When the Lights Go on Again: An Unusual Problem with a Gamma Camera

TO THE EDITOR: We would like to report a technical problem with a multihead gamma camera exhibiting unusual and apparently random behavior in the location of the energy peak for ^{99m}Tc in 1 of the heads.

The problem arose in a Siemens MS3 (Hoffman Estates, IL) camera after removal of the heads for correction of uniformity problems under warranty. After release of the camera for clinical use by the engineers, the instrument appeared to perform normally. Subsequently, images from head 3 were noted to be count deficient compared with the other 2 heads. When we checked the energy spectrum for this head, we discovered that the ^{99m}Tc peak was displaced downward by about 6% from the center of the energy window. The energy window had been set for each head when the camera was peaked without the collimators, as a part of daily quality control.

When we requested that this shift be corrected, the service engineer checked and adjusted the high tension and then retuned and peaked head 3, after which the camera was declared serviceable and head 3 seemed to be correctly peaked.

Some weeks later, we observed that head 3 was again count deficient. On checking, the peak was again found to be offset from the center by about the same amount. The service engineers followed the same procedure as they had before and were unable to replicate the problem.

This intermittent behavior continued for almost 12 mo, resulting in loss of confidence in any imaging that required the use of head 3. This impacted most heavily on cerebral perfusion imaging, forcing the use of acquisition parameters that did not use this head.

Eventually a different service organization was recruited to solve the problem. This approach was successful. It appeared that for these engineers, the intermittent nature of the problem had become permanent. When they removed the collimators and peaked the camera, each peak was observed to be centered within the window. Immediately after replacement of the collimators, they found that the peak for head 3 was displaced. This effect was repeatable and implied an intrinsic fault in the camera head, rather than in the high tension supply or amplifier chain.

When the original engineers were recalled in expectation of being able to demonstrate the fault that we thought was by now persistent, Murphy's law took over. The camera peaks would not shift. The engineers checked and rechecked every connection and voltage. As they checked the high voltage, we turned on the lights at the rear of the room to improve illumination. As soon as the lights were turned on, the problem manifested itself with a large increase in the dead time for head 3 and a shift in the peak. It indicated that a light leak was the problem, and this was confirmed by further investigation with a torch.

The light seal was reseated in the body of head 3 and checked for patency. The problem with the camera was finally "put to bed with the lights out" after much grief!

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Evaluation of Motion-Correction Techniques in Cardiac SPECT

TO THE EDITOR: We recently reported on a comparison of 4 motion-correction techniques in SPECT imaging of the heart (*1*). In that study, we found that the cross-correlation technique originally described by Eisner et al. (*2*) performed poorly compared with the other techniques evaluated. We recently evaluated a modified version of this algorithm using the same dataset as reported in our study. Briefly, the modified version incorporated 2 significant enhancements over the original algorithm. Rather than performing cross-correlation on the entire image, the user first limits the algorithm to a horizontal band encompassing the myocardium. This band is adjusted so that the myocardium lies within it on all images, which minimizes the impact of noncardiac structures on the cross-correlation between successive images. Second, the modified technique allows the use of any image as the reference image. The original algorithm used the first image of the acquisition (typically at 45° right anterior oblique for a conventional 180° acquisition). This image often contains significant hepatic activity with poor visualization of the myocardium, which can corrupt the algorithm and result in it tracking hepatic activity rather myocardial activity.

For evaluation of the modified cross-correlation technique, data were transferred by Interfile to a Unix system (Powerstation; SMV, Twinsburg, OH). The 6 studies with motion artifact were reprocessed with the modified cross-correlation method in an identical manner to that described in the original study (*1*).

The average absolute error (AAE) in estimating the true location of the heart for the 6 studies was reduced from 0.89 cm for the original cross-correlation method to 0.19 cm for the modified cross-correlation method. The modified cross-correlation method yielded similar results to the 2-dimensional fit method of Cooper et al. (*3*) (this method proved to be the most accurate of the automated methods in our original study, with an AAE of 0.17 cm). Both methods were slightly inferior to manual correction of the data by an experienced technologist (AAE = 0.15 cm), although the differences were small. We believe that the increased availability of accurate motion-correction methods is an important factor in improving the overall quality of cardiac SPECT studies. For anyone interested in evaluating new or enhanced motion-correction techniques, we would be happy to make available copies of the motion artifact studies used in our study (Interfile format).

REFERENCES

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