

Alpha Therapy with ^{225}Ac Actinium Labeled Prostate Specific Membrane Antigen: Reporting New Photopeak of 78 Kilo-electron Volts for Better Image Statistics

Sir,

Recent work has shown that Alpha-emitting radioisotope Actinium-225 (^{225}Ac) appears more effective than other radionuclides due to better half-life and targeted radiolabeling.^[1,2] Limited imaging data are available on the posttherapy imaging using ^{225}Ac labeled prostate-specific membrane antigen (^{225}Ac -PSMA) radioligand therapy in metastatic castration-resistant prostate cancer.^[3] The count rate or imaging statistics can be used to enhance the image quality in posttherapy ^{225}Ac images to have a better image contrast for assessment of tracer localization in the target/metastatic lesions. Moreover, high image count rate is also helpful in dosimetry calculations and assessment of *in-vivo* biodistribution. Current literature suggests clinical imaging using two photopeaks 440 kilo-electron volts (KeV) (26.5% of ^{213}Bi decays to give 440 KeV) and 218 KeV during ^{225}Ac -PSMA therapy.^[4] However, during our initial study of ^{225}Ac gamma-ray spectrum, it was noted that ^{225}Ac has a third notable photopeak of 78 KeV [Figure 1], which shows higher share of photon abundance than the rest of the photopeaks, that is, 440 KeV and 218 KeV. The effective imaging potential of each peak was studied with hot-rod phantom [Figure 2] using medium energy collimator as per recommendations for ^{225}Ac quality control. The results showed that 78 KeV peaks have significant count statistics for imaging [Figure 2b] when compared to prior recommended photopeaks as shown in Figure 2c. The images acquired with addition of 78 keV photo peak has better count statistics than the images taken with only two photo peaks of 440 KeV and 218 KeV. The technetium-99m phantom images were also acquired, as for

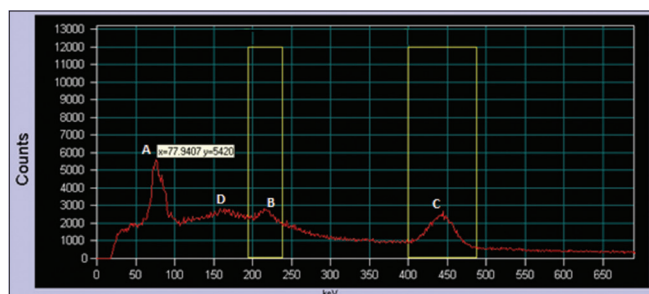


Figure 1: Gamma ray spectrum of ^{225}Ac labeled prostate specific membrane antigen-617 showing multiple photo peaks in red. (A) Photo peak of 77.94 kilo electron volts, (B) Photo peak of 218 kilo electron volts in yellow box, (C) Photo peak of 440 kilo electron volts yellow box, (D) Bremsstrahlung peak (very low abundance which is not suitable for imaging). Currently, the literature recommends ^{225}Ac imaging using two photo peaks, that is, 440 kilo electron volts and 218 kilo electron volts. However, it is appreciable that there is a third significant peak of 77.9 kilo electron volts which has a significant count density

exemplary image of high counts for visual comparison with ^{225}Ac images as shown in Figure 2a.

Posttherapy images are a potential source of quality control to confirm the localization of ^{225}Ac -PSMA-617 in the target metastatic sites; therefore, posttherapy imaging has vital place in the management of cancer patients, especially to differentiate posttherapy flare from other possible systemic adverse effects after radionuclide therapy and to calculate organ dosimetry wherever required. It is, therefore, suggested that photopeak of 78 KeV may be included in the imaging of ^{225}Ac -PSMA-617 therapy to get better image quality and to perform better statistical analysis.

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Nil.

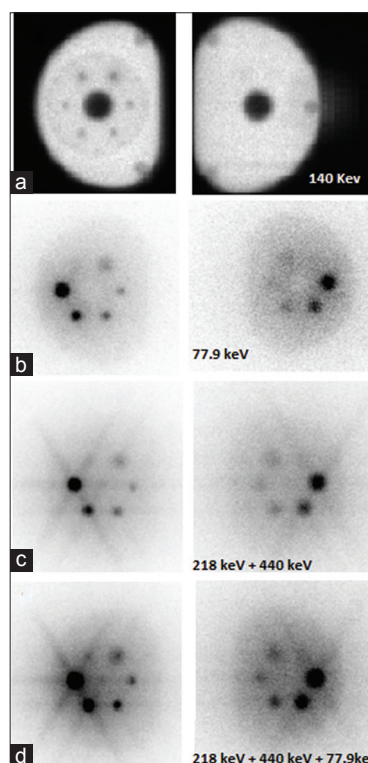


Figure 2: Phantom study of ^{225}Ac labeled prostate specific membrane antigen-617 showing magnitude and count density of each photo peak. (a) reference Technetium flood showing good count statistics and good image resolution at 140 kilo electron volts, (b) Phantom image with single photo peak of 77.9 kilo electron volts showing significant count density to be used in future actinium-225 imaging, (c) Phantom imaging with two photo peaks (218 kilo electron volts and 440 kilo electron volts), (d) Phantom image showing image of all three photo peaks (77.9 kilo electron volts + 218 kilo electron volts and 440 kilo electron volts)

Conflicts of interest

There are no conflicts of interest.

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