

Prospects of chemotherapy side effects minimization

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Received: September 14, 2018 | **Published:** September 24, 2018

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Keywords: tumor, treatment, side effect, nanoparticles, heterocyclic compounds, chemotherapy

Introduction

Oncological pathology is one of the most important social issues. In fact, there is no country in the world with this problem standing not at the first place.^{1,2} High mortality of patients with neoplasms is determined by imperfection of diagnostic and therapy methods.³ Plenty of facts of accidental tumor revelation in patients seeking medical care are the evidence.⁴ Therapy methods are also inadequate: some of them though considered radical, however during treatment measures in patients lead to fatal outcome.³⁻⁶

Modern treatment in oncology

There are three main types of treatment in oncology: surgical, chemotherapeutic and radiation therapy.^{1,2} Each one has its own guidelines, and, in most cases, oncologists combine them.¹⁻³ Recently, chemotherapy found new application.⁷ This method is commonly used as adjuvant therapy in combination with surgery to eliminate those metastases which cannot be removed during the operation. On the one hand, administration of chemotherapeutic drugs into bloodstream leads to their vast distribution and interaction with both solid tumor and metastases. On the other hand, spreading of cytostatic drugs around the organism is accompanied with side effects when both tumor and non-tumor cells are destroyed, for example stem cells—the ones with high proliferative potential.⁷

Also oncologists implement hormone therapy, immunotherapy, targeted therapy and gene engineering.⁷⁻¹⁰ These techniques haven't revealed their opportunities yet and are of limited application in oncology. Authors chose one of the most complicated oncological problems and put minds on chemotherapy drawbacks. Development of new medicinal drug with targeted antitumor effect is highly expensive. Such technologies are available for certain countries only, and this eventually leads to relatively high price of cytostatic drugs. So we have high-cost process of expensive chemotherapeutic agents' development which will also cause side effects leading to worsening of functional state of somatic, autonomic and psychologic processes in patients.¹⁰ The presence of this imperfect situation stimulates to search for new alternative treatment methods.¹¹⁻¹⁴

There are different ways to minimize negative effects of chemotherapy. Combination of three main types of treatment (surgical, chemotherapeutic and radiation therapy) is one of them.

Another way is to combine chemotherapy with techniques aimed at change of immune system activity—sometimes this increases effectiveness of treatment.⁸ However, insufficient effectiveness causes researchers to focus efforts on nanoparticles.^{11,12} Scientists attempt to use nanoparticles as highly effective antitumor factors. But nowadays these technologies don't show their high effectiveness.¹⁵

Minimization of chemotherapy side effects

There were several investigations appeared recently which are aimed at resolution of socially important problem from different position. Experimental studies on linear animals addicted to tumor development together with *in vitro* ones showed that chemotherapy drug dose can be decreased when combined with nanoparticles and heterocyclic compounds. How nanoparticles and heterocycles can contribute to minimization of chemotherapy side effects? The main advantage of new technology is that there is no increase of cytostatic drugs' effect by additional antitumor activity of nanoparticles and heterocycles. The idea is to search for such combinations which will allow reduction of recommended dose by ten- or even hundredfold – with preserved effectiveness.¹¹⁻¹⁴

First experiments aimed at verification of above mentioned hypothesis showed amazing results.¹¹⁻¹⁴ Little by little the facts have been collected proving the reality of dose reduction by 10-100times using the combination of chemotherapeutic agents with fullerenes and dendrimers.^{11,12} It is important, that dosages of fullerenes and dendrimers have been chosen in order to not cause antitumor effects when used alone. Therefore, we speak for those nanoparticles and heterocyclic compounds which have neither antitumor effect nor side effects. Namely ones have been chosen that have no side effects in relation to both tumor and non-tumor cells.¹¹⁻¹⁴

Conclusion

What are the prospects of such a new technology? New possibilities are opened for different chemotherapeutic drugs that are used below those dosages recommended by international protocols when combined with nanoparticles and heterocyclic compounds. Such tactics is cost-effective. But for patients it is most important that this approach accompanies reduction of side effects.

Acknowledgements

This pooled analysis was funded by LLC “Synergy”, and by grant IEMAM-BAS&IP-NASB-BRFFI, and by grant NCI-L&IP-NASB.

Conflict of interest

All listed authors concur with the submission of the manuscript; all authors have approved the final version. The authors have no financial or personal conflicts of interest.

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