Meetings International
SciTechnol

J Diagn Tech Biomed Anal 2018, Volume: 7
DOI: 10.4172/2469-5653-C1-012

International Conference on

NUCLEAR MEDICINE AND RADIATION THERAPY

July 16-17, 2018 | Madrid, Spain

In vitro cell studies using radiolabelled compounds – To study the biological effects of Auger electrons emitted by ^{123}I

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Auger electrons have a low energy and a very short range in the order of nanometres in tissue. This study uses ^{123}I-labelled compounds to test the effectiveness of Auger electron emitting ^{123}I to kill tumour cells with different sensitivity to photon irradiation.[1] Owing to its structural similarities to the DNA base pair thymidine, deoxyuridine was selected as the compound of interest as it can enter cells and can be incorporated into newly synthesised DNA. Thus, allowing the Auger electrons to invoke high-LET radiation damage to the DNA. A stannylated deoxyuridine was prepared from 5-iodo-2'-deoxyuridine using a Pd(0) mediated reaction. The radiolabelled compound was synthesised via a nucleophilic aromatic substitution reaction using a tin/iodine exchange protocol. This resulted in a specific activity of 1.4 mCi/mL for ^{123}I-deoxyuridine ($^{123}IUdR$). To determine the biological effects of Auger electrons, isolated human T-lymphocytes (stimulated and unstimulated) were pulse labelled with $^{123}IUdR$ in order to observe its specific uptake. A clear linear uptake pattern was noted in the stimulated samples with an increase in the amount (µCi) of $^{123}IUdR$ added. Following the same pulse labelled method, cellular radiation damage was determined in BM1604 and CHO-K1 cell lines by analysing the micronuclei formations in binucleated cells with fluorescence microscopy. From these results, it was noted that there was an increased specific uptake in the CHO-K1 cell line, due to its higher potential doubling time. This result indicates that there is a direct correlation between the uptake and the number of cells in the S-phase (synthesis phase) of the cell cycle. It is further noted that the increase in micronuclei formation is not proportional to the change in the S-phase fraction, which is a result of the different inherent radio sensitives of cell types used in the study.

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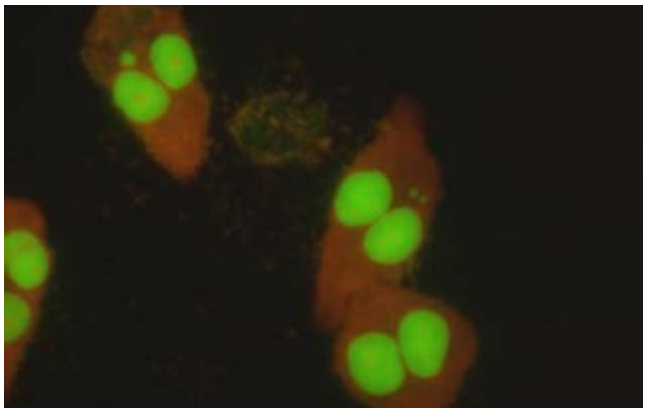

Acridine orange stained binucleated cells showing micronuclei formation.