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Cancer treatment: current trends

K.Praveen*, P.D Srinivas Chowdary*, G.Usha Kiran[1], N.Nagamalleswari[1], Y.A Chowdary[1]

[1]*NRI College of Pharmacy, Pothavarappadu (V), Krishna District.*

***Corresponding Author**: **K.Praveen**

ABSTRACT

Among various other diseases, cancer has become a big threat to human beings globally. According to the As per Indian population census data, the rate of mortality due to cancer in India was high and alarming with about 806000 existing cases by the end of the last century. Cancer is the second most common disease in India responsible for maximum mortality with more than 1300 Indians die due to cancer. This is owing to the poor availability of prevention, diagnosis and treatment of the disease. The causes of such high incidence rates of these cancers may be both internal (genetic, mutations, hormonal, poor immune conditions) and external or environmental factors (food habits, industrialization, over growth of population, social etc).

INTRODUCTION

Since 20th century, more than 60 novel therapies have launched globally for the treatment of cancer. These developments have lead to improved outcomes for patients, especially for metastatic disease, and have lead to an increased number of patients receiving treatment. The pipeline for oncology remains robust, with over 600 molecules in late stage development. The focus on oncology will remain high over the next decade driven by the ongoing research and development and remaining unmet need. According to the WHO, cancer was the second leading cause of death in 2015, responsible for 8.8 million deaths globally. While the global burden of cancer continues to be high, therapeutic innovation based on improved understanding of disease biology and transitional research has contributed to the changing paradigm of cancer treatment over the past two decades. Since 2011, 68 new drugs have been approved for 22 indications, including immune oncology agents that have considerably changed the treatment paradigm in many of the cancers. Oncology continues to be an area of active interest with a robust pipeline of which 87% is a targeted therapy. Due to specific targeting of the molecular pathways, they are less toxic compared to traditional chemotherapy. With the advent of chemotherapy in 1940 the etiology of cancer broadened.

The concept of personalized medicine is now an integral part of clinical practice in oncology, and more clinical trials are stratifying patient populations with predictive biomarkers; this has led to improved clinical outcomes by stratifying patients for their response to treatment.

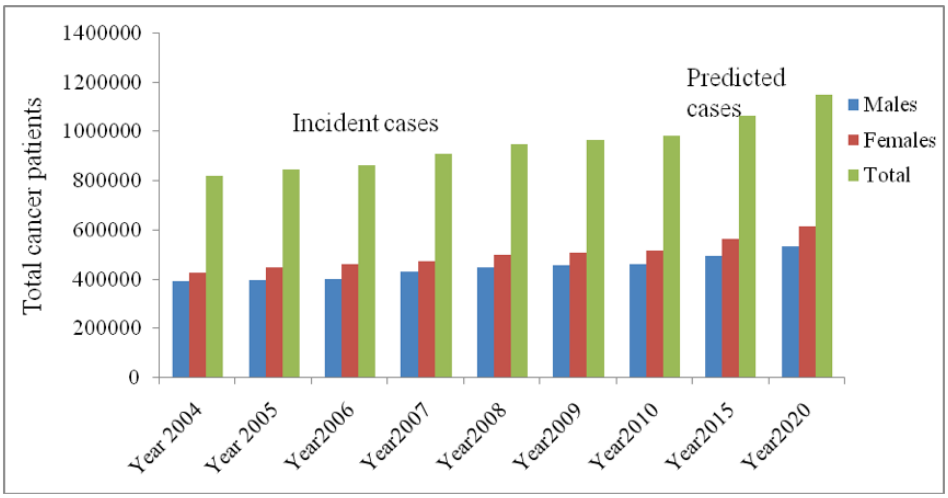
Reimbursement for new cancer medicines also varies by geography, and reimbursement ranges from 100% to 61% across the countries under study. Spending on new medicines for oncology and supportive oncology care has increased since

2011 and those therapies launched within the past five years now account for more than 20% of global oncology spending in 2016.

Cancer mortality rates have steadily declined across major developed countries over the past decade.

The largest decline in mortality over the past decade has been among those tumor types with the greatest number of new treatment mechanisms in areas such as breast, lung, and colorectal cancers.

Madame Curie discovered radium in 1897 and the application of radiation to treat cancer has been a prominent toxicity of anti-tumor therapies. Many contributing factors at the time to launch oncology medicines has accelerated, which has allowed more novel therapies to enter the market, adding to the burden of treatment decisions. New medicines launched within the past years now account for more than 20% of global oncology spending in 2016.Spending on new cancer medicines differs by region on an invoice price basis with over 60% of developed market spending for medicines available globally for less than 15 years. National Cancer Control Programme (NCCP) (started in 1975-1976 in India) led to the development of Regional Cancer Centers (RCCs), in many medical colleges this supported the purchase of teletherapy machines. District Cancer Control Programme was also initiated but could not result into sustainable and productive activity (National Cancer Control Programme).



Total cancer prevalence data of patients from 2004 to 2010 in India

Treatment of cancer is improving by saving lives and extending survival rate of many cancer patients. In cancer management the principal modes of therapy – surgery, radiotherapy and chemotherapy – may be given alone or in combination.

Targets: Undruggable molecules

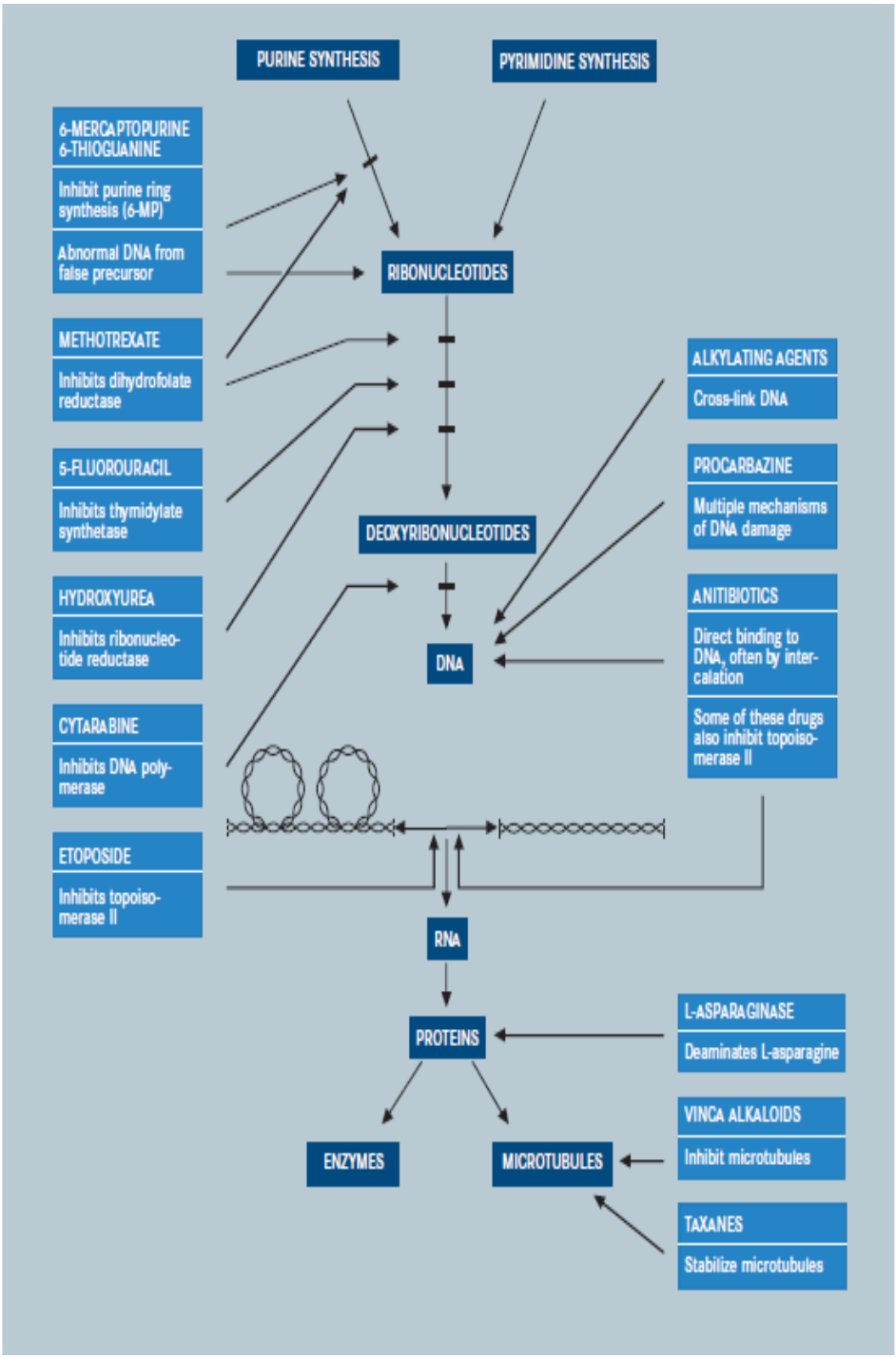
Targeted therapies have had a profound effect on cancer medicine, only approximately 20% of proteins in cancer cells can be targeted by currently available medicines. Many of the undruggable targets include important molecules in pathways that suppress or promote tumor growth. One of the reasons these targets are undruggable is that, historically, it has been difficult to block these pathways with small molecules, and protein drugs do not easily penetrate the cell.

A new class of drugs, known as stapled peptides, has emerged as a promising way to target protein-protein interactions. These small proteins have an artificial chemical bridge, or staple, that holds them in a specific shape that allows them to penetrate the cell.

RECOMMENDATIONS	PREVENTION
Vegetables, fruits, fibers, folates, Vitamins (C,D and E) Spices, condiments and cereals	Epithelial, Colorectal, bladder, prostate, lungs, breast, esophagus, non-Hodgkin's lymphoma
Safety measures in industries	Lungs, leukemia, bladder, liver, gall bladder and kidneys
Non-smoking	Lungs, bladder

Control and drug abuse	Cervical and breast
Physical exercise	Reduce overweight, bladder, colon, breast (postmenopausal), colon, endometrial, prostrate, melanoma, kidneys, gastric cardiac, liver, gallbladder, ovary, pancreatic, colorectal and breast.
POLLUTION CONTROL	
Water pollution	Almost all types of cancer
Air pollution	Lungs
Ban on ozone depleting chemicals	Skin
Adaptation of traditional values	Almost all types
Awareness	All types

Over the next decade there are many new cancer drugs coming into the market worldwide. Apart from the various approaches of treatment, cancer chemotherapy is one of the major therapeutic approaches for cancer. The risk of cancer reoccurrence is one of the most common concerns of post treatment cancer survivors. Even after treatment cancer cells persisit and grow where they are detected- this is called recurrence. Recurrence can occur at the original site or at the lymph node near the original site or else where in the body. Studies show that recurrence rates vary depending on tumor characteristics, stage of disease and treatment received. Cancer can be treated with a single chemo drug, but often several drugs are used in certain combinations (called combination therapy). Different drugs that work in different ways can work together to kill more cancer cells.



Mechanism of action of different anti cancer drugs

Recent Advances in Cancer Treatment

Drug development efforts begun during 70's are now coming into existence, which results in the availability of several new anticancer drugs with impressive activity against additional types of cancer. These drugs improve several times and quality of life for patients with advanced diseases, and they hold promise as part of multimodality therapies during earlier stages of many common cancers in adults.

Cancer prevention efforts, including cancer screening, vaccination, tobacco control, healthy eating, and physical activity, remain key to reducing the effect of cancer and improving outcomes across communities worldwide. In fact, researchers estimate that 50% of cancer cases and deaths in the United States could be prevented if

people adopted simple healthy lifestyle choices that include avoiding smoking and alcohol, maintaining a healthy weight, and exercising regularly [1] Lung cancer is among the most common types of cancer and the leading cause of cancer death in men and women worldwide. Radiation therapy for lung cancer increases the risk for heart problems. High dose radiation has been the backbone for treatment of different stage of cancer and it is believed that few live long experience heart complications. Studies published in 2017challenge this notion by showing that heart problems are relatively common in this patient population.

In an analysis of patients who were treated in six clinical trials from 1996 to 2009, 21% of those who received a high dose of radiation developed symptomatic heart problems within 2 year [2]. Heart problems were independently linked to high doses of radiation and underlying risk (eg, smoking and cardiovascular disease). A second analysis of patients who were treated in four clinical trials from 2004 to 2013 demonstrated similar results; 11% developed severe heart problems within 2 years [3]. As in the other study, patients who received a higher radiation dose and/or had pre-existing heart disease were more likely to develop heart problems. Furthermore, both cancer worsening and heart problems were linked. Research presented in 2017 demonstrated that a single radiation treatment may be sufficient for cancer patients with a shorter life expectancy [4]

Emerging Role for Precision Medicine in Cancer

Scientists are only beginning to understand how the complex interplay of all these factors raises or lowers the chance of developing cancer in an individual with an inherited cancer gene mutation. It is also not clear why changes in genes with broad functions, such as the DNA repair and MMR genes, predispose people for certain, but not all cancers. Large-scale genomics studies are providing insights by which to fine-tune cancer risk assessment for each person. Genomic information, along with reproductive and family history, lifestyle, and other factors, may help patients decide whether and when to have preventive surgery. Scientists are also exploring the possibility of using immune based approaches, such as vaccines for cancer prevention in healthy people with cancer predisposition syndromes [5]. With the new national investment in cancer prevention through the Cancer Moon shot initiative and cutting-edge technologies, such as sequencing the genomes of individual cells, the opportunity to advance this field is closer than ever. Socioeconomic disparities have also reversed over time. In 1950, people in the most-deprived socioeconomic group had a 27% lower cancer mortality rate than those in the most affluent group, but by 2010 to 2014, the most deprived group had a 22% higher cancer mortality than their most affluent counterparts [6]. Another analysis demonstrated that among people with no health insurance, black patients had rates of cancer mortality that were similar to those of white patients, but had higher mortality rates among either Medicaid or private insurance groups [7]. Taken together, this body of research suggests that addressing cancer disparities and achieving equity calls for multifaceted approaches that are focused on efforts to improve prevention, screening and access to high- quality cancer care.

Patient Centered Care

Early detection of disease is known to lead to a higher probability of survival in many cancer types [8, 9]. As life expectancy after a cancer diagnosis continues to improve, there is growing recognition of the need to address patients' emotional and psychosocial needs from the time of diagnosis through treatment and survivorship. Clinical Cancer Advances 2018 highlights efforts to preserve patient quality of life by avoiding unnecessary treatment or by lowering therapy dose or duration. Furthermore, new tools that engage patients in their own care, for symptom monitoring, psychological support, and end-of-life planning, are showing benefits for both patients and health care systems. Finally, we are entering a new era in care in which biomedical research is no longer solely driven by researchers and physicians, but also by patients who are more and more directly engaged in driving progress forward. By donating tissue samples and clinical information, or by helping to design research studies and formulate practice guidelines, patients are providing valuable perspectives and contributing to better care. Progress against rare cancers is often slow because of a combination of scarce funding and a limited availability of patients and tumor samples for research. An attractive solution to this problem is crowd sourcing. More and more people with rare and common cancers today have the opportunity to

rapidly and directly affect research by sharing their tumor tissue samples and medical and/or genetic information to help others with the same or similar diseases. In return, researchers share what they learn with participants. Cancer survivors are prone to persistent psychological distress which can have wide reaching and persistent effects on family, friends, and care givers [10, 11].

CONCLUSION

It is estimated that about 90% cancer is owing to the environmental contaminants [12]. As per the proverb, "prevention is better than cure" the prevention strategy is crucial in cancer treatment. This approach offers a great public health concern and inexpensive long term method of cancer control. We should create awareness among public about the cancer havoc and its prevention. The different programs should be started by Government and NGOs for creating awareness among Indian public. The diet and living style are important factors to control the spreading of cancers and, hence, Indians should be careful about these facts. Briefly, cancer is disturbing the growing economy of the country, which can be saved by proper handling of this disease. In view of these facts, it is very important to eradicate this havoc. Let us hope for the best future of this country, which is playing an essential role in the development of the whole world.

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