Phase II/III solid tumors, gastrointestinal, and genitourinary cancers [147].

4. TOXICOLOGICAL PROFILE OF NANOPARTICLES

The application of nanoparticles in pharmaceuticals is increasing in the last few years to reduce drug doses and their side effects. However, these nanoparticles themselves may eventually cause the risks of toxicity in patients. Nanoparticles sizes are similar to cellular organelles therefore nanoparticles can enter inside the human body through dermal, oral, inhalation, intravenous, and intraperitoneal routes [148]. It can induce cytotoxicity, oxidative stress, genotoxicity, and inflammatory responses inside the body therefore before application of nanoparticles as a drug carrier it should make biocompatible specifically metallic nanoparticles [148–152]. Agglomeration of nanoparticles may also occur during the drug delivery in the vascular system which might lead to blockage and further could induce toxicity [153,154]. Some previous studies reported that the accumulation of cationic liposomes in vital organs can also lead to toxicity by disrupting cell membrane function and attaching to serum proteins [155,156]. Therefore, it is necessary to methodically study the toxicological profile of nanoparticles in human before their applications used in medicine.

5. CONCLUSION AND FUTURE DEVELOPMENT

The recent advancement in nanomedicine uses a wide range of nanoparticles for drug delivery, imaging and biosensing (nanosensor) to cure incurable diseases. These multidirectional approaches of nanoparticles have revolutionized the nanomedicine. However, nanoparticles applications for drug delivery have both beneficial and harmful effects on human health. Several nanoparticles have been evaluated clinically, but still, some limitations are there which needs more experimental studies. Standard methods should be established to encourage the benchmark materials, analyze both the short-term and long-term effects and quality management for the preclinical characterization of nanoparticles used for drug delivery.

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