

**Abstract**

Cancer is one of the most dreaded diseases of the 20<sup>th</sup> century and spreading further with continuance and increasing incidence in the 21<sup>st</sup> century. The situation is so alarming that every fourth person is having a lifetime risk of cancer. India registers more than 11 lakh new cases of cancer every year, whereas, this figure is above 14 million worldwide. Is cancer curable? The short answer to this question is “Yes.” In fact, all cancers are curable if they are caught early enough. Cancer cells continue to grow unless one of four things occur: (1) The cancerous mass is removed surgically; (2) using chemotherapy or another type of cancer-specific medication, such as hormonal therapy; (3) using radiation therapy; or (4) the cancer cells shrink and disappear on their own.

**Key Words:** Cancer, carcinogenesis, targeted therapy

**Introduction**

A hundred years ago, cancer was not so common; however, since the last couple of decades, its incidence has been rising alarmingly, probably due to our changing lifestyle, habits, and increased life expectancy. Cancer is one of the most dreaded diseases of the 20<sup>th</sup> century and spreading further with continuance and increasing incidence in the 21<sup>st</sup> century. The situation is so alarming that every fourth person is having a lifetime risk of cancer.<sup>[1]</sup> India registers more than 11 lakh new cases of cancer every year, whereas, this figure is above 14 million worldwide. We are constantly exposed to a variety of cancer causing agents, known as carcinogens.

What is cancer? Put simply; cancer is the abnormal growth of cells. Cancers arise from any organ or body structure and are composed of tiny cells that have lost the ability to stop growing. Occasionally, cancer may be detected “incidentally” by a laboratory test or radiological routine test or for an entirely different reason. In general, cancer must reach a size of 1 cm, or be comprised of 1 million cells, before it is detected. At this point, it may be referred to as a “mass,” a “growth,” a “tumor,” a “nodule,” a “lump,” or a “lesion.” Exceptions to this general rule include cancers of the blood and bone marrow (leukemia’s and lymphomas) – which frequently do not produce a “mass,” but will be evident on laboratory tests.

Transformation of a normal cell into a cancerous cell is probably not such a critical event in the genesis of cancer; rather it is the inability of immune cells of the body to identify and destroy the newly formed cancer cells when they are a few in numbers.<sup>[2]</sup> The risk of cancer is multiplied in those persons, whose immune system is suppressed due to any factor including chronic stress, old age, chronic debilitating disease, previous use of chemotherapy, and abuse of drugs such as analgesics, antibiotics, and corticosteroids.

**Multidisciplinary Aspects**

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medication, such as hormonal therapy; (3) using radiation therapy; or (4) the cancer cells shrink and disappear on their own. This last event, while extremely rare, can occur with some melanomas or some kidney cancers.

Surgery, radiotherapy, and chemotherapy from the conventional approaches are used to treat cancer. Surgery was the first modality used successfully in the treatment of cancer. It is the only curative therapy for many common solid tumors. The most important determinant of a successful surgical therapy is the absence of distant metastases and no local infiltration. Chemotherapy is the administration of cytotoxic agents (orally or intravenously, usually in combinations) resulting in cytotoxicity to both resting and dividing cells. The objective of cancer chemotherapy is to prevent cancer cells from multiplying, invading, metastasizing, and killing the patient. Systemic chemotherapy is the main treatment available for disseminated malignant diseases. Radiation therapy is a local modality used in the treatment of cancer. Other conventional techniques used in the treatment of cancer including bone marrow transplantation, peripheral stem cell transplantation, hormone therapy, photodynamic therapy, cryosurgery, immunotherapy, and gene therapy.

Is cancer curable? The short answer to this question is “Yes.” In fact, all cancers are curable if they are caught early enough. That is the justification for screening tests (such as mammograms, colonoscopies, and Pap smear examination). When cancers are caught early, they tend to be smaller; they are thus either easier to remove surgically or more likely to shrink in response to chemotherapy or radiation therapy. When cancer is localized, it can be totally removed by surgery but in most of the cases, it is practically impossible to detect cancer at such an early stage. Early detection is often the key to surviving any form of cancer.

The diagnosis and treatment of cancer have come a long way in the last 50 years. In the past, cancer, the “C-word,” was a death sentence. Today, we can treat and cure several types of cancer; however, it is evident that these cancers need to be found at an early stage. More than 7 out of 10 children are cured of cancer. Testicular cancer, Hodgkin’s lymphoma and

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many cases of leukemia can all be cured in adults with current treatments. Most skin cancers are cured with surgery. Moreover, many cases of thyroid cancer and cancer of the larynx are cured with radiotherapy. Many other types of cancer are also cured if they are found early enough – for example, 75% of breast cancers found at an early stage. Of course, there is still a long way to go before we can cure most cancers. The difficulty is that different cancers are caused by different things, so there is not one strategy that can prevent them. They also respond to different treatments, so not one kind of treatment can cure them all. Even though we can cure several types of cancers, it is important to maintain vigilance about screening for cancer.

Some forms of cancer are curable no matter when they are detected, and some are only curable if they are caught at any early stage. For example, acute leukemia and some types of lymphoma can be curable with chemotherapy. Certain lymphomas such as Hodgkin's disease require radiation therapy for a cure. Other common cancers such as colon cancer, breast cancer, prostate cancer, lung cancer, and pancreatic cancer are all curable, but only if they are detected in early stages (Stage I or II).

Some cancers have high survival rates with early detection. Six highly treatable cancers among others are – cancers of breast, skin (nonmelanomas), colon, prostate, testes, and cervix. Most of the childhood malignancies (both solid and hematolymphoid) are curable.

Breast cancer is the most common nonskin cancer among women, as one out of every eight women will be diagnosed in her lifetime. In patients whose breast cancer is detected while still in localized form have a 5-year survival rate of 98%, compared with a survival rate of 72% by Stage III and just 22% by Stage IV.<sup>[3,4]</sup>

Skin cancers (basal cell carcinoma and squamous cell carcinoma) are the most common form of all human cancers, and if found early, skin cancer is nearly 100% treatable. Likewise, diagnosing cervical cancer while the lesions are precancerous leads to a near 100% survival rate, but the rate drops to just 32% if diagnosed in Stage III and 16% if diagnosed at Stage IV. Testicular cancer is treatable in 99% of the time when detected early, but only 73% are cancer-free after 5 years if diagnosed in advanced stages. Similarly, 5-year survival rate when colon cancer is detected early is 90%, yet only 39% of cases are diagnosed before cancer has begun to spread. According to the Surveillance, Epidemiology, and End Results Program, it is 98% survivable for 5 or more years if prostate cancer diagnosed at stages when the disease is confined to the prostate gland (Stage I and II).<sup>[1]</sup> The survival rate drops to about 28% if diagnosed at Stage IV.

Cancers cells not only have mutations that result in dysregulated expression of oncogenes and tumor suppressor genes, but these changes result in the alteration of expression of hundreds of genes. Looking at this, we have various forms of “targeted” therapy directed at specific single molecular targets or a class of molecular targets in cancer cells. With targeted therapy, the specific mechanism of action of the drug results in an increase in its therapeutic index. Currently, the two major classes of targeted therapy are the small molecule

tyrosine kinase inhibitors and monoclonal antibodies (MABs). Imatinib, for instance, has been amazingly successful as a targeted agent directed against several members of a class of enzyme known as tyrosine kinases, and by that mechanism, it has been phenomenally successful as a treatment of chronic myeloid leukemia and gastrointestinal stromal tumors. Tamoxifen is a targeted therapy directed at the estrogen receptor (ER), and it still remains a mainstay of treatment for ER-positive breast cancers, along with a newer class of drugs known as aromatase inhibitors.

Cancer researchers work on developing new and more effective surgery techniques, radiotherapy and chemotherapy drugs all the time. Biological therapies such as MABs, cancer vaccines, and gene therapies are all active areas of research. There are various anti-angiogenic drugs that can stop cancers from growing the blood vessels that they need. Research is also looking into developing cost-effective ways of screening for the different common cancers so they can be diagnosed early enough to be cured.

Avoiding immune destruction is now considered a hallmark of cancer, and the immunotherapy arena has exploded with the recent advances demonstrating an improvement in survival and a durability of response in patients with different cancer types, like in melanoma, which translates into an improved overall survival benefit.<sup>[5]</sup> To name those immunotherapeutic strategies that include the adoptive transfer of *ex vivo* activated T cells, immunomodulatory MABs, and cancer vaccines. Advances in molecular pathology will provide the means to identify the targets and will be used to subtype tumors and will provide predict response to therapy and provide prognostic information.<sup>[6]</sup>

## Conclusion

Unfortunately, although we do fairly well (and in some cases very well) against early stage cancer, we do not do so well against Stage IV metastatic disease, particularly solid tumors. There is still a long way to go before we can cure most cancers.

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## Conflicts of interest

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