurs through the upregulation of efflux pumps that transport the drug out of the cell more efficiently than it can enter or remain, reducing the drug's efficacy. These pumps recognize various chemotherapeutic agents and actively eliminate them, thereby allowing cancer cells to survive in the presence of drugs that would typically be cytotoxic. This mechanism can significantly limit the effectiveness of the treatment, leading to treatment failures and cancer progression. The other options, while they describe processes that may occur in cancer biology, do not directly relate to the established mechanisms of drug resistance in the same way. Increased drug uptake by cancer cells, for example, would enhance sensitivity to chemotherapy rather than contribute to resistance. Alterations to the metabolism of healthy cells may affect the overall environment but do not represent a direct drug resistance mechanism. Lastly, the development of beneficial functions in tumor cells may describe adaptive traits of cancer but, again, is not a mechanism by which drugs are effectively resisted.

7. Doubling time refers to which of the following?

A. The cycle time for a cell to replicate

B. The required time for a tumor mass to double in size

C. The rate at which cancer cells die

D. The time frame for treatment effectiveness

Doubling time is specifically defined as the period it takes for a tumor mass to double in size. This measurement is significant in oncology as it provides insight into how aggressive a tumor might be. A shorter doubling time can indicate a more rapidly growing cancer, which may require more immediate or aggressive treatment strategies. Understanding the doubling time helps clinicians assess the growth rate of a tumor, evaluate treatment responses, and predict prognosis. While the other options touch on important concepts related to cell growth and cancer treatment, they do not accurately define what doubling time refers to. For instance, the cell cycle time relates to the rapid succession of individual cell division cycles but does not reflect the tumor's overall size increase. Similarly, the rate of cancer cell death pertains to the effectiveness of therapies rather than the growth metrics of the tumor mass, and the timeframe for treatment effectiveness relates to how soon a treatment shows results but is distinct from measuring the physical growth of the tumor itself.

8. Neoadjuvant chemotherapy is used in what context?

A. To treat advanced metastatic disease

B. Before surgery to reduce tumor size

C. As a follow-up after surgery

D. To manage side effects of chemotherapy

Neoadjuvant chemotherapy is specifically administered before surgery with the primary goal of reducing the size or extent of the tumor. This approach can make surgical removal easier, more effective, and may also minimize the risk of cancer recurrence. By shrinking the tumor, neoadjuvant therapy can facilitate a more conservative surgical approach, potentially allowing for less extensive surgery and preserving surrounding healthy tissue. The timing of the chemotherapy is crucial; it precedes surgical intervention rather than following it or being used in cases of advanced metastatic disease. This proactive strategy can also provide an early indication of how the tumor responds to the treatment, allowing oncologists to assess the effectiveness of the chemotherapy regimen before surgery.

9. What is the main side effect of the antimetabolite methotrexate?

A. Hypotension

B. Bone marrow suppression

C. Weight loss

D. Hypoglycemia

The main side effect of the antimetabolite methotrexate is bone marrow suppression. This occurs because methotrexate inhibits the metabolism of folic acid, which is essential for the synthesis of nucleotides needed for DNA and RNA production. The bone marrow is particularly sensitive to this effect because it rapidly produces blood cells, including red blood cells, white blood cells, and platelets. As a result, patients treated with methotrexate may experience myelosuppression, which can lead to anemia, increased risk of infections due to lower white blood cell counts, and a greater likelihood of bleeding due to decreased platelet production. This side effect is significant and requires monitoring of blood counts during treatment to manage and mitigate risks associated with such therapy. Consideration of other options reveals that hypotension, weight loss, and hypoglycemia are not the primary or common side effects associated with methotrexate, making them less relevant in the context of its major adverse effects.

10. In which phase is cellular DNA duplicated?

A. Resting phase

B. Synthesis (S) Phase

C. Palliation phase

D. Postmitotic phase

Cellular DNA duplication occurs during the Synthesis (S) Phase of the cell cycle. This phase is a crucial part of the interphase, where the cell prepares for division. During the S Phase, each chromosome is replicated, resulting in two identical sets of chromosomes, which are essential for ensuring that each daughter cell receives an exact copy of the genetic material during mitosis. This process is vital for cellular reproduction and growth, as it allows for the correct distribution of genetic material when the cell divides. In contrast, other phases mentioned do not involve DNA replication. The Resting phase (usually considered the G0 phase) is a state where cells are not actively preparing to divide. The Palliation phase typically refers to a stage in treatment rather than a part of the cell cycle, while the Postmitotic phase follows mitosis and involves the cells in a differentiated state, where they are not preparing to duplicate their DNA for the next cell cycle. Understanding the specific roles of each phase of the cell cycle helps clarify the mechanisms behind cell division and the importance of the S Phase in maintaining genetic integrity.