Case Report

Tc-99m ECD 뇌혈류 SPECT 시행시 부적절한 영상획득 모수에 의한 인공산물

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An Artifact Caused by Using the Inadequate Acquisition Parameter in Tc-99m ECD Brain Perfusion SPECT

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Although artifacts in tomographic imaging can arise from a number of sources, this case presents an artifact caused by using inadequate acquisition parameters which do not match the collimator with which a camera equipped in Tc-99m ECD brain SPECT. Whenever the collimator in tomographic studies is changed, we should take care to use suitable parameters of acquisition protocol according to the collimator with which a camera is fitted. Other ways to prevent an error of this type is to use a point source.(Korean J Nucl Med 38(6):540-542, 2004)

Key Words: Artifact, SPECT, Brain, Tc-99m ECD

It is well known that the common causes of artifacts in brain perfusion SPECT are related to camera uniformity, center of rotation, the patient's motion and foreign bodies. However, these can be well recognized and avoided. We report a case in which the interesting artifact can be caused by using the inadequate acquisition parameter.

Case Report

A 16-year-old boy underwent brain single photon emission computed tomography (SPECT) for the evaluation of an organic brain disorder caused by a traffic accident. The patient was scanned after an intravenous injection of 740 MBq (20 mCi) of Tc-99m ECD. Imaging was initiated approximately 30 minutes after injection and was performed using a dual head gamma camera (MS2, Siemens, Germany) equipped with a low energy high resolution (LEHR) collimator and 80 projections were obtained over a 360° total rotation. The time per projection was 20 seconds resulting in a total scan acquisition time of 15 minutes. The image data were stored into a 256 256 matrix. Filtered back projection reconstruction was performed using a Butterworth filter (frequency cut off value 0.4, order value 1). The Chang's attenuation correction algorithm was employed. The reconstructed images we obtained were so blurred that we could not interpretate them (Fig. 1). It was then noted that the parameters of the acquisition protocol we used did not match the collimator with which the camera was equipped. The brain SPECT images were obtained using an acquisition protocol predefined with fan-beam parameters even though we used a gamma camera equipped with an LEHR collimator. The computer did not recognize the data as LEHR during the acquisition.

After 2 days, a second image was obtained from the same patient. This time we used a gamma camera equipped with an LEHR collimator and an acquisition protocol predefined with LEHR parameters, which enabled us to obtain satisfactorily reconstructed images demonstrating sharp and detailed delineation in accordance with a person of the same age (Fig. 2).

• **Received**: 2004. 10. 14. • **Accepted**: 2004. 11. 9.
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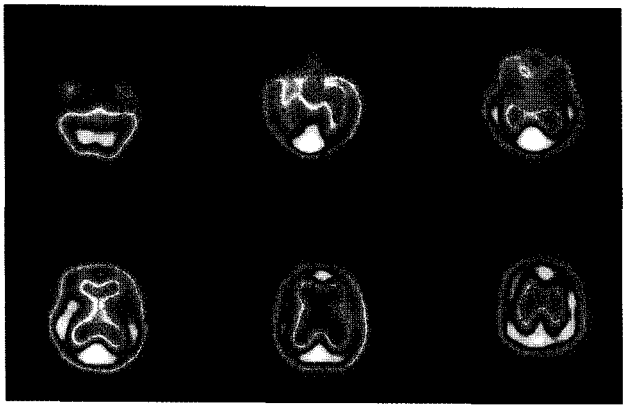

Fig. 1. The reconstructed transaxial images obtained with fan-beam protocol are so blurred that we can not interpretate them because the parameters of acquisition protocol (fan-beam) do not match the collimator (low energy high resolution) that a camera is equipped with.

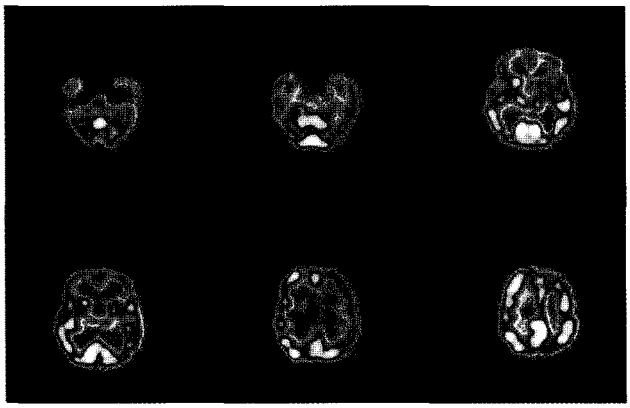

Fig. 2. The reconstructed transaxial images demonstrate sharp and detailed delineation because the parameters of acquisition protocol (low energy high resolution) accord with the collimator (low energy high resolution) that a camera is fitted with. Transaxial images show decreased activity involving the left temporal region.

Discussion

Several reports have addressed SPECT artifacts.[1-9] Generally, SPECT artifacts are related to various causes to be well recognized and avoided. Now and then, artifacts can be caused by a simple technologist's mistake as in our case. A brain SPECT artifact made by a technologist's error from a triple-headed camera was reported by Zhang JJ et al.[6] During the studies, one of the three detector heads was mismounted with a general, all-purpose collimator instead of the ultrahigh-resolution collimator. This resulted in a false cerebral blood flow defect. Hackett et al.[7] reported that on patients having metallic cranioplasty after head trauma, radiopaque metallic plates in brain SPECT studies caused an increased activity artifact at the periphery of the photon-deficient area. A similar brain SPECT artifact caused by a metallic plate can be seen in the case presentation by Boren et al.[8] Attenuation made by skull thickness or holders of a scan table will also cause brain SPECT artifacts.[9] Other factors including temperature and adjacency to other sources of radiation or electromagnetic fields can potentially cause artifacts in brain SPECT studies.

As fan-beam collimators are coming into widespread use in brain studies, we have also begun using them but because of the alignment error in the fan-beam collimator cart during our initial scan, we had to use a camera equipped with an LEHR collimator in brain SPECT. However, we had a habitual mistake using the acquisition protocol predefined with

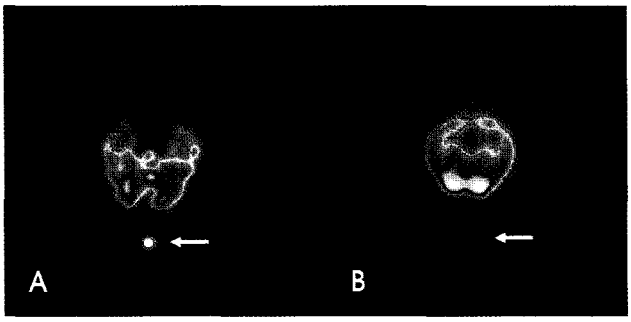

Fig. 3. The reconstructed transaxial image (A) of a point source (arrow) and brain shows sharp and detailed delineation because the parameters of acquisition protocol (low energy high resolution) accord with the collimator (low energy high resolution) that a camera is fitted with. The reconstructed transaxial image (B) of a point source (arrow) and brain shows marked distortion because the parameters of acquisition protocol (fan-beam) do not match the collimator (low energy high resolution) that a camera is equipped with.

fan-beam parameter. The computer recognized the data as fan-beam. This lead to highly distorted images. When we used the LEHR collimator, the effect of use in the fan-beam parameter resulted in changes of the tomographic images. Whenever the collimator in tomographic studies is changed, acquisition protocol must be set carefully using suitable parameters in accordance with the collimator with which a camera is equipped. Other ways to prevent an error is to use a point source. The changes in the resolution of a point source mean the distortion of reconstructed images in brain SPECT (Fig. 3). To observe the changes in the resolution of the point source enables us to avoid a mistake.

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