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Letter to the Editor

Nanotechnology in Healthcare: An Overview

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ABSTRACT

Nanotechnology products have become increasingly helpful in healthcare and have led to the emergence of novel nanosystems for the diagnosis, imaging, and treatment of number of diseases, such as cardiovascular, ocular, renal and central nervous system related diseases and cancer. The usage of nanotechnology ranges from prevention, management and rehabilitation. The nanostructured materials used in PPE and other materials contains silver, copper, bismuth and titanium as they exhibit the antimicrobial and antiviral properties. Impact on health and safety issues still unclear in terms of cellular or organ toxicity, genotoxic or carcinogenicity. But the long term impact is yet to be explored.

Keywords: Nanotechnology; Carcinogenicity; Genotoxic; Titanium

LETTER TO THE EDITOR

Nanotechnologies emerged in the 20th century as the most presumptive approach to impart remarkable offbeat properties to nanomaterials for a variety of medical applications. The prefix "nano" is an ancient greek word meaning "dwarf". Nanotechnology is the study, design, synthesis, creation, manipulation, and application of materials, devices, and systems at the nanometer scale [1]. Nanotechnology products have become increasingly helpful in healthcare and have led to the emergence of novel nanosystems for the diagnosis, imaging, and treatment of number of diseases, such as cardiovascular, ocular, renal and central nervous system related diseases and cancer [2]. The nanotechnology intervention has a promising potential to innovate next level of diagnostic and therapeutic modalities for important diseases through intracellular molecular targets and thereby rapid and cost effective treatment modalities have becoming achievable.

There are various types of Nanoparticles (NPs) that are used in the health care, such as metal, metal oxide, semiconductor, organic, and inorganic NPs. The wastage of drugs, chemical and physical incompatibilities, interactions between drugs, the occurrence of side effects associated with the dosage and time constraints are the major restrain of conventional approaches that are overthrown by nanotechnology [3]. The current thrust areas in nanotechnology are therapeutics, unique targeted drug delivery devices, amplification of efficacy of the currently available drugs, diagnosis of disease through early detection and imaging, scheming and advancement of smart-nano material for medical applications such as vaccines and implants, tissue engineering and nanosensors for detection of chemicals and pathogens in the human body [3]. The usage of nanotechnology ranges from prevention, management and rehabilitation as shown in Table 1.

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Prevention	Refining the existing vaccines or creating new ones, Augmenting gene therapy using stem cells. Personal Protective Equipments (PPE), Medical textiles, Packaging, wound dressing and air filters (COVID).
Diagnosis	Earlier detection of pathologies using highly sensitive, personalized and real-time diagnosis system nanotechnology like stent retrievers, estimating the resistance and capacitance from pressure and flow while measuring blood pressure to redefine action of vasoactive drugs on small and/or large arteries.
Treatment	Controlled release therapy can be provided by means of these targeted nano carrier system that shows high surface-to-volume ratio, send drugs to particular sites or tissues and enhanced retention time, avoiding the damage of healthy cells, as compared to conventional techniques focusing on disease areas like: Tuberculosis, Cardio-Vascular Diseases (CVD), Chronic Obstructive Pulmonary Diseases (COPD) and Cancer.
Rehabilitation	Reconstructing damaged tissue, biocompatible implants, skin grafting and organ replacement using nanomaterials in stem cell technology.

Table 1: Uses of nanotechnology in healthcare.

Further, the nanostructured materials used in PPE and other materials contains silver, copper, Bismuth and titanium as they exhibit the antimicrobial and antiviral properties by reducing the attachment of pathogens and even disrupting the structure of the pathogen due to nanoscale topography organization. The technology has expanded to the progression of artificial organs like nano artificial myocardium, artificial sphincters for post op colon cancer patients and much more ongoing animal research.

Nanotechnology is a double edged sword which has its own potential health risks and challenges. The physicochemical phenomenon of the nanomaterials are not well understood leading to difficulty in identifying the right nonmaterial for the intended indication. Impact on health and safety issues still unclear in terms of cellular or organ toxicity, genotoxic or carcinogenicity [4]. The technology production cost is very high and restricted accessibility to people.

To conclude, with its vast application and promising benefits, Nanotechnology is considered to be an emerging field in the health care as it provides the ability to frame the large number of products that are incredibly powerful. The ultimate achievement of this technology will reflect in the amelioration of quality of life of all the patients suffering the complex diseases like cancer. At the same time the long term impact is yet to be explored as various researches in the pipeline [5].

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CONFLICTS OF INTEREST

No conflict of Interest.

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