Basal Ganglia 6 (2016) 19–22

Contents lists available at ScienceDirect

Basal Ganglia

journal homepage: www.elsevier.com/locate/baga

Interaction between cardiac pacemakers and deep brain stimulation pulse generators: Technical considerations

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ARTICLE INFO

Article history:
Received 21 June 2015
Received in revised form 22 August 2015
Accepted 6 November 2015
Available online 26 November 2015

Keywords:
Deep brain stimulation
Neuromodulation
Cardiac pacemakers
Implantable pulse generators
Parkinson's disease

ABSTRACT

Deep brain stimulators and cardiac pacemakers are well established modalities for movement disorders and cardiac abnormalities respectively. Here, we report our experience with three patients who have cardiac pacemaker/implantable cardioverter defibrillator (ICD) implanted in another facility and presented with both cardiac and neurologic symptoms which required surgical intervention and repositioning of the deep brain stimulator generator. It is essential to keep both devices in separate compartments at a safe distance of more than 6 inches with appropriate programming parameters to avoid interference between the devices. Device interference may result in neurologic or cardiac sequel. DBS can be implanted safely in patients with cardiac pacemakers under strict vigilance.

1. Introduction

With the growing population of aging individuals, the incidence of both cardiac and a variety of movement disorders is likely to increase. Deep brain stimulators (DBS) and cardiac pacemakers are well established modalities for movement disorders and cardiac abnormalities respectively [1–3]. Simultaneous implantation of these biomedical devices may result in interference between these devices with alteration in sensing and programming parameters. There are few cases reporting the implantation of DBS in patients with pacemakers or implantation of pacemakers in patients with coexistent DBS [4–11]. Here, we report our experience with three patients who have cardiac pacemaker/Implantable cardioverter defibrillator (ICD) implanted in another facility and presented with both cardiac and neurologic symptoms which required surgical intervention and repositioning of the deep brain stimulator generator. Interestingly, one of the patients presented with a fracture in his ICD leads which caused neurologic symptoms. Our cases are unique as these are the first reports of interference between DBS and cardiac pacemakers presenting with cardiac and neurological manifestations.

1.1. Case illustrations

1.1.1. Case 1:

A 76 years old male with Parkinson's disease had a left STN DBS implanted by our team 2 years ago, presented to the clinic with severe lightheadedness, headaches and nausea. He was hemodynamically stable and neurologically intact on examination. He had a positive cardiac history of mitral valve insufficiency, congestive cardiac failure, atrial flutter, orthostatic hypotension, obstructive sleep apnea, bradycardia, coronary artery disease and underwent coronary artery bypass with mitral and aortic valve replacement. He reported that two months prior to onset of symptoms, a Medtronic® cardiac pacemaker was implanted in the right subclavicular region, in proximity to the DBS IPG. The pacemaker was placed due to symptomatic bradycardia. The DBS unit was functioning appropriately with normal impedance and intact physical integrity. He was also getting good benefits in terms of optimal control of his Parkinson symptoms with DBS therapy. He was then evaluated by the electrophysiologist and was noted to have elevated sensing thresholds that had been previously programmed to eliminate interference from the DBS. The IPG initial settings were contact 3 positive and contact 2 negative, amplitude 3.3 V, PW 90 ms, and rate of 160 Hz. Lower amplitudes were associated with increased tremor. Higher amplitude were associated with capsular stimulation above 3.5 V. Final settings were contact 3 positive and contact 2 negative, amplitude 3.3 V, PW 90 ms, and rate of 145 Hz. Therapy impedence was 1232 ω and current 41 mA which were within normal parameters. Of note, there were few periods during the programming when he had

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http://dx.doi.org/10.1016/j.baga.2015.11.001
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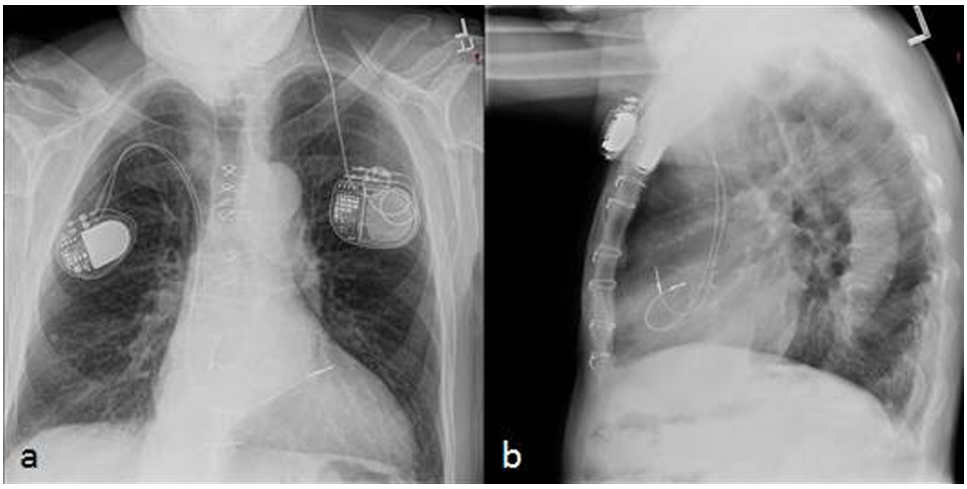

Fig. 1. X-ray chest postero-anterior (1a) and lateral view (1b) shows the position of DBS pulse generator (left chest wall) and cardiac pacemaker (right chest wall). Note the distance between two devices >6 in.

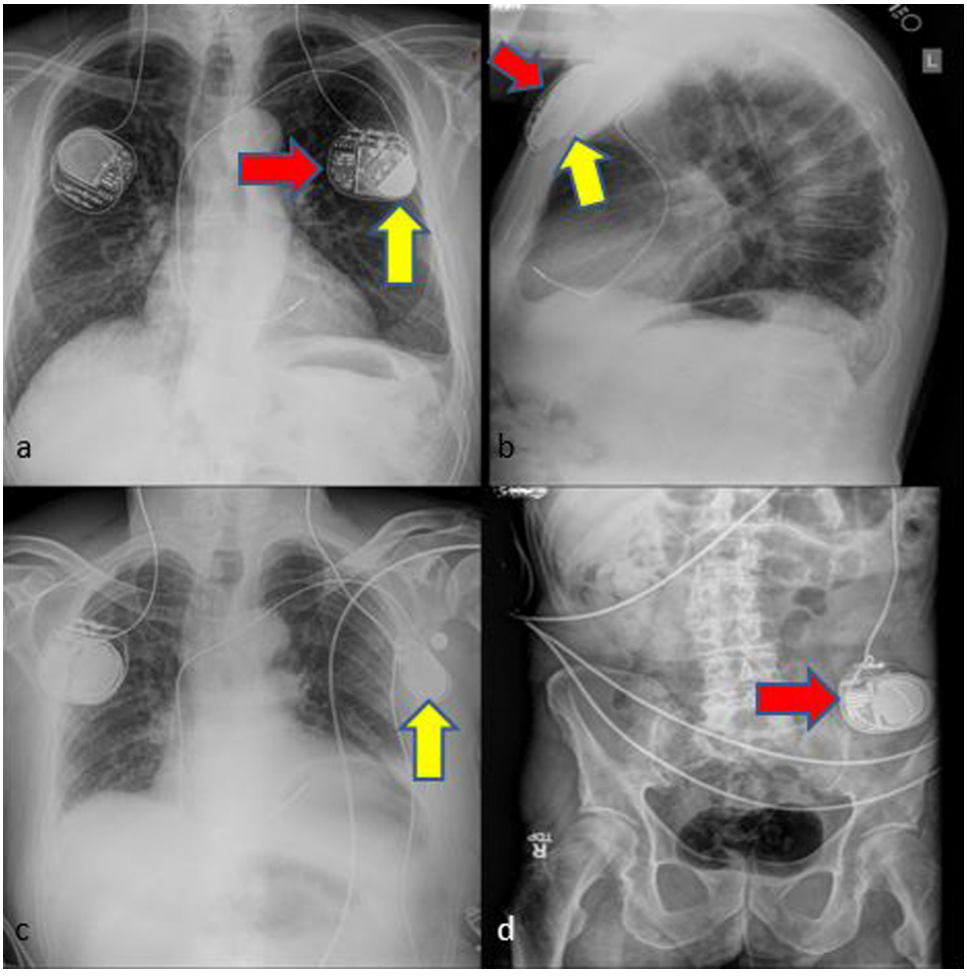

Fig. 2. X-ray chest postero-anterior (2a) and lateral view (2b) shows the position of DBS pulse generators and cardiac pacemaker underlying the left chest wall pulse generator. Fig. 2c and d shows the position of left IPG over the left abdominal wall after repositioning. Red arrow indicates the position of DBS IPG and yellow arrow indicates the positioning of cardiac pacemaker.