ScienSage

Journal of Advanced Scientific Research

Available online through http://www.sciensage.info/jasr

ISSN
0976-9595
Review Article

THE PURVIEW OF NANOSCIENCE IN THE FIELD OF OVARIAN ONCOLOGY

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ABSTRACT

There has been a burgeon effort to prevent and detect cancer, especially in the field of Ovarian cancer via various inventions and scientific developments. Nanoscience and Nanotechnology, to this context has a pivotal role to play in the treatment of ovarian cancer. This compact communicative review describes the evolution and the trending nanotechnology deployed to curb ovarian cancer.

Keywords: *Ovarian Cancer, Nanotechnology, NanoTherapy.*

1. BACKDROP

The need for an enhanced technology to curb cancer can be evident from the statistics [1] which indicate the rising cancer occurrences coupled with an increased mortality rate. Cancer is one of the leading causes of deaths worldwide with an estimated 7.6 million individuals lost each year and accounting for 13% of all deaths [2]. Several reports have predicted that the cancer related deaths will go up to 13.1 million by the end of 2020, and this is because cancer is not a single disease in which particular virus/bacteria affects the immune system [3]. Instead it is a combination of several diseases related with each organ system. To combat this burgeoning of the mortality statistics, technological innovations are needed to enhance along with human behavior changes. Several vaccines were developed to cure cancer caused by the Human papilloma virus by enhanced drug delivery and precision medicine. But in the course of this technological era, these vaccines got more efficient by the incorporation of nanotechnology to it. Nanotechnology does provide us with the space to improve the cancer prevention efficacy by using advanced techniques like precision medicine, successive and confined screening techniques. Still, for many cancer types, new approaches for treating established disease are required, especially for treating ovarian cancer, which requires a targeted drug therapy; nanotechnology has been the most modern tool to develop the same [4].

2. OTHER THERAPIES

To this context, although the traditional chemotherapy has been a successful to some extent, the process still remains an imperfect diagnosis treatment its poor bioavailability, high-dose requirements, adverse side effects, low therapeutic indices, development of multiple drug resistance, and non-specific targeting [5-10]. And because of this non specific domain, the cost of the treatment automatically rises. The main driving force in the development of Nanotechnology is to successfully overcome these problems of non specific targets' and carry drugs to the desired sites of therapeutic action while reducing adverse side effects and making the entire process economical.

3. NANOTECHNOLOGY AND NANOTHERAPY

Nanotechnology has redesigned several aspects to the existing challenges in treating the Ovarian Cancer detection along with providing with precision therapeutics technological treatments. Nanotechnology improves the untraced biomarkers creating new possibilities to enhance imaging and personalized care. Furthermore, the low dissolution factor [11] of the chemotherapeutic drugs can be over mined by the usage of nanotechnology especially in treating ovarian cancer which relies highly on the amount of the aqueous solubility, thus reducing the side effect along with the adverse pharmacogenomic effects [12].

The effects of nanotechnologies have also revealed treating ovarian cancer through various others chemotherapeutic agents such as the nitric oxide therapy, genetic and phototherapy using siRNA. The most important of all is that nanotechnology will help to suppress the disadvantages which platinum and paclitaxel [13] had over the drug delivery pathway for treating ovarian cancer. Some drugs such as the pegylated liposomal [14, 15] doxorubicin are already being used to

cure ovarian cancer and are expected to evolve further in these coming decades benchmarking upon the effectiveness and the price. A subclass of nanotechnology is Nanotheranostics which provides heterogeneity, drug resistances and recurrences within the affected Cancerian cells [16]. Recent studies using curcumin has proved to be an effective agent for gene therapy in the purview of ovarian cancers which offers high selectivity along with the combined therapeutics resistances [17].

While nanotechnology can be implied to isolate the blood circulating cancer cells by plugging in the target particle, the same technology can be implemented in case of ovarian cancer to cure advanced stages of cancer and even stage III metastasis [18-20]. Additionally, these technologies can help to identify the cancerous cell an assist to modify it by providing chemoresistance and recurrences. Ovarian cancer cells like EphA2 have tested to prove the above technology to be true [19].

Recent advancements have converted this technology to isolate the cancer cells by surface modification and probation isolation. Isolating these cells has definitely turned out to be one of the groundbreaking treatments in the field of medical sciences. These approaches aim to affect the cellular maker genes which are controlled by the epigenetic methylations [21] and hence affecting the pharmacokinetics of the micro RNAs associated with cancer mediated cells.

Amidst of it praises, the main disadvantages nanomaterial have is their bio-compatibility. Nanocarriers like quantum dots, metal-ligand bonded nanocarriers or carbon nanotubes possess toxicity to humans since they are not biocompatible and are preferred to be used as ex vivo treatment rather than in vivo therapies [21]. Several pieces of research suggest grafting peroxidases with carbon nanotubes which can make the system biocompatible; however incorporating the grafted agents may decrease the efficiency of the carrier system. The loading charges [22], which a non grafted nanocarriers posses is much higher as compared to a grafted one, once again questioning the efficiency of the therapeutic pharmacokinetics. For this reason, it is essential to develop a simple structure nanoparticle so that there is viability in terms of reproducibility, control, composition and loading capacities [23].

4. CONCLUSIONS

Although it seems that fabricating the design is a herculean task, with recent advancements and developments it is possible to synthesize biocompatible carriers. The number of students opting courses like biotechnology is much less as compared to computer sciences. The result of the same is that we do not produce enough scientists to think about the new synthesis routes and the possibilities. Nanoscience or nanotechnology is not classified as a proper field of engineering making several biologists and chemists diverge away from the field. We need to have more inter-disciplinary classes on these topics which can coalesce amongst themselves to form an entire pivot for a stream. Stress should be made on the technology rather than the associated sciences or the diseases. We can cover several scopes of subjects like polymer science, pharmaceutical science, and material science in this field to strengthen it up giving rise to a proper shape which can mold the problem e are addressing.

Nanotechnology is definitely one of the prime paths taken by researchers to accelerate its way to early detection and cure of ovarian cancer. The advancement and the innovation can only be connected to solving the problem if the stream gets a bit more orientation blended with physicist, biologists, chemist, technologists, and pharmaceutics.

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