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Recent Therapeutic Options in Cancer Therapy

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ABSTRACT

Nanoparticles are used in several fields and its importance in medical field has proven to be beneficial. They have proven to be useful in cancer treatment due to their quick target delivery and also due to their effectiveness in penetrating the cancer cells. They have also proven to be beneficial in psychotic conditions as drugs like haloperidol and risperidone are already proven to be effective. Their role in psychotic and cancer treatment has been analyzed in this review.

Keywords: Cancer; Nanotechnology; Target Delivery; Drugs

Introduction

Nanotechnology is already widely applicable in medical field by their various drug delivery systems, in the principle of magnetic resonance in cancer treatments and cellular biology [1-3]. Researchers in nanotechnology have carefully monitored and applied its use in creating the best medical and biological equipment's and devices so as to be beneficial for patient care [4-6]. This review briefly details the role of nanoparticles in general medicine and then focusing on its application in treating patients with brain and lung cancers [7-9].

Role of Nanotechnology in Medicine

Nanoparticles are used successfully in the deliverance of basic physical substances such as heat, light, and other substances to the target cell of interest [10,11]. This has been beneficial in using nanotechnology as a treatment option for managing cancers [12]. The nanoparticles enter the target cancer cell and produce a cellular arrest and thereby inhibiting the uncontrolled tumor growth [13]. This further interrupt the proto-oncogenes and tumor suppressor genes causing an abrupt interference of the tumor growth cycle [14]. The highly effective tumor cell penetrance property of the nanoparticles has been proven to be beneficial in combatting the tumor cell biology (Figure 1). The adverse effects in the application of nanotechnology in cancer care treatment is very minimal and hence has shown to be widely applicable[15]. The role of gapmer design in downregulating the cancer cells has also been proven recently [16]. This design model has shown to increase the binding capacity of the nanoparticles to the cancer cells and then downregulates the entire tumor environment [17-19].

The role of nanotechnology in treating brain and lung cancers has been formulated with the LMP *in vivo* and *in vitro* levels [20-22]. The LMP formulations reach high levels in these cancer types, hence providing a better chemical and physical stability. These properties further enhance the overhaul performance of nanoparticles effect in brain and lung cancers. The antisense oligonucleotide combination with lipid subunit of nanoparticles produces quaternary amine-tertiary cation lipid complex. This complex is very efficient and also cost-effective in cancer therapy [23-25]. Nanoparticles can be combined with various elements, however its combination with polymers and lipid component seems to be the most effective formula [26]. This is mainly attributed to its high bioavailability, compatibility, and also higher safety level. These combinations are used in treating varying cancer types, especially the brain and lung cancers [27].

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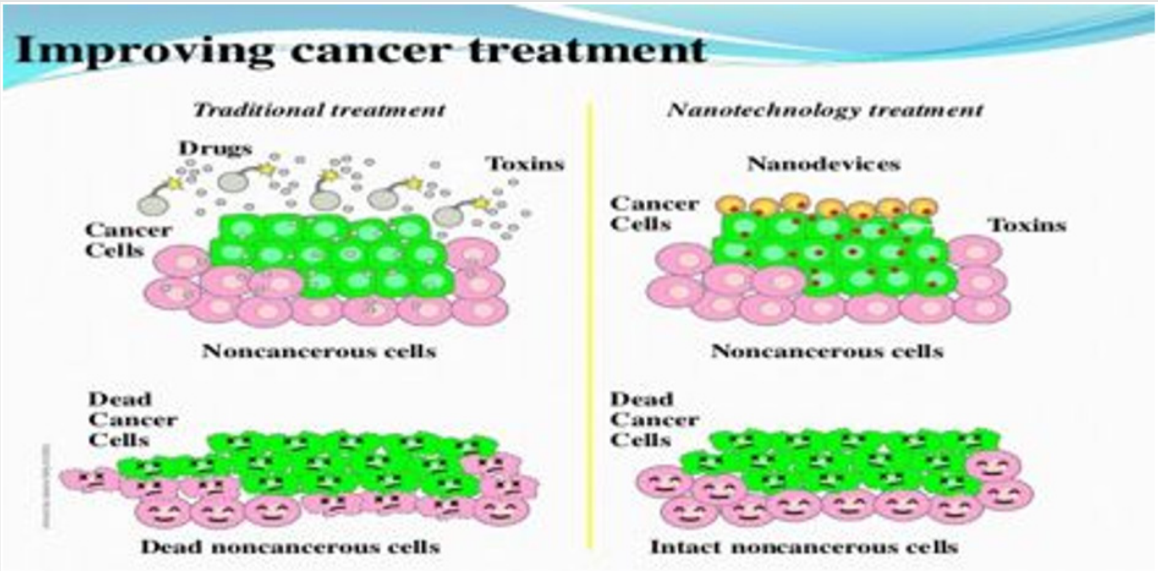

Figure 1: A schematic representation of the nanoparticle effect. The colloidal nanoparticles are accumulated in tumors due to their higher vascular endothelial penetrance.

Role of Nanoparticles in Brain Cancer Treatment

The role of nanoparticles as a therapeutic option in psychosis is well versed. The anti-psychotic drug, haloperidol develops blocks at neuronal level and thereby ensures slow release of the pharmaceutical substances [28]. This has been beneficial as the relevance of psychosis in modern society has been exponential raising [29]. The dendrimers further alter and induced as nanoparticles. The other popular anti-psychotic medication, risperidone is used effectively in treating schizophrenia [30]. As both these basic and common anti-psychotic drugs are already in treatment plans for psychosis, we now move to the role of nanoparticles in treating brain cancers [31]. Brain tumors are mostly glial based. These are classified as Gliomas by the World Health Organization (WHO). Based on its histological features they are further subtyped into grad 1 to 4. Grade 1 been most mild and grade 4 been most aggressive [32-34]. The application of nanotechnology in treating brain cancers has been limited even though there is abundance of nanoparticles available in the market. This is mainly attributed to the aggressiveness of the brain tumor and also the limitations of nanoparticles in arresting the cell cycle of the tumor. However, when nanoparticle is combined with other chemotherapeutic drugs they produce beneficial effects to the patients by reducing the extent of side effects. This occurs due to the *in vivo* and *in vitro* effects of nanoparticles in a tumor environment [35,36].

The application of gold nanoparticles has been effective and productive in brain target drug delivery. The gold electrons are conducted on the metal surface followed by light excitation [37]. The Serine-arginine-leucine (SRL) modified dendrimers produce a high transfusion rate and a low toxicity level. These effects have limitations as they can only be applied in less aggressive forms of brain cancers [38]. In Glioblastoma multiforme, a form of brain tumor, is aggressive and makes it difficult for the procedure to turn effective. Fibrin binding peptide can be induced to treat this case [39]. Studies are still underway in applying polymer, lips, and microbubbles form of nanoparticles to treat brain tumors [40]. These forms have shown lower toxicity compared to other forms of nanoparticles. This application is important as there needs to be an equilibrium between the drug delivery and adverse effects during treatment of aggressive forms of brain cancers [41].

Role of Nanoparticles in Lung Cancer Treatment

Lung cancers are mainly adenocarcinomas. These are followed by squamous cells carcinomas and neuroendocrine cancers [42]. The origin of lung cancer has been cited mainly due to its molecular alterations and environmental-host imbalances [43]. The overexpression of an anti-apoptotic gene, Bcl-2 has shown to be a very important cause for lung cancer origin. The expression of Bcl-2 has been controlled by the antisense oligonucleotides (ASOs) therapy [44]. But this control level has been minimal due to problems in tumor-particle binding ratio, immune nature if oligonucleotide and low *in vitro* and *in vivo* nanoparticle concentration. This has led to the demand of lipid nanoparticles which can increase the overall nuclease stability and the circulation time of such oligonucleotides [45,46]. The lipid nanoparticles alter the tumor microenvironment by altering the cell cycle, inhibiting proto-oncogenes, and enhancing cell cycle arrest factors [47]. miR-21 plays an essential role in regulating the propagation of tumor and cancer. QTsome nanoparticles are ideal for inducing strong dosage of the therapy

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without affecting the sensitivity and increasing the invasion pace [48]. However, extensive research is still required in order to use nanoparticles more commonly in lung cancer treatment.

Conclusion

The role of nanotechnology in patient care has been growing every year. The success of these particles has been attributed to its fast drug deliverance systems and its ability to interrupt the cancer microenvironment. The beneficial effects of nanoparticles in treating psychosis have laid a foundation on which its physical and chemical nature cane be more explored. This holds true for treating cancers especially of the brain and the lungs.

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Conflicts of Interest

Nil.

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Author Contributions

All authors were involved in concept, design, data collection, formulation, writing the manuscript, editing and approval of final manuscript.

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