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Electromagnetic Interference in a Private Swimming Pool

Case report

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ABSTRACT

Although current lead design and filtering capabilities have greatly improved, Electromagnetic Interference (EMI) from environmental sources has been increasingly reported in patients with Cardiac Implantable Electronic Device (CIED) [1]. Few cases of inappropriate intracardiac Cardioverter Defibrillator (ICD) associated with swimming pool has been described [2]. Here we present a case of 64 year old male who presented with an interesting EMI signal that was subsequently identified to be related to AC current leak in his swimming pool.

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Introduction

CIED implantation (of ICDs and pacemakers) have increased exponentially in the recent years. Approximately 3 million pacemakers and 1 million of ICDs were implanted between 1993 and 2008 [3]. Interference with the normal sensing capabilities of an ICD can lead to delivery of inappropriate shocks which is detrimental to patient's prognosis. EMI from various environmental sources such as airport security checks, Electronic Article Surveillance (EAS) systems, and Tasers are well described [3]. However little is known about swimming pool safety [2]. Electrical currents inside of standard pools originating from sources such as underwater lighting may be misinterpreted by CIEDs as cardiac signals

especially when pools are not properly bonded [4]. Here we present a case of 64 year old male who presented with an interesting EMI pattern when he was in the swimming pool.

Case report

A 64 year old male with past medical history of coronary artery disease, ischemic cardiomyopathy with Ejection fraction of 45%, and sick sinus syndrome presented for an ICD check due to unusual beeping of his device noted 4 days prior to his visit. He was asymptomatic during the episode. He denies chest pain, palpitation, or dizziness during the event. Further questioning revealed that patient was sitting in the swimming pool and talking to his wife.

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swimming pool, the RV lead integrity alert came on in the form of a beeping sound.

We performed some isometric exercises in the clinic and we did not see any noise on the A lead. The last impedance of the A lead was 494 Ω showing a stable trend, therefore no chest X-ray was performed as we did not suspect lead fracture. Upon further inquiry into the incident, we noted that this noise was detected while he was only inside the swimming pool. The patient reported that the swimming pool he was in had underwater lights. We then deduced that the most likely cause of the EMI was a flow of electric current in the water.

Discussion

In this case, the EMI was detected exclusively in the A lead and not in the V lead intermittently. The patient noted the noise alert (corresponding to RV lead integrity warning) and subsequently exited the swimming pool. Fortunately he did not receive a shock as the episodes were very brief and did not meet the V-fib detection criteria. According to an in vivo study by Napp et al., the atrial lead is more susceptible to electromagnetic field in compare to RV lead, leading to inappropriate pacemaker function [5]. Atrial noise may be under recognized especially if no concomitant RV sensing is detected. This may have important clinical impact as this atrial noise often be misinterpreted as atrial arrhythmia and may lead to inappropriate treatment.

It is important to recognize abnormalities detected during device check and always refer to the actual electrogram. This is especially important in pacemaker dependent patient. We should always ask patients where and what they were doing when noise is detected to identify the source of the problem and therefore avoiding unnecessary tests and anxiety.

Our patient was advised to avoid the swimming pool and to have the pool company investigate the current and reinsulate any underwater wires. No further EMI episodes and mode switches were detected by remote telemetry. Our case suggests that the Incidence of EMI in the swimming pool may be more common than reported and that patients receiving CIED

implants need to be made aware of swimming pools as potential sources of EMI.

Conclusion

Our case suggests that many instances of CIED noise and mode switches may be a result of common yet unrecognized sources such as current leak in swimming pools. Our report stresses the importance of counseling patients about potential environmental sources of EMI as a part of post procedure education.

Disclosures

None of the authors have any disclosures.

Conflict of interest

None of the authors have any conflict of interest.

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