

Nanoparticles in Radionuclide Therapy: The Future



Geetanjali Arora, Gurupad Bandopadhyaya*

Department of Nuclear Medicine, All India Institute of Medical Sciences, India

Submission: March 26, 2018; Published: April 09, 2018

*Corresponding author: JGurupad Bandopadhyaya, Department of Nuclear Medicine, All India Institute of Medical Sciences, India, Tel: 08076513669; Email: guru47@gmail.com

Abstract

Nanoparticles are being increasingly used to deliver chemotherapeutic drugs. However, their use to deliver radionuclide/radiopharmaceutical is highly limited. We present the work done in recent times in this area and what the future holds for radiolabeled.

Keywords: Nanoparticles; Radionuclide therapy; Poly-Lacto-Glycolic Acid; Anti-Epidermal Growth Factor Receptor Targeted

Introduction

The application of nanotechnology in medicine is multifarious such as diagnostic and therapeutic applications of nanomaterials, biological devices and nanoelectronic biosensors [1]. However, of all the applications, role of nanomedicine in oncology has been most widely studied by far. Nanoparticle-based drug delivery systems have gained considerable popularity as they have the potential to overcome the limitations of the currently available cancer therapeutic drugs such as damage to surrounding normal tissues [2].

Nanoparticles in Radionuclide Therapy

The use of radioabeled particles in diagnostic nuclear medicine such as sulfur colloid, human serum albumin and tin colloid is a routine practice. However, in radionuclide therapy the nanoparticle application has been largely restricted to research [1]. We did a pioneer work of developing nanoparticles for use in peptide receptor radionuclide therapy (PRRT) of neuroendocrine tumors. Biodegradable polymer based nanoparticles of poly-lacto-glycolic acid (PLGA) were developed and PRRT drug ¹⁷⁷Lu-DOTATATE was loaded in the particles. The drug loading efficiency and slow release properties observed during the in vitro studies [3] encouraged us to further study in vivo tumor targeting capability of these particles. In subsequent study, we also tried different polymers that are alginate and alginate/chitosan for nanoparticle formulation. In vivo distribution in wistar rats showed a high accumulation in tumor. Also, very less renal activity was observed which could overcome nephrotoxicity, a major limitation of conventional PRRT [4].

Li et al. [5] formulated ¹³¹I-labeled anti-epidermal growth factor receptor targeted (EGFR) nanoparticles for radionuclide therapy of EGFR-expressing tumors. The particles were found to have excellent targeted cell killing and suppressed cancer cell growth. More recently, the same group of researchers tested these ¹³¹I-labeled anti-EGFR nanoparticles in vivo for glioblastoma treatment in xenograft nude mouse model and concluded this to be a potent therapeutic option for glioblastoma [6]. The growing research in the area is reflection of widening scope of nanoparticles in radionuclide therapy and more so in theranostics. Kozirowski et al. [7] have recently presented a futuristic review of the application of radiolabeled nanoparticulate constructs in diagnosis and therapy of cancer. Radionuclide therapy has always played a significant in management of various cancers especially unresectable tumors. However, like any other cancer therapy, radionuclide therapy also suffers from limitations such as unnecessary radiation exposure to normal tissues. These limitations can be overcome by using nanoparticles as drug delivery vehicles. Much translational research remains to be done before both radionuclide therapy and nanotechnology can act synergistically against cancer in clinical practice.

Conclusion

Nanoparticle-mediated radionuclide therapy is a potent tool against cancer. They together can overcome the limitations of conventional cancer therapy providing an efficacious therapeutic and/or theranostic option. Nanomedicine is the

future of cancer therapy and together with various alpha and beta emitting radionuclides/radiopharmaceuticals; it may well be indispensable in management of cancer.

References

1. Assadi M, Afrasiabi K, Nabipour I, Seyedabadi M (2011) Nanotechnology and nuclear medicine; research and preclinical applications. *Hell J Nucl Med* 14(2): 149-159.
2. Arora G, Bandopadhyaya G (2018) Paradigm shift in theranostics of neuroendocrine tumors: conceptual horizons of nanotechnology in nuclear medicine. *Ann Nucl Med* 32(3): 151-164.
3. Arora G, Shukla J, Ghosh S, Maulik SK, Malhotra A, et al. (2012) PLGA nanoparticles for peptide receptor radionuclide therapy of neuroendocrine tumors: a novel approach towards reduction of renal radiation dose. *PLoS One* 7(3): e34019.
4. Arora G, Dubey P, Shukla J, Ghosh S, Bandopadhyaya G (2016) Evaluation of cytotoxic and tumor targeting capability of (177) Lu-DOTATATE-nanoparticles: a trailblazing strategy in peptide receptor radionuclide therapy. *Ann Nucl Med* 30(5): 334-345.
5. Li W, Liu Z, Li C, Li N, Fang L, et al. (2016) Radionuclide therapy using ¹³¹I-labeled anti-epidermal growth factor receptor-targeted nanoparticles suppresses cancer cell growth caused by EGFR overexpression. *J Cancer Res Clin Oncol* 142(3): 619-632.
6. Li C, Tan J, Chang J, Li W, Liu Z, et al. (2017) Radioiodine-labeled anti-epidermal growth factor receptor binding bovine serum albumin-polycaprolactone for targeting imaging of glioblastoma. *Oncol Rep* 38(5): 2919-2926.
7. Koziorowski J, Stanciu AE, Gomez-Vallejo V, Llop J (2017) Radiolabeled Nanoparticles for Cancer Diagnosis and Therapy. *Anticancer Agents Med Chem* 17(3): 333-354.



This work is licensed under Creative Commons Attribution 4.0 License
DOI: [10.19080/GJN.2018.04.555628](https://doi.org/10.19080/GJN.2018.04.555628)

Your next submission with JuniperPublishers will reach you the below assets

- Quality Editorial service
- Swift Peer Review
- Reprints availability
- E-prints Service
- Manuscript Podcast for convenient understanding
- Global attainment for your research
- Manuscript accessibility in different formats
(Pdf, E-pub, Full Text, Audio)
- Unceasing customer service

Track the below URL for one-step submission

<https://juniperpublishers.com/submit-manuscript.php>