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Indole-3-carbinol-mediated biogenic gold nanoparticles provoke cell death by inducing oxidative stress and apoptosis in T cell leukemia and lymphoma

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Background: Gold nanoparticles have potential use in cancer diagnosis and therapy due to their size and enhanced permeability and retention effect that enables easy penetration and accumulation at tumor sites. Indole-3-carbinol (I3C), a phenolic phytochemical, has been reported to possess pro-apoptotic, anti-proliferative and anti-carcinogenic properties via modulation of immune pathways in Jurkat cell. So, an attempt has been made to green synthesize gold nanoparticles using indole-3-carbinol and to investigate whether its anticancer efficacy is enhanced at the nanoscale level or not by the induction of apoptosis.

Methodology: AuNPI3Cs were characterized and its cellular uptake was investigated using fluorescence microscopy. Induction of apoptosis of AuNPI3Cs in Jurkat and Dalton ascites lymphoma (DLA) cells was assessed by DAPI/PI staining, cell cycle study by flow cytometry, immunoblotting assay and by other relevant methods.

Findings: FTIR analysis confirmed the role of indole-3-carbinol in the stabilization of AuNPI3Cs. TEM analysis study revealed that AuNPI3Cs were mostly spherical in shape with an average particle size of 3nm. Results showed that the respective IC50 doses of AuNPI3Cs were significantly capable of elevating intracellular reactive oxygen species in Jurkat and DLA cells. AuNPI3Cs induced apoptosis by increasing reactive oxygen species, chromatin condensation, cell cycle arrest at G_0/G_1, expression of proapoptotic proteins and mitochondrial dysfunction in Jurkat cell, T cell leukemia and also in lymphoma cell. The fluorescence studies of cytoskeletal and nuclear morphology showed that AuNPI3Cs treatment changed the structural organization of actin filaments in T-cell leukemia cell.

Conclusion and Significance: The overall results firmly indicated that indole-3-carbinol, as appropriate reducing and stabilizing agent, led to the green synthesis of potent anticancer agent AuNPI3Cs with high potential for cancer therapy and may be considered as one of the best anticancer theranostic nanostructures among those reported until date.

Biography

Ananya Pradhan is a PhD candidate in Department of Human Physiology in Vidyasagar University, Midnapore, West Bengal, India. She completed her BSc in Physiology (2007-2010) and MSc in Human Physiology (2010-2012) from Vidyasagar University. She joined Inspire fellowship, Dept of Science and Technology, Govt. of India, since 2014. Her research area is cancer nano-therapeutics and she has some good quality peer reviewed papers. Her special interest is to explore different mechanistic pathway of cancer therapeutics. She is a life member of Indian Science Congress Association and a member of Indian Association of Cancer Research.

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