

Electromagnetic Interference of Wireless Local Area Network on Electrocardiogram Monitoring System: A Case Report

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Electromagnetic interference (EMI) can affect various medical devices. Herein, we report the case of EMI from wireless local area network (WLAN) on an electrocardiogram (ECG) monitoring system. A patient who had a prior myocardial infarction participated in the cardiac rehabilitation program in the sports medicine center of our hospital under the wireless ECG monitoring system. After WLAN was installed, wireless ECG monitoring system failed to show a proper ECG signal. ECG signal was distorted when WLAN was turned on, but it was normalized after turning off the WLAN. (**Korean Circ J 2013;43:187-188**)

KEY WORDS: Wireless technology; Electrocardiography.

Introduction

Use of mobile communication devices and wireless data transmission in the hospital environment is increasing.¹⁾ Electric devices such as cellular phones, walkie-talkie radios, wireless local area networks (WLAN), personal digital assistants, and Bluetooth devices can cause electromagnetic interference (EMI).²⁾ Medical device malfunction related to cellular phones has been reported.³⁾ However, reports describing EMI from WLAN on electrocardiogram (ECG) machines in routine clinical practice are limited. Recently, we experienced a case of EMI from WLAN on ECG monitoring system.

Case

A patient, who had experienced a prior myocardial infarction, par-

Received: July 2, 2012

Revision Received: August 24, 2012

Accepted: August 28, 2012

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• The authors have no financial conflicts of interest.

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ticipated in the cardiac rehabilitation program in the sports medicine center of our hospital, under the wireless ECG monitoring system (Quinton Q-Tel Cardiac Rehabilitation Management System, Cardiac Science, Bothell, WA, USA). The patient's ECG signal was transmitted from a transmitter to a receiver at frequency of 2.4 GHz by the system. Five leads were attached to the patient's chest wall for ECG monitoring during exercise. The ECG monitor had shown clear ECG signals until WLAN (SK Telecom, Seoul, Korea) was set up at the sports medicine center. Therefore, EMI from WLAN on ECG monitoring system was suspected. The WLAN signals were transmitted at 100 mW and in the 2.4 GHz frequency bands. Wireless access point was located 2 m apart from the receiver of the ECG monitoring system. A distorted ECG signal was displayed when WLAN was turned on (Fig. 1A). The ECG signal was normalized after WLAN was turned off (Fig. 1B). Abnormal ECG signal reappeared right after turning on the WLAN (Fig. 1C). We concluded that WLAN signal interfered ECG signal. Thus, we removed the WLAN device from the sports medicine center.

Discussion

Mobile cellular phones and other wireless communication devices are widely used by in-hospital care providers.²⁾ It has been recognized that wireless devices can induce EMI that may interfere in the operation of cardiac monitors,⁴⁾ pacemakers,⁵⁾ implantable defibrillators,⁶⁾ and ventilators.⁷⁾ It has been reported that mobile cellular phones produce EMI on modern ECG machines when activated in di-

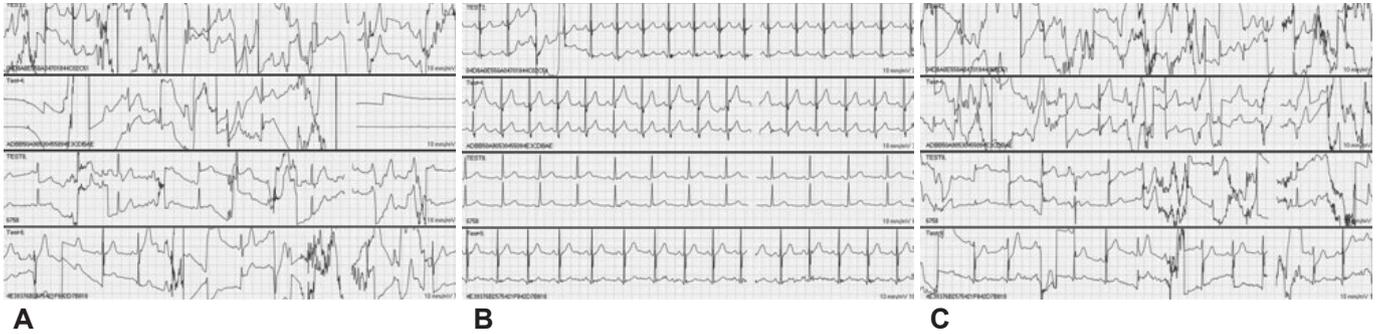


Fig. 1. Electromagnetic interference of wireless local area network (WLAN) on ECG monitor. A distorted ECG signal was displayed on the ECG monitor after placing ECG leads when the WLAN was turned on (A). The ECG was normalized after turning off WLAN (B). The abnormal ECG pattern reappeared right after turning on the WLAN (C). ECG: electrocardiogram.

rect contact to the acquisition module and EMI impairs ECG interpretation.⁸⁾ In addition, it has been shown that magnetic field based wireless auto identification technology produces hazardous EMI in two 12-lead ECG machines.⁹⁾

It has been known that WLAN is far less likely to produce EMI than mobile cellular phones and clinically relevant EMI is very uncommon at distances greater than 1 m.²⁾ In our case, the WLAN signal interfered ECG monitor signal, though wireless access point was located 2 m apart from the receiver of ECG monitoring system. We speculate that EMI occurred because WLAN and ECG monitor operated in the same 2.4 GHz band. A different ECG monitoring system (Philips Medical System, Andover, MA, USA) has been used at the cardiology unit in our hospital. The frequency range of the system allows operation in both the 590–632 MHz and the 406–480 MHz frequency bands. WLAN in the cardiology unit operates in the 2.4 GHz frequency bands. There is no interference between ECG monitoring system and WLAN in the cardiology unit. Therefore, sharing the same frequency band may lead to interference.¹⁰⁾

To our knowledge, this is the first case of EMI from WLAN on an ECG monitoring system in Korea. WLAN is used more frequently than in the past, therefore, EMI from WLAN on medical apparatus should be carefully monitored.

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