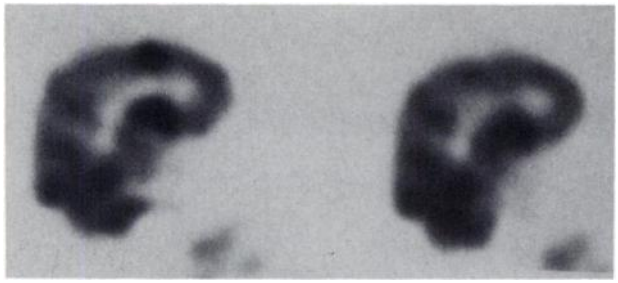

FIGURE 1
Sagittal slice from an HM-PAO brain SPECT study obtained using a conventional uniformity correction map (left image) and a zoomed correction map (right image). Note the presence of a hot spot in the superior cerebral cortex and increased activity in the basal ganglia due to ring artifacts (left image).

the 90-million count flood exhibited the same hot spots seen in the original reconstruction, while data reconstructed using the zoomed flood was free of such hot spots.

Examples of these hot spots are shown in Figures 1 and 2. In each case, the image obtained using the conventional unzoomed correction map is shown along with the artifact-free image generated with the zoomed correction map. In both cases, the artifacts are severe and very misleading and do not resemble the classic ring artifact appearance often shown in textbooks. These findings were confirmed by analysis of a tomographic study obtained with a commercial SPECT phantom. This study was acquired in an identical manner to the brain SPECT studies.

From the above, it is apparent that there is an error in the application of the uniformity correction map to projection images obtained using zoom and offset. This is a potential problem as the technique used for brain SPECT studies is that recommended by the manufacturer; hence, there is the potential for artifacts to be present in many clinical brain SPECT studies being performed in the U.S.

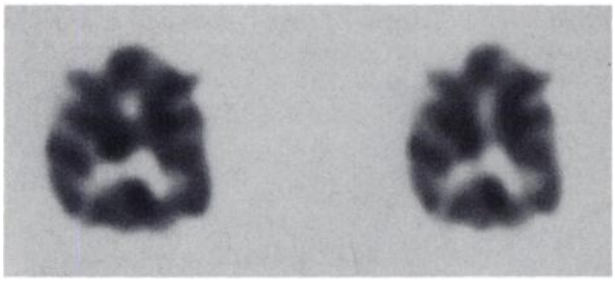

FIGURE 2
Transaxial slice from HM-PAO brain SPECT study obtained using a conventional uniformity correction map (left image) and a zoomed correction (right image). Note distortion of the left-to-right ratio of activity in the basal ganglia of the left image.

For future studies, the problem can be overcome through the use of a uniformity correction map acquired using the same zoom and offset parameters as used for the brain SPECT studies. For previous studies, it may not be possible to apply a new uniformity correction in all cases due to subtle variations in gamma camera/collimator uniformity over time. However there are two simple checks that can aid in identifying potential artifacts in brain SPECT studies:

1. Display the transaxial slices and place a mark at the center of the image matrix. Ring artifacts will be concentric with the center of rotation which should lie within ±1 pixel of the center of the matrix. Hot or cold lesions in this location should be viewed with suspicion.
2. Reprocess the projection data without any flood correction. While this will introduce some small ring artifacts, in our experience these are of smaller magnitude than those created by the interpolation error. If a hot or cold area near the center of the matrix is significantly changed in intensity, it should be interpreted as a possible artifact.

Little has been written about the validity of the uniformity correction process, particularly in the case of zoomed acquisitions—although most commercial SPECT systems offer this capability. Institutions using this type of zoomed acquisition need to check the validity of the uniformity correction process, especially if it involves interpolation of an unzoomed uniformity correction map. To perform this check, acquire images of a uniform cylinder of activity, using similar parameters to those used for a clinical SPECT study employing zoomed acquisition. Reconstruct the study with both conventional and zoomed uniformity correction maps and compare the two sets of transaxial images to verify that interpolation of the conventional correction map is being performed correctly.

Michael K. O'Connor
Mayo Clinic
Rochester, Minnesota

REPLY: We appreciate Dr. O'Connor's efforts in bringing this problem to our attention. He is correct in his observations and conclusions. The problem has been traced to a software bug causing misregistration of the acquired views with the uniformity correction map, when zoom and offset are used in the acquisition.

A detailed notice has been prepared on the proper procedure for avoiding this problem. It will have been sent to all GE SPECT customers before publication of this letter. A correction of this problem will be included in the next software release.

Tsur Bernstein
GE Medical Systems
Milwaukee, Wisconsin