Incidental Change in Photopeak During A Dynamic Renal Scan

Case Report

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INTRODUCTION

Renal scan is one of the common imaging requests in every nuclear medicine center (1-3).

Measurement of renal function is used to make critical clinical management decisions and, as such, their reliability needs to be quality assured (4). Gamma cameras are used for renal scintigraphy which contains energy discriminators that allow only those photons within a specified energy range to be recorded (5). Periodic quality control (QC) of gamma cameras is essential to provide a reliable image. However artifacts are commonly seen in scintigraphy and nuclear physicians should be familiar with different types of artifacts to prevent misdiagnosis. We report a case of spontaneous photopeak shift during acquisition of a dynamic renal scan.

CASE REPORT

A 40 years old man with history of renal transplant was referred to nuclear medicine department for ^{99m}Tc-DTPA renal scan. The scan is performed in anterior view after IV injection of 12 mCi of Tc-99m-DTPA in supine position by a SMV-DSX gamma camera (SMV, France) equipped with a LEPH general purpose collimator. The images performed in two phases: 2sec/view for the first 2 minutes and 60sec/view for the next 40 minutes. The images are recorded in a 128×128 matrix. The perfusion phase is shown in figure 1.

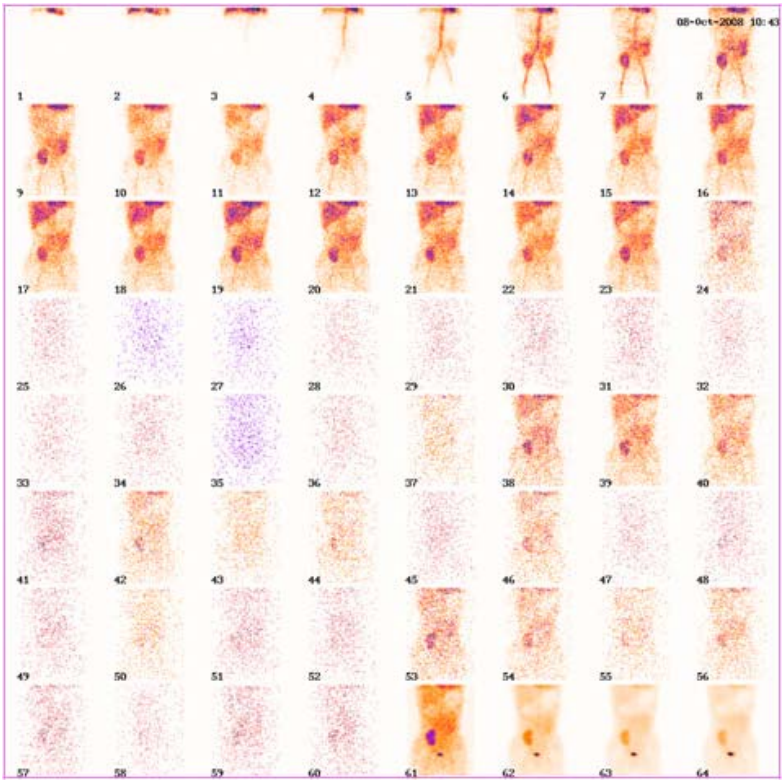

Figure 1. ^{99m}Tc-DTPA renal scan (perfusion phase). Note loss of the contrast in some of the frames

Beginnings from frame number 24, the count in following frames are severely decreased, resulting in complete loss of contrast in some of the frames. Quantitative analysis showed that the total counts are fluctuating in different frames. These fluctuations in count density suggested an unstable system. We checked the software and hardware of the system thoroughly and a malfunctioning hardware which was used for controlling power supply of the system was detected. This malfunctioning hardware was responsible for transient shift of photopeak to lower portion of the energy window and beyond it. As a result only scattered photons were recorded. The hardware was replaced and the system returned to normal function.

DISCUSSION

The performance parameters most commonly evaluated as part of a routine gamma camera QC program include uniformity, spatial resolution, spatial linearity, and energy resolution and peaking (6). Energy peaking is very important and is suggested to be checked every day (6). This test will confirm that the energy window is correctly selected. Off-peak artifacts may significantly degrade image quality in gamma cameras (7). Off-peak artifact is caused by shift of a specified radioisotope photopeak from its real position (7).The optimal shift off-peak is 0%, however in an experiment on static images, off-peaking even in the range of 2-6% significantly decreased the count of the images (7). A loss

in registered count will result in loss of contrast as well.

With transient shift as we had in our system, a static imaging may not be affected if predefined count was set for acquisition. However the required time for acquisition may be increased. On the other hand if predefined time was set for acquisition, the image count will be significantly decreased. In a dynamic scintigraphy, spontaneous and transient shift in photopeak during an acquisition will lead to absent or decreased count on some frames.

In dual head gamma cameras, a spontaneous shift in peak of 1 head may cause even more complicated artifacts in SPECT imaging (5). In one case report, a spontaneous peak shift in one camera head suggested apparent extensive ischemia in a myocardial perfusion SPECT (8). Also review of linogram and sinogram has been suggested as an easy way to detect off-peak artifacts in myocardial perfusion SPECT. These findings emphasize the need for fastidious quality control and raw data cine loop image review for detection of off-peak artifacts.

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