Effect of Mobile Cell Phone Ringing on Function of Gamma Camera

Zahra Azizmohammadi, MD, Nastaran Baharfar, MD,* Hamid Javadi, MD,† Babak Shafiei, MD,* Sareh Delavari, MD,* Ali Akbar Babaei, MD,* Abdolmohsen Ahmadi, MSc,‡ Majid Assadi, MD,§ and Isa Neshandarasli, MD**

Abstract: After the start of renal scintigraphy in a 32-year-old woman, there was an abnormal view in frame 6 that was simultaneous with the start of ringing of a mobile cell phone that was in the patient's trousers pocket. In frame 6 of the flow phase, some bright dots were observed, suggesting photomultiplier tubes. Immediately after that frame, in spite of continued ringing of the mobile cell phone (up to 1–2 minutes), the imaging frames came back to a normal situation. In the case, electromagnetic interference from the mobile cell phone may disrupt the photoelectric functioning of photomultiplier tubes during scintigraphy.

Received for publication February 24, 2011; revision accepted June 13, 2011.

From the *Department of Nuclear Medicine, Taleghani Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran; †Golestan Research Center of Gastroenterology and Hepatology (GRCGH), Golestan University of Medical Sciences (GUOMS), Gorgan, Iran; ‡Telecommunication Company of Bushehr, Bushehr, Iran; and §The Persian Gulf Nuclear Medicine Research Center, Bushehr University of Medical Sciences, Bushehr, Iran.

Conflicts of interest and sources of funding: none declared.

Reprints: Majid Assadi, MD, The Persian Gulf Nuclear Medicine Research Center, The Persian Gulf Biomedical Sciences Institute, Bushehr University of Medical Sciences, Boostan 19 Alley, Sangi Street, Bushehr, Iran. E-mail: assadipoya@yahoo.com or asadi@bpums.ac.ir.

ISSN: 0363-9762/11/3612-1131

Key Words: mobile cell phone, photomultiplier tube (PMT), electromagnetic frequency, photoelectric effect

(*Clin Nucl Med* 2011;36: 1131–1132)

REFERENCES

1. Dubey RB, Hanmandlu M, Gupta SK. Risk of brain tumors from wireless phone use. *J Comput Assist Tomogr*. 2010;34:799–807.
2. Takebayashi T, Varsier N, Kikuchi Y, et al. Mobile phone use, exposure to radiofrequency electromagnetic field, and brain tumour: a case-control study. *Br J Cancer*. 2008;98:65207–659.
3. Roncali E, Cherry SR. Application of silicon photomultipliers to positron emission tomography. *Ann Biomed Eng*. 2011;39:1358–1377.
4. Habte F, Foudray AM, Olcott PD, et al. Effects of system geometry and other physical factors on photon sensitivity of high-resolution positron emission tomography. *Phys Med Biol*. 2007;52:3753–3772.
5. Bousselham A, Barrett HH, Bora V, et al. Photoelectron anticorrelations and sub-Poisson statistics in scintillation detectors. *Nucl Instrum Methods Phys Res A*. 2010;620:359–362.
6. Ziegler SI, Pichler BJ, Boening G, et al. A prototype high-resolution animal positron tomograph with avalanche photodiode arrays and LSO crystals. *Eur J Nucl Med*. 2001;28:136–143.
7. Zhang H, Vu NT, Bao Q, et al. Performance characteristics of BGO detectors for a low cost preclinical PET scanner. *IEEE Trans Nucl Sci*. 2010;57:1038–1044.
8. Baron AQ, Kishimoto S, Morse J, et al. Silicon avalanche photodiodes for direct detection of X-rays. *J Synchrotron Radiat*. 2006;13:131–142.

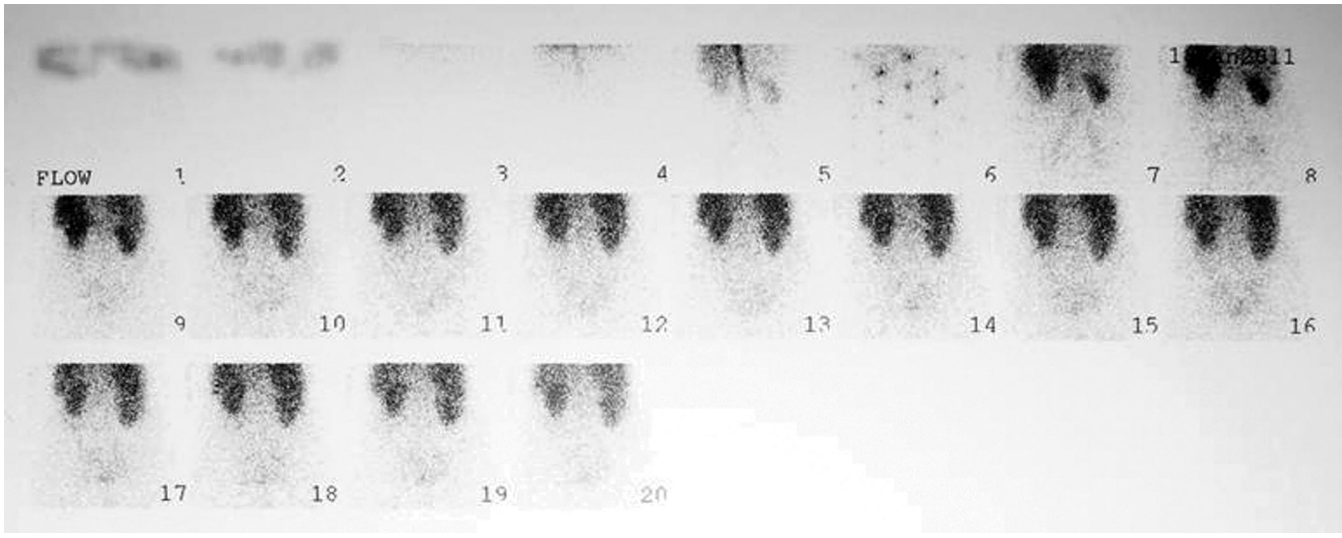

FIGURE 1. A 32-year-old woman was referred to our department with a recent onset of hypertension suspicious for renovascular hypertension. The patient underwent renal scintigraphy following intravenous administration of Tc-99m-ethylenedicysteine while lying on a bed in the supine position. Scans were performed using a single-head ADAC camera (ADAC SH Genesys Epic, Milpitas, CA) equipped with a pair of low-energy, high-resolution collimators, and frames were recorded with an online computer, initially at 3 seconds for 1 minute and then at 10 seconds for 29 minutes. After the start of scanning, there was an abnormal view in frame 6 that was simultaneous with the start of ringing of a mobile cell phone that was in the patient's trousers pocket. In frame 6 of the flow phase, some bright dots were observed, suggesting photomultiplier tubes (PMTs). Immediately after that frame, in spite of continued ringing of the mobile cell phone (up to 1–2 minute), the imaging frames came back to a normal situation. This test was repeated in other patients during the same acquisition and also with flood source images and collimator off state, but there was no abnormality in the images, suggesting this experience is not a reproducible phenomenon.

In the presented case, the radiofrequency energy from the mobile cell phone that created electromagnetic interference may disrupt the photoelectric functioning of PMT during scintigraphy. The aforementioned gamma camera had 55 PMTs.

Electromagnetic frequency of mobile cell phones is collected from an electric field produced by divergences in voltage and a magnetic field produced by the flow of current; this electromagnetic frequency is in the microwave range.[1,2] The system for mobile communications cell phones develops at a frequency of 900 or 1800 MHz, which is maximized during ringing and talking.[1]

On the other hand, photomultipliers (PMs) are used in scintillators to discover nuclear and particle radiation and are particularly sensitive to light in the ultraviolet, visible, and near-infrared ranges of the electromagnetic spectrum.[3,4] The role of PMs is first, the determination of photoelectric effect, and second, the detection of secondary emission.[5,6] In addition, strong magnetic fields result in damage to the normal function of PMs and is greater in those with large distances between the photocathode and the first dynode.[7,8]

Cameras manufactured in the late 1980s already have the PMT well shielded by mu-metal to eliminate interference from the Earth's magnetic field during single-photon emission computed tomography.[7]

In this case, the cell phone intensity was much greater than the Earth's magnetic field that the mu-metal shields were designed for.