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Innovative Applications of Nanoparticles in Cancer Diagnosis and Treatment

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Abstract: *Numerous nanoparticles have been created and evaluated during the last few decades, sparking a great deal of interest in their possible applications as therapeutic and diagnostic tools. Iron oxide nanoparticles are the sole formulation of nanoparticles that has been used in clinical practice to date, despite the fact that they have been suggested as potential diagnostic tools. This is mostly because it is difficult to consistently produce monodispersed nanoparticles and get appropriate pharmacokinetic characteristics. Concerns exist over their possible toxicity, biodegradation, and remove as well. Currently, therapeutic applications account for the majority of nanoparticle formulations utilized in clinical settings. The goal of these therapeutic nanoparticles is to minimize accumulation in healthy tissues and organs while more effectively delivering (chemo-)therapeutic medicines to specific locations. The "enhanced permeability and retention" (EPR) effect forms a substantial part of their foundation. Furthermore, because nanoparticles can combine therapeutic and diagnostic properties in a single formulation, they exhibit significant promise for theranostic applications. They are extremely useful for customizing therapies based on nanomedicine because of this feature. In this study, we address the function of EPR in the development of nanotheranostic formulations, examine the application of therapeutic and diagnostic nanoparticles, and provide an overview of popular non-invasive imaging methods. We also look at the practical possibilities of image-guided drug administration and nanotheranostics for more individualized and effective (chemo-)therapeutic treatments.*

Keywords: Nanoparticles; Diagnostic agents; Pharmacokinetics; Drug delivery;(Chemo-) therapeutic interventions; Targeted drug delivery.

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