# Causes And Treatment of Cancer

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| Key Points |
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| ➢ Uncontrolled division of cells which spread into surrounding tissues.<br>➢ RNA processing is changed in cancer.<br>➢ Nanotheranostics the way forward in cancer diagnosis. |

Cancer is a disease which is caused when the cells divide uncontrollably and spread into surrounding tissues. Cell division mechanism is controlled by many evolutionarily conserved cell cycles, which ensure the production of clones. Cell cycle checkpoints prevent the accumulation and propagation of genetic errors during cell division, which can delay cell cycle process. Irrevocable DNA damage causes cell death. Cancer-associated mutations that disturb cell cycle allows continuous cell division by compromising the ability of cells to exit the cell cycle. Continuous cell division, however, creates increased reliance on other cell cycle control mechanisms to prevent ruinous levels of damage and maintain cell viability. New detailed awareness into cell cycle control mechanisms and their role in cancer, reveal how these dependencies can be best utilized in cancer treatment.[1] The extracellular matrix is necessary for existence of multicellular organisms and is a fundamental component of all tissues of body. In cancer, the extracellular matrix is changed at the biochemical, architectural, and topographical levels. However, an exponential increase in the study and recognition of the significance of matrix in solid tumors has been noted. Along with the development of new technologies to study various elements of the matrix, we are also beginning to see the arrangement of matrix-centric and stromal targeting cancer therapies.[2]

Along with the aim of highlighting some of the apparent interactions of the matrix and influence the matrix, this Review touches on many of the surfaces of matrix biology in solid cancers, including breast, pancreatic and lung cancer has on tumor onset.[2] The guidelines of clinical practice on oncology have typically focused upon disease staging, and management of medicine. Although the advocacy for surgical care have been included in these guidelines, those recommendations have mainly addressed problems such as surgical role or the incorporation of surgery into multidisciplinary treatment techniques, not the technical performance of the operative processes themselves. Therefore, surgical quality, the only component of versatile cancer care proven to be potentially curative, has been poorly controlled. Previously, the American College of Surgeons (ACS) cancer programs have tried to fill this gap by developing “operative standards” for cancer surgery.[2]

**Causes:**

Since the refining of mRNA is necessary for gene expression, recent researches have pointed out that RNA processing is systematically changed in cancer. The mutations in RNA splicing factor genes and the shortening of 3' untranslated areas are widely noticed. Therefore, it is found that tumorigenesis is caused by different types of RNA such as Circular RNA. It has been told, how altered activity of coding and non-coding RNAs contributes to cancer. The regulation of gene expression by coding and non-coding RNA have established roles (microRNAs and long non-coding RNAs) and emerging roles (selective mRNA processing and circular RNAs) for RNAs, highlighting the potential processes by these RNA subtypes that leads to cancer. The widespread changes of coding

and non-coding RNA donate that changed RNA biogenesis contributes to multiple hallmarks of cancer.[3] Breast cancers are greatly dependent on the heterotypic interaction between stromal cells and tumor cell microenvironment. Cancer-associated adipocytes (CAAs) are breast cancer cell partners recommending growth, seizure, and metastasis. It has been told that the link between extracellular signals and the transcriptional cascade that regulates adipocyte differentiation in order to value the molecular pathways that have been described to drive adipocyte dedifferentiation. Moreover, recent studies on the mechanisms through which CAAs affect the growth of breast cancer. These include adipokine regulation, extracellular matrix remodeling, metabolic reprogramming, and immune cell modulation. The concept of the complex vicious cycle between CAAs and breast cancer cells is settling for designing new novel strategies.[4]

**Estimated values:**

Based upon population-based cancer registries (PBCR) and mortality from the World Health Organization (WHO) mortality database, the national estimates were calculated. 38 cancer sites and 185 countries or territories worldwide were evaluated for cancer incidents for the year 2020 by sex and age groups. Estimately 19.3 million (95% uncertainty interval [UI]: 19.0-19.6 million) new cases of cancer (18.1 million excluding non-melanoma skin cancer) and almost 10.0 million (95% UI: 9.7-10.2 million) deaths from cancer (9.9 million excluding non-melanoma skin cancer) were reported in 2020 worldwide. Female breast cancer (2.26 million cases), lung (2.21) and prostate cancers (1.41) were the most reported diseases. Lung cancer (1.79 million deaths), liver cancer (830000) and stomach cancers (769000) were the most common cause of deaths.[5]

**Treatment:**

Nanotheranostics, the merger of therapy and diagnosis in nanoformulations, are the future ways to meet personalized medicine challenges in precision to cancer diagnosis. Rational management and effective therapy, increase the survival rate and improves the cancer patient's life. Different from most the conventional platforms with unsatisfactory theranostic capabilities, supramolecular cancer nanotheranostics have unprecedented advantages during the start stage diagnosis. However, personal therapy, shows promising potential in clinical applications.[6] Ineradicable mark has been made by Immune checkpoint inhibitors (ICIs) in cancer immunotherapy field. Anti-cytotoxic T lymphocyte-associated protein 4 (anti-CTLA-4) is used for advanced-stage melanoma in 2011, ICIs is used for the treatment of different cancer types like antibodies against programmed cell death 1 (PD-1) and its ligand (PD-L1) since it got approval, in US, for being drug admistered. However, a number of patients have been prevented from achieving long lasting responses, and immune-related unfavorable events. Thus, a better understanding of ICI therapy is needed. Changes in tumoral and systemic studies have capitulated in the basis of efficacy and resistance. Therefore, much broader efficacy and safety could be achieved by building on these insights by combining ICIs with other agents to produce new immunotherapies .[7]

**Drawbacks:**

There are certain limitations to the conventional cancer treatment methods i.e radiotherapy and chemotherapy .Radiotherapy (radiosensitizer) and chemotherapy (chemosensitizer) have a synergistic effect by hyperthermia, which is an adjuvant therapeutic modality, these have low specificity and affects tumoral and healthy tissues. Moreover, the temperature gradient developed near the deep-seated tumors along the path of the heat source is way more serious. Thus, these drawbacks could be handled by creating a local hyperthermia around tumoral tissues i.e by help of Nanoparticles (NPs)-induced hyperthermia. It produces heat nanostructures like gold NPs, iron oxide NPs, and carbon NPs. While the non-heat-producing nanostructures include lipid-based, polymeric, and silica-based NPs, as the carrier for heat-producing NPs.[8]

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