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Cancer Problems and Emotional Distress: High Costs of Care

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Abstract

Cancer is one of the main causes of death worldwide, and in the past decade, many research studies have focused on finding new therapies to reduce the side effects caused by conventional therapies.

Keywords: Phosphotungstic; Cell culture; Fluid; Margins; Malignant degeneration; Anti-angiogenesis

Introduction

Cancer is possibly the oldest disease afflicting humanity for the past 4,000 years. It was hidden from view and misinterpreted because of prevailing other diseases and the relative shortness of the human's lifespan. With the victory over a plethora of such diseases and humanity's increasing longevity, cancer has emerged in full force during approximately the last two centuries and will, unfortunately, still be with us for the remainder of humanity's existence. Micelles, instead, own a hydrophobic core that can encapsulate hydrophobic drugs. Doxil, doxorubicin-loaded PEGylated liposomes, were the first nanoparticles approved by the FDA in 1995 to treat AIDS-associated Kaposi's sarcoma. This formulation drastically reduces doxorubicin side effects. Since then, other liposomal formulations have been approved by the FDA for cancer therapy, such as Myocet and DaunoXome. Polymeric nanoparticles are made of biocompatible or natural polymers, such as poly lactide-co-glycolide, poly ε-caprolactone, chitosan, alginate and albumin. Some formulations have already been accepted by the FDA, such as Abraxane and Ontak [1]. As well as these systems, which have been either accepted or are under clinical investigation, it is worth mentioning some new nanoparticles currently undergoing testing at the research level, which should improve treatment performance. For example, solid lipid nanoparticles, made of lipids that are solid at body temperature and fabricated to load hydrophobic drugs have been demonstrated to give a higher drug stability and prolonged release compared to other systems; however, the encapsulation efficiency is often low because of their high crystal-linity. To overcome this issue, one or more lipids, liquid at room temperature, are included in the formulation. Lipid nanoparticles are good candidates for brain tumour therapy as they are able to cross the blood–brain barrier. A recent work showed that lipid nanoparticles loaded with SPIONs and temozolomide are efficient to treat glioblastoma since they combine the effect of the conventional chemotherapy and hyperthermia Dendrimers are another family of nanoparticles composed of polymers with a repetitive branched structure and characterised by a globular morphology [2]. Their architecture can be easily controlled, making their structure extremely versatile for many applications. For example, some recent studies show that poly-L-lysine dendrimers loaded with doxorubicin induce anti-angiogenic responses in in vivo tumour models.

Discussion

Currently, there is only one clinical trial for a formulation named ImDendrim based on a dendrimer and on a rhenium complex coupled to an imidazolium ligand, for the treatment of inoperable liver cancers that do not respond to conventional therapies [3]. During cancer progression, tumours become highly heterogeneous, creating a mixed population of cells characterised by different molecular features and diverse responsively to therapies. This heterogeneity can be appreciated both at spatial and temporal levels and is the key factor responsible for the development of resistant phenotypes promoted by a selective pressure upon treatment administration. Usually, cancer is treated as a global and homogeneous disease and tumours are considered as a whole population of cells. Thus, a deep understanding of these complex phenomena is of fundamental importance in order to design precise and efficient therapies. Nanomedicine offers a versatile platform of biocompatible and biodegradable systems that are able to deliver conventional chemotherapeutic drugs in vivo, increasing their bioavailability and concentration around tumour tissues, and improving their release profile. Nanoparticles can be exploited for different applications, ranging from diagnosis to therapy. Recently, extracellular vesicles, responsible for cancer development, microenvironment modification and required for metastatic progression, have been widely investigated as efficient drug delivery vehicles. Natural antioxidants and many phytochemicals have been recently introduced as anti-cancer adjuvant therapies due to their anti-proliferative and pro-apoptotic properties [4]. Targeted therapy is another branch of cancer therapy aiming at targeting a specific site, such as tumour vasculature or intracellular organelles, leaving the surroundings unaffected. This enormously increases the specificity of the treatment, reducing its drawbacks. Another promising opportunity relies on gene therapy and expression of genes triggering apoptosis and wild type tumour suppressors, or the targeted silencing mediated by siRNAs, currently under evaluation in many clinical trials worldwide. Thermal ablation of tumours and magnetic hyperthermia are opening new opportunities for precision medicine, making the treatment localised in very narrow and precise areas. These methods could be a potential substitute for more invasive practices, such as surgery. Furthermore, new fields such as radiomics and pathomics are contributing to the development of innovative approaches for collecting big amounts of data and elaborate new therapeutic strategies and predict accurate responses, clinical outcome and cancer recurrence. Taken all together, these strategies will be able to provide the best personalised therapies for cancer patients, highlighting the importance of combining multiple disciplines to get the best outcome [5]. In this review, we will provide a general overview

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of the most advanced basic and applied cancer therapies, as well as newly proposed methods that are currently under investigation at the research stage that should overcome the limitation of conventional therapies; different approaches to cancer diagnosis and therapy and their current status in the clinical context will be discussed, underlining their impact as innovative anti-cancer strategies. Every year, cancer is responsible for millions of deaths worldwide and, even though much progress has been achieved in medicine, there are still many issues that must be addressed in order to improve cancer therapy. For this reason, oncological research is putting a lot of effort towards finding new and efficient therapies which can alleviate critical side effects caused by conventional treatments. Different technologies are currently under evaluation in clinical trials or have been already introduced into clinical practice [6]. While nanomedicine is contributing to the development of biocompatible materials both for diagnostic and therapeutic purposes, bioengineering of extracellular vesicles and cells derived from patients has allowed designing ad hoc systems and univocal targeting strategies. In this review, we will provide an in-depth analysis of the most innovative advances in basic and applied cancer research. According to the World Health Organization, cancer is the second leading cause of death globally, accounting for an estimated 9.6 million deaths, or one in six deaths. The cancer burden continues to grow globally, exerting tremendous physical, emotional, and financial strain on individuals, families, communities, and health systems. For its part, the American Cancer Society has repertoires 72 types of cancer and estimated that by the end of 2015, there were approximately 1.66 million new cancer cases diagnosed in the country. But why hasn't cancer been cured despite a four-decade war against the disease and the expenditure of hundreds of billions of dollars worldwide It is essentially because of our incomplete understanding of the basic underlying molecular mechanisms that drive it [7]. Cancer is not a single disease. It is a multiplicity of diseases caused by the uncontrolled growth of a single cell unleashed by mutations. Cancer cells are better versions of normal cells in terms of their growth, spread, repair ability, and longevity. We naively thought we could defeat them by preventing or even eliminating the initial occurrence of mutations without hopefully impacting normal cell growth [8]. Unfortunately, this view did not consider the pernicious genetic intertwining of normal and cancerous growths wherein cancer is braided in our genome. Thus, we can rid ourselves of cancer only in as much as we can rid ourselves of the processes in our physiology that depend on growth – aging, regeneration, healing, reproduction [9]. The mutated genes are but distorted versions of the normal ones; they are braided together and unbridling them continues to be the most formidable undertaking. Fortunately, most cancer cases are due to environmental risk factors, many of which being controllable lifestyle choices and, thus, preventable. It has been suggested that cancer deaths could be prevented by avoiding risk factors including tobacco, overweight, obesity, insufficient or/and inappropriate diet, physical inactivity, alcohol, transmitted infections, and air pollution. But not all environmental causes could be controlled. Normally, cell division is controlled by the balancing of complementary growth and inhibition factors after which they are unable to migrate to other organs and die. When these antagonistic signals are impaired, no longer operate, or are bypassed, new genetic mutations take place, grow, escape, get transported in the blood stream, colonize distant areas, and metastasize. This development is governed by the individual's inherited tendency and environmental exposure. No less than eleven hypotheses and theories of cancer have been advanced over the years, including blood suppuration, somatic mutation, viral, retroviral, infectious mononucleosis, endogenous proto-oncogene, two-hit, inflammation, angiogenesis, hormone therapy, and immunotherapy [10]. Synthetic immunotherapy using either chimeric antigen receptor T-cells or programmed-death inhibitors. In this elegant and appealing approach, the immune system is stimulated rather than targeting the cancer itself. Further, their task completed, the engineered cells remain in the body, offering future protection. Unfortunately, today's immunotherapies do not help everyone and biomarkers that might offer answers remain to be designed as well as experimenting with ways to make therapies more potent.

Conclusion

Nonetheless, even cancers impervious to the new drugs could be treated if those malignancies have the right error-riddled DNA signature. In its refined version, the genome of a common bacteriophage and synthetic strands that were designed to fold up its DNA are encapsulated and do not encode any proteins or do any of the normal DNA functions. Potentially, the technique should work on most any form of drug-resistant cancer.

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Conflict of Interest

None

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