Is CT imaging a risk to ICD patients?

Yusaku Nishikawa
Akio Yamazaki
Kou Takahama
Yuma Tumagari
Takehiro Gotoh
Masayuki Tomita
Tatsuhiko Hakumae
Takashi Sasou
Masako Yamada

Introduction: It has been said that a computed tomography (CT) scan of the Implantable Cardioverter Defibrillator (ICD) in patients might cause inappropriate tachycardia detection by over sensing and irradiated X-rays the body implantation site. Therefore there were instructions from Pharmaceuticals and Medical Devices Agency (PMDA) to turn off the tachycardia detection function during testing. As a result we are present at all chest CT scans of ICD patients turn off the detection function during a scan. However, the chance of miss diagnosing even if keeping also the tachycardia detection function turned on is very slim.

Methods: Five ICD model were used from five manufacturing companies sold in Japan. The CT scanner Aquilion ONE (CANON medical systems) was used. The ICD was connected to a false heart potential generator, and attached stuck to chest of a human body simulation model. The detection setting of the tachycardia was set at the maximum sensitivity. A scan was carried out in the range of 16cm from the center of ICD. The tube voltage is 80, 100, 120, 135 kV, the tube current is 50, 150, 250, 350, 450, 550 mA, and the rotation time is 0.35, 0.4, 0.5, 0.75, 1.0, 1.5 sec. CT imaging was performed five times at each setting to observe the result.

Result: In all scans, there was no miss diagnosing. There was also no the record of the tachycardia detection by noise corruption.

Conclusion: When X-rays are irradiated in a Complementary Metal Oxide Semiconductor (CMOS), the noise by the X-rays of ICD occurs. The possibility that treatment is carried out is extremely slim. This is because X-rays irradiation to the ICD body is over early than it leads to treatment by the CT scan. On the one hand the risk to turn off a tachycardia detection function is present when arrhythmia occurred during a CT scan. For example, a judgment that the patients whom spontaneous termination is got from by the long detection establishment discontinue testing and shift to treatment is difficult. Also, we may defibrillate it if ventricular tachycardia occurs during a CT scan even if anti tachycardia pacing (ATP) is effective. Because width of a mechanism and the setting of the detection varies according to a model, the investigating with other models is necessary, but it is thought that it does not have to necessarily turn off a tachycardia detection function.