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β-radiating radionuclides in cancer treatment, novel insight into promising approach

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Abstract

Targeted radionuclide therapy, known as molecular radiotherapy is a novel therapeutic module in cancer medicine. β-radiating radionuclides have definite impact on target cells via interference in cell cycle and particular signalings that can lead to tumor regression with minimal off-target effects on the surrounding tissues. Radionuclides play a remarkable role not only in apoptosis induction and cell cycle arrest, but also in the amelioration of other characteristics of cancer cells. Recently, application of novel β-radiating radionuclides in cancer therapy has been emerged as a promising therapeutic modality. Several investigations are ongoing to understand the underlying molecular mechanisms of β-radiating elements in cancer medicine. Based on the radiation dose, exposure time and type of the β-radiating element, different results could be achieved in cancer cells. It has been shown that β-radiating radioisotopes block cancer cell proliferation by inducing apoptosis and cell cycle arrest. However, physical characteristics of the β-radiating element (half-life, tissue penetration range, and maximum energy) and treatment protocol determine whether tumor cells undergo cell cycle arrest, apoptosis or both and to which extent. In this review, we highlighted novel therapeutic effects of β-radiating radionuclides on cancer cells, particularly apoptosis induction and cell cycle arrest.

Keywords: Apoptosis; Cancer therapy; Cell cycle arrest; Nuclear medicine; Selective radionuclide therapy; β-radiating radionuclides.