

中文題目：心臟再同步化治療(CRT)患者受經皮式電神經刺激復健器材(TENS)訊號干擾而產生之暫時心跳停止-個案報告

英文題目：Transient Ventricular Asystole During Physiotherapy Using Transcutaneous Electrical Nerve Stimulation in a Patient with Cardiac Resynchronization Therapy Device

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Introduction: The development of modern technology such as smartphones, wireless communication systems, or even electric massager makes our life more convenient and improves our life quality. However, potential interference between implanted cardiac devices and electromagnetic fields is an important concern for patients with implanted devices and physicians who take care of these patients. Electromagnetic interference(EMI) may be radiated or conducted and may be present in many different forms including radiofrequency waves, microwaves, ionizing radiation, acoustic radiation, static and pulsed magnetic fields, and electric currents. Clinicians caring for implanted cardiac device patients are frequently asked questions concerning electromagnetic interference (EMI) sources and the devices.

Case presentation: A 57-year-old male with underlying diseases of hypertension and old stroke, had a DDD pacemaker implanted in 2005 for complete AV block. After more than a decade of cardiac pacing, he developed heart failure progressively with reduce left ventricular ejection fraction (LVEF 14%) . After excluding other possible causes of heart failure, he was considered to have pacing-induced cardiomyopathy. His DDD pacemaker was eventually upgraded to a cardiac resynchronization therapy (CRT) device in 2020 due to worsening of heart failure symptoms despite medical therapy. He was able to return to heavy work after CRT device implanted.

Because of his occupation, he always suffered from low back pain and muscle soreness requiring physiotherapy. Cardiology consultation was advised by physiotherapist because he was noticed to have a transient unawakable episode during electrical stimulation therapy using DYNAPROG 529 for his back pain. The patient thought that he was falling in sleep because of tiredness. Twelve-lead ECG showed satisfactorily atrial sensing and biventricular pacing rhythm. It was surprising that 24-hour Holter ECG which was done afterward disclosed multiple unexplained stimulation spikes with varying stimulation interval. He denied any possible electromagnetic field contact during the Holter ECG recording. CRT device was interrogated to review the device memory, ventricular channels oversensing with pacing inhibition resulting in ventricular asystole was shown in the unawakable period during previous physiotherapy. While we were struggling hard to find out the possible causes of those stimulation spikes recorded on Holter ECG, the patient recalled that he always put a small commercially available transcutaneous electrical nerve stimulator(TENS) in his back pocket during work to relieve his muscle soreness and low back pain. The current output of a TENS was much lower than DYNAPROG 529 used in physiotherapy. Therefore the electromagnetic signals generated by TENS were not sensed by the CRT device, but they could interfere the surface ECG recordings. We demonstrated surface ECG interferences

recorded under different modes of TENS.

Discussion: There are many sources of electromagnetic interference (EMI); however, only a small number of these cause significant problems that need attention. Nevertheless, these significant problems may cause serious consequences, even life-threatening. EMI is of greater concern for a patient who is dependent on paced rhythm because inhibition of the pacemaker by EMI may produce ventricular standstill. Education of the awareness of EMI is important to both the patients with implanted intracardiac device and physicians who take care of these patients.

Conclusion: The potential interference between implanted cardiac devices and electromagnetic interference (EMI) is an important concern for patients with implanted devices and physicians who take care of these patients.