

Cytotoxicity impacts of linear and branched polyethylenimine nanostructures in A431 cells

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Background and Aims: Polyethylenimine (PEI), as a nonviral cationic polymer, has been widely used as gene delivery nanosystem. Although a number of investigations have highlighted its toxic impacts on target cells through induction of apoptosis/necrosis, still it is essential to look at its structural impacts on target cells.

Methods: In this current study, cytogenomic impacts of 25 kD linear and branched PEI (LPEI and BPEI, respectively) in A431 cells are reported to address possible mechanism for induction of apoptosis. At 40-50% confluency, A431 cells were exposed to PEI at a recommended concentration for 4 hr. After 24 hr, to detect apoptosis and DNA damage, the treated cells were subjected to MTT assay, FITC-labeled annexin V flow cytometry and comet assay.

Results: Flow cytometry assessments revealed that the BPEI can result in greater internalization than the linear PEI, which also induced greater cytotoxicity. Annexin V assay confirmed early and late apoptosis by BPEI, imposing somewhat DNA damage detected by comet assay. Western blot analysis resulted in induction of Akt-kinase which is possibly one of biomolecules affected by PEI.

Conclusions: These results highlight that, despite induction of Akt-kinase, the BPEI can elicit apoptosis in target cells.

Keywords: Akt kinase; Cationic polymers; Cytotoxicity; Cellular toxicity; Gene delivery systems; Polyethylenimine