



## Editorial

# Role of nanotechnology-based smart drug delivery approaches to combat cancer drug resistance

**Aleem Ahmed Khan**

Central Laboratory for Stem Cell Research and Translational Medicine, Centre for Liver Research and Diagnostics, Deccan College of Medical Sciences, Kanchanbagh, Hyderabad-500058, Telangana, India.  
Phone: +91-9391064053, Email: aleem\_a\_khan@rediffmail.com

Early online 28 July 2017, Print 31 July 2017

DOI: 10.5455/jmas.276179

© 2017 Deccan College of Medical Sciences. All rights reserved.

**M**ultidrug resistance (MDR) in cancer cells reduces the therapeutic efficacy of anti-cancer drugs and cause the tumor recurrence which represents challenging hurdle to combat cancer. Cancer drug resistance allows tumor cells to evade the chemotherapeutic agents which have been a major impediment in medical oncology. Chemotherapy is one of the standard treatments for different types of cancers. Although several new pharmacological interventions are being developed for specific cancers, the drug resistance cases are increasing continuously every year. In last few years considerable progress has been made to design effective strategies to combat the cancer drug resistance, the clinical applicability of these strategies are questionable.

The most common MDR mechanism in cancer drug resistance has been identified by the over expression of energy-dependent transporters (also called as ABC transporters) which can increase the efflux of drugs from cancer cells and lowers the intracellular drug concentration. Additional MDR mechanisms include DNA repair, metabolic modification, detoxification and altered expression of oncogenic markers. These mechanisms are more important to avoid malignant transformation of healthy cells. Failing of these mechanisms leads to the predisposition of altered phenotypic and molecular alterations which affects the response to chemotherapy. Various treatment strategies have been designed based on these molecular pathways in order to prevent the MDR in cancer cells. However, these strategies have limitations for their wider applicability due to detrimental effects on healthy cells and low therapeutic response.

The development of nanotechnology-based drug delivery platforms has provided major breakthrough in cancer theranostics. The nanoparticles have been considered as excellent tumor-targeting vehicles due to enhanced permeability and retention effect in the tumor microenvironment which could alter the MDR mechanisms in cancer cells. Since last few years' significant advancement has been made in designing novel nanoformulation of drugs such as polymer conjugates, micelles, dendrimers and liposomes. Nevertheless, a nanopatform which could sense and inhibit the MDR mechanisms followed by selective drug release has not been reported yet.

Another major limitation in the treatment of MDR cancer cells is the detrimental cytotoxicity of the drugs in healthy tissues. Recently gold nanoparticle-based successful smart cancer drug delivery approach has been developed to successfully revert back the cancer drug resistance mechanisms by reducing the expression of drug transporters without eliciting the systemic toxicological response in healthy tissues<sup>1</sup>. This particular strategy of using biocompatible Sorafenib-gold nanoconjugates in treating Sorafenib-resistant liver cancer cells may augment the possibility of anti-cancer drugs to reduce the load of drug resistance with lower dose and reduced adverse events in advanced cancer by evading the drug efflux mechanisms. This nanoparticles-based drug delivery approach may provide a new dimension in the treatment of drug resistant cancer cells by restoring the treatment efficacy at lower dose. More such advanced therapeutic approaches are desired to fully eradicate and overcome drug resistance mechanisms in cancer cells. With further ad-

vancements in smart nanotechnology-based drug delivery systems could provide better treatment options to increase the therapeutic efficacy for complete eradication of drug-resistant cancer cells.

**Acknowledgments:** None

**Conflict of interest:** None

## References

1. Vishwakarma SK, Sharmila P, Bardia A, Chandrakala L, Raju N, Sravani G, Sastry BVS, Habeeb MA, Khan AA, Dhayal M. Use of biocompatible Sorafenib-gold nanoconjugates for reversal of drug resistance in human hepatoblastoma cells. *Sci Rep.* 2017 Aug; 7(1):8539.