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Oncology Agents for Cancer Therapy: A Review

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Abstract

The introduction of novel agents for the management of advanced prostate cancer has significantly expanded treatment options, particularly benefiting men with metastatic castration-resistant prostate cancer (mCRPC). However, there are still gaps in understanding optimal patient selection, effective sequential use of treatments, and the development of resistance patterns.

Certainly, reviewing current systemic therapies and recent advances in drug development for metastatic castration-resistant prostate cancer (mCRPC), as well as discussing strategies to aid in patient selection and optimal sequencing, is crucial for improving patient outcomes and treatment efficacy. This involves analyzing the latest clinical data, understanding the mechanisms of action of new therapies, and considering factors such as tumor biology, previous treatments, and patient preferences to tailor treatment strategies for each individual. Selective kinase inhibitors have indeed emerged as a significant class of anticancer agents, showing promising clinical efficacy and generally favorable toxicity profiles in various disease settings. They have particularly shown potential in cases where conventional treatments have offered only limited benefit. This underscores their importance in expanding treatment options and improving outcomes for patients across different cancer types.

Keywords: mCRPC, NSCLC

Introduction

Oncology agents are those agents which are used in the treatment of cancer and to control uncontrollable growth of cells. these are those agents or chemicals which are used in cancer therapy (1)

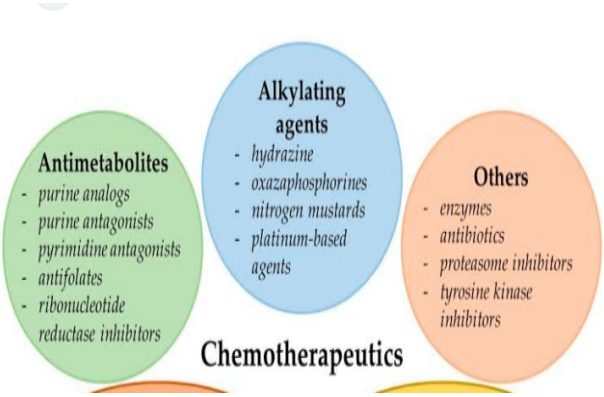
There are various types of Oncology agents which are mentioned below: -

1:- Alkylating agents:- hydrazine, oxaphosphorines, nitrogen mustards

2:- Antimetabolites:-purine analogue, purine antagonists, antifolates

3:- Mitotic spindle inhibitors:- taxanes, vinca alkaloids.

4:- others:- enzymes, antibiotics, tyrosine kinase inhibitors(2)



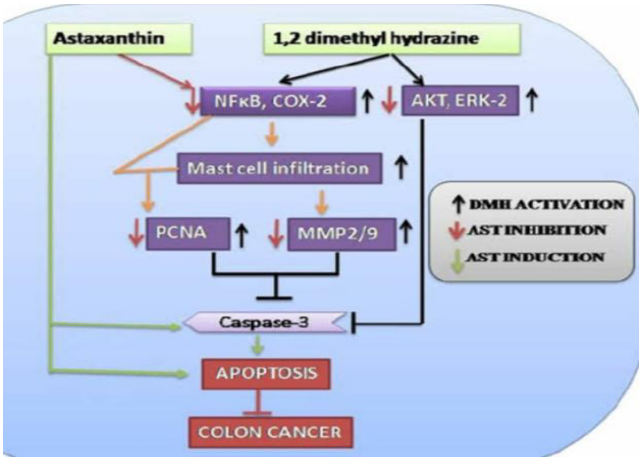
Alkylating agents:

Alkylating agents are crucial in cancer treatment due to their ability to disrupt DNA and halt cell division, leading to cell death. However, their effectiveness is limited by

systemic toxicity and drug resistance. Researchers are focusing on combining alkylating agents with other anticancer drugs or inhibitors to enhance their efficacy. Additionally, novel modulators are being explored to increase cancer cell sensitivity to alkylating agents.eg:- hydrazine.

Mechanism of action of hydrazine:-

Hydrazine sulfate, as a gluconeogenic blocking agent, has shown promise in inhibiting cancer cachexia and eliciting subjective and objective responses in late-stage cancer patients. Moreover, it appears to induce minimal clinical side effects.(3)

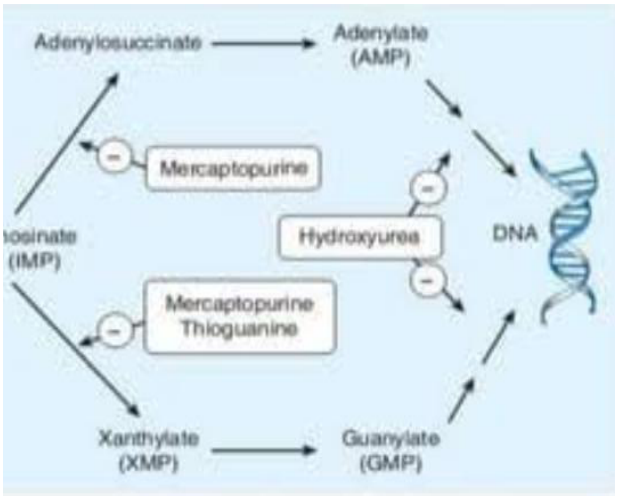


2. Antimetabolites:

That's correct! Antimetabolites are indeed crucial in cancer chemotherapy because they disrupt the normal functioning of cells, particularly those undergoing rapid division like cancer cells, by interfering with DNA synthesis or other essential metabolic pathways. This interference ultimately leads to cell death.Eg:- purine analogue, pyramid antagonists.

Mechanism of action of Antimetabolites:

Cell death has been divided into two main types: programmed cell death, in which the cell plays an active role, and passive (necrotic) cell death. Senescence arrest, accelerated senescence and differentiation are also responses that can be induced in response to DNA-damaging agents. (4).



Progress and opportunities for enhancing the delivery and efficacy of checkpoint inhibitors for cancer immunotherapy...

The utilization of paclitaxel in contemporary oncology and cancer therapy based on nanomedicine is emphasized in the study. Derived *primarily* from the bark of the yew tree, Taxus brevifolia Nutt, paclitaxel serves as a versatile anticancer agent. Belonging to the class of diterpene taxanes, it is widely employed

in chemotherapy for various cancer types, including ovarian, lung, and breast cancers, showcasing its established efficacy in combating.(5)

Macrophages eliminate circulating tumor cells after monoclonal antibody therapy:-

Monoclonal antibodies (mAbs) designed to selectively target tumor-associated antigens offer a promising new avenue for treating malignancies alongside traditional methods such as chemotherapy or radiotherapy. Rituximab, an anti-CD20 monoclonal antibody, stands out as one of the initial drugs approved for clinical treatment of B cell malignancies, marking a milestone in its efficacy.(6)

Paul Ehrlich proposed the idea of utilizing antibodies to specifically target tumors more than a century ago. The development of hybridoma technology in 1975 facilitated the production of monoclonal antibodies.(7)

Cancer serology:-

The concept of using antibodies as 'magic bullets' in cancer diagnosis and treatment has been around since their discovery in the late 19th century.(8)

The advent of inbred mice marked a new phase in cancer serological research, leading to the emergence of the cytotoxic test as a potent method for analyzing the cell surface reactivity of specific antibodies.

Immuno oncology agents used for the treatment of different types of cancer:-

Lungs cancer:- Lung cancer stands as the foremost cause of cancer-related fatalities globally, with an estimated 1.59 million deaths recorded in 2012.(10)Non-small-cell lung cancer (NSCLC) constitutes the primary type, making up about 85% of cases. The majority of patients are diagnosed with locally advanced or metastatic forms, often leading to a survival period of less than five years post-diagnosis (11). Despite targeted therapy showing promise for certain molecular subtypes of NSCLC, traditional chemotherapy remains the primary option for most patients, offering only short-lived benefits. Hence, there is a critical demand for treatments that significantly prolong patient survival while maintaining their quality of life.

In recent times, there has been a growing acknowledgment of the immune system's significance in cancer initiation and progression. This has led to a concentrated effort on incorporating immunotherapy into clinical practice, resulting in regulatory approvals for immunotherapy treatments for various cancers such as renal cell cancer, prostate cancer, and melanoma.(12) While non-small-cell lung cancer (NSCLC) was traditionally viewed as nonimmunogenic, emerging evidence indicates that the apparent lack of immune response often stems from specific immune-evasive mechanisms.(13) Understanding these mechanisms opens avenues for therapeutic interventions with notable clinical effectiveness. Consequently, harnessing the immune system's potential has become a pivotal focus in clinical research.(14)With a deeper comprehension of the immunological aspects of oncology, this article explores the pivotal components of the immune system relevant to cancer, particularly NSCLC, and provides an overview of ongoing efforts to develop immunotherapeutic approaches aimed at enhancing patient outcomes.

Immuno oncology agents for oral, head and neck cancer:-

Head and neck squamous cell carcinoma (HNSCC) refers to cancer originating from the squamous cells lining the moist, mucosal surfaces within the head and neck region. This encompasses various areas such as the oral cavity, pharynx, larynx, salivary glands, paranasal sinuses, and nasal cavity. HNSCC stands out as the most aggressive type of cancer developing in the mucosa of the upper aerodigestive tract.(15)

1:-**CCR7** :-CC-chemokine receptor 7 (CCR7) is present in various subsets of immune cells and primarily plays a role in directing the migration (facilitated by its ligands CCL19 and CCL21) of numerous T cell subgroups and antigen-presenting dendritic cells (DC) towards the lymph nodes.(16)

This underscores how crucial the tumor microenvironment is in dictating the expression of chemokines by infiltrating immune cells during inflammation, ultimately impacting the

tumor's progression.

2. T cell:- Naive T cells, which carry a specific epitope specificity, undergo maturation in the thymus through either positive or negative selection processes. Upon encountering a cognate antigen (Ag), these naive T cells proliferate and differentiate into effector cells. Subsequently, the majority of them migrate to peripheral tissues and sites of infection to aid in their elimination.(17

Immunological methods for the detection and treatment of disease and biological warfare agents:-

1:-BW agents:- A biological weapon unleashed by terrorists or a military group would likely be surreptitious and hard to detect, as demonstrated by the anthrax attack in the eastern United States in 2001. People would start showing up at hospitals and clinics several days after exposure, experiencing flu-like symptoms that might not immediately raise suspicion(20).

Additionally, factors like environmental durability, ease of manufacturing, severity of the disease, and how easily it spreads dictate which agents are most likely to be chosen for deployments. (21)

2:- Emergency infectious desease agents:- Apart from illnesses resulting from deliberate epidemics, there are numerous newly emerging infectious diseases (IDs) that pose substantial risks to public health, such as dengue fever, West Nile fever, and Rift Valley fever, along with the recent resurgence of malaria in the eastern United States.(22)

In addition to diseases deliberately caused, there are various newly emerging infectious diseases (IDs) posing significant threats to public health, like dengue fever, West Nile fever, and Rift Valley fever, alongside the recent resurgence of malaria in the eastern United States.(23)

Antibodies development: - Suitable polyclonal and monoclonal antibodies can be produced through various methods. One common approach involves injecting host animals, such as mice for monoclonal antibody production or rabbits or goats for polyclonal antibody production, with live or inactivated material. Afterward, the spleens are fused or the blood is collected from animals that have developed high titers against the target agent.(24) When executed properly, this method tends to yield high-affinity antibodies with neutralizing titers.(25)

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