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Review Article

A review on role of biomarkers in diagnosis and treatments of various cancers

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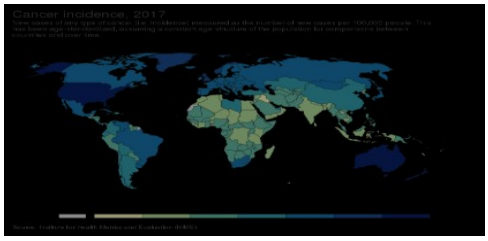
Abstract

This article is focused mainly on the role of the remote presence robot in health care facilities. This article has a view of the advantages, disadvantages, objectives, uses of RPRT in health care settings, and in different departments, and precautions to be taken while using RPR. In recent decades the usage of remote presence robots has been used in many clinical settings like ICU, emergency departments, medical, surgical, neurological units, and operating rooms. Remote presence robot technology RPRT, is an advanced robotics device technology that enables health care professionals to provide real-time clinical services to patients. This has been increasing in both outpatient and inpatient settings. RPRT in medical education can teach the professional curriculum to students in an interactive way as teachers do. RPR can even enable teachers to teach and interact with students remotely. The world's first hospital to introduce remote presence robots in the university of California, Los Angeles in its neurosurgery intensive care unit. The application of RPRT will increase doctor access for patients, families, and hospital staff in clinical care settings.

Introduction

Cancer is defined as a mass of tissue formed as a result of abnormal, excessive, uncontrolled and purposeless proliferation of cells, even after removal of growth stimulus which caused it. The point should be noted that the cancer is the second most cause of death in the world and it is estimated to be 9.6million deaths in 2018. About 1 in 6 deaths is due to the cancer. On approximation 70% of deaths in the world is from the cancer occurring in low and middle income countries. Epidemiological studies gives an information regarding the number of deaths and number of patients who are suffering from cancer and which countries shows dominant with cancers [1].



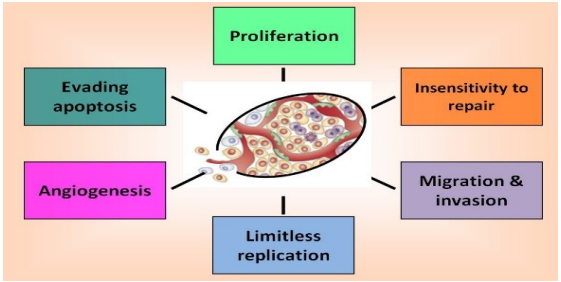


Figure 01: Representing the epidemiology and etiological factors associated with Cancer [1,2].

Table 01: Representing the five most common primary cancers in the world [7]

MEN	WOMEN	CHILDREN (under 20)
Prostate (oral cavity	Breast (cervix in	Acute leukaemia

in India)	India)	
Lung	Lung	Brain tumours
Colorectal	Colorectal	Lymphoma
Urinary bladder	Endometrial	Bone sarcoma
Melanoma	Thyroid	Soft tissue carcinomas

The Major Cancer Control Centres In India

- Tata Memorial Government Hospital (Mumbai)
- Fortis Malar Private Hospital (Chennai)
- Apollo Hospitals Private Hospital (Chennai)
- KIDWAI Memorial Institute of Oncology Government Hospital (Bengaluru)
- AIIMS (New Delhi)
- Columbia Asia Hospital (Hyderabad)
- Basavatarakam Indo-American Cancer Hospital (Hyderabad)
- Yashoda Cancer institute (Telangana)
- Adyar Cancer institute (Chennai)
- Rajiv Gandhi Cancer Institute and Research Centre (New Delhi)

Hence, to control this dangerous disease called cancer the biomarkers are introduced. According to US Food and Drug administration (FDA) defines the cancer biomarkers as it is an indicator that is used to find out the presence or absence of disease [5,7].

Role Of Biomarkers In Cancer

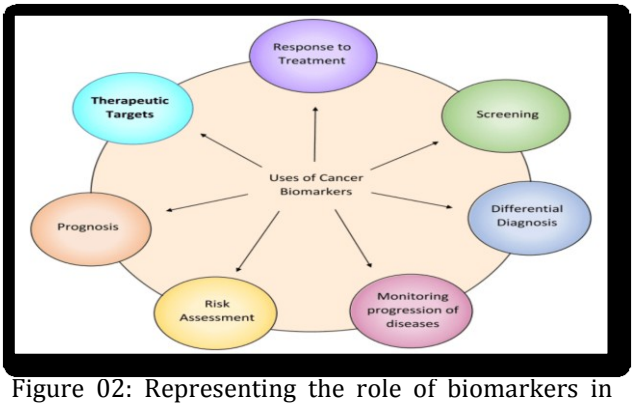


Figure 02: Representing the role of biomarkers in Cancer [1,2]

A biomarker may be a molecule that is secreted by a tumour or a specific response of the body to the presence of cancer. These biomarkers are used as an indicator for screening, diagnosis and in prognosis. Screening biomarkers are used in the prediction of the occurrence of the cancer disease in patients with asymptomatic condition.

Diagnostic biomarkers are used to make sure on the patients who are suspected of having the disease. Prognostic biomarkers are used to predict the outcome of a patient who are suffering from a disease. Cancer biomarkers can be genes, proteins, molecules, enzymes or hormones which can be detected in the blood, urine, tissues or other body fluids.

Biomarkers can also be used as indicators of the functional and structural changes in organs and cells. Such changes may be associated with the consequences of normal and the pathological events. Hence, the biomarkers can be used to detect and screen the molecular changes that are relevant to the current development or the future development of diseases, complications or responses [5].

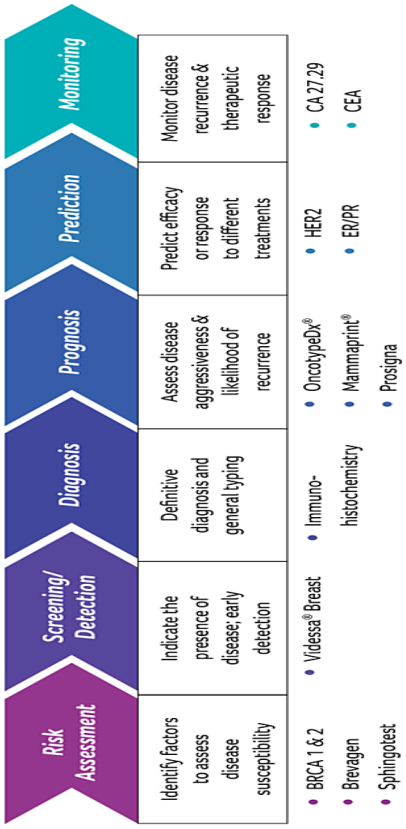


Figure 02: Representing the schematic representation of various steps involved in diagnosis of Cancer

Diagnosis Of Cancer By Using Biomarkers

In diagnosis of cancer, the main work of the biomarker is to detect whether the tumours produced in the patient are of primary or metastatic in origin. To get distinction, researchers can monitor the alterations in chromosomes found on the cells located in the primary tumour site against those found in the secondary site. If there is a matching in the alteration, then we can say that the secondary tumour is a metastatic, if the alterations differ, we can say that the secondary tumour is identified as a distinct primary tumour [2,3,4].For simple diagnosis, like IHC (Immuno histochemistry) test which is mainly used in the breast cancer. IHC is used to show whether the cancer cells have HER-2 receptors or not. But, the IHC tests are already on the market with low costs and risks. So, it was relatively easy to have diagnostic companies to develop these tests. But the more complicated diagnostics that might have undergo extensive invitro-diagnostics (IVD)

approval process with the FDA to reach the market. IVD tests have more extensive testing requirements than the home-brew development process often used for the diagnostic tests, which only requires CLIA (Clinical laboratory improvement amendments) certification of the laboratory performing the tests [2-5].

An alternative regulatory model is introduced in order to reduce the risks and costs of developing biomarker diagnostic tests that is linked to the new targeted cancer treatments. In this method, the researchers should use a biomarker assay that meets CLIA requirements during the clinical trials of the new therapeutic for which its use will be linked. If the drug is then approved by the FDA, the diagnostic test would also enter the market via CLIA certified labs. The diagnostic approval is later then evaluated by the FDA as an IVD [4,5].

Treatment Of Cancer By Using Biomarkers

Cancer biomarkers are also used in monitoring that how well a treatment is working overtime. Mine aim is for providing the significant cost reduction in patient, as the current image based tests like CT and MRI for the tumour monitoring status are of highly costly. One noticeable biomarker is the protein biomarker S100- beta in screening the response of the malignant melanoma. In the higher concentrations that are dependent on the number of cancer cells. Where as in response to the treatment it is thus associated with reduced levels of S100- beta in the blood of such individuals. In the same way the additional laboratory research shows that the tumour cells which undergoing apoptosis can release the cellular components like cytochrome.C, nucleosomes, cytokeratin- 18 and E-cadherin etc. Few research studies have shown that these macromolecules and others can be seen in the circulation during the cancer therapy, by providing a very good potential source of clinical metrics for the treatment monitoring [5,7].

Gene Therapy

Gene therapy is a possible approach for the treating and curing the disease by altering gene expression. The goal of gene therapy is to correct the genetic defects permanently and thereby restore the normal cellular function. The first gene therapy was introduced in the patient with the Melanoma type of cancer. FDA approved the first gene therapy for cancer. First the tumour infiltration lymphocytes are collect from the patients with the advanced Melanoma were ex- vivo transduced with a marker gene or therapeutic gene expanded in- vitro and then re-infused to the patients. The therapy was successfully worked for the cancer. Later the Gene therapy is used in the treatment of patients with thalassaemia. Here the bone marrow cells and transfected ex- vivo with plasmids containing the human globulin gene. After cells were transfected and re- administered back to the patient [5-7].

Gene Transfer

In gene therapy the challenge is to deliver the adequate amount of genetic material into the target cells or tissues and the gene expression is maintained for a desired period of time. The gene transfer method is used to deliver the genetic material to their target cells or tissues.

The principles that are followed in the gene transfer methods are: Physical, viral, non- viral and bacterial or yeast method [7].

1. Physical methods: The examples of physical methods that are used commonly are electroporation, ultrasound and gene gun deliveries.
2. Viral vectors methods: In this method the virus acts as a vehicle to deliver the genetic material into the cells. Examples of viral vectors that are used in gene transfer are adenovirus, lenti and retroviruses (like HIV), vaccinia viruses, adeno associated viruses (AVV) and baculo viruses.
3. Non- viral vectors methods: In this method other than the virus (i.e., liposomes or nano particles) acts as a synthetic carrier.

Conclusion

Cancer is a very dangerous disease caused due to the uncontrolled cell division or multiplication. It has a ability to spread all over the body. To control this dangerous disease the biomarkers or tumour markers are introduced.These markers acts as an indicator to determine the presence or absence of disease. By using the cancer biomarkers the disease can be screened, diagnosed and finally can be treated.

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