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Phrenic Nerve Stimulation: An Unexpected Complication of Implantable Cardioverter Defibrillator (ICD).

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Introduction:

The Implantable Cardioverter-Defibrillator (ICD) is effective in primary and secondary prevention of sudden cardiac death in ischemic and non ischemic cardiomyopathy.[1,2]
ICD has better survival outcome in comparison to antiarrhythmic medications when used in patients with Left ventricular ejection fraction (EF) less than 35%.[3]
ICD can be associated with a variety of complications.
60% of ICD complication is related to the ICD system, which includes lead dysfunction and pulse generator complications.[4]
Diaphragmatic pacing secondary to phrenic nerve stimulation is a rare complication of implantable cardioverter defibrillator (ICD).
Phrenic nerve stimulation has been described to be the result of lead or generator displacement.[5,6]
However, we report 2 patients with ICDs presenting with hiccups and abdominal cramps due to diaphragmatic pacing secondary to phrenic nerve stimulation without lead or generator displacement.

Case series:

Two men aged 86 and 61 years underwent placement of bi-ventricular ICDs for primary prevention of ventricular tachyarrythmias.
Both patients had cardiomyopathy with low ejection fractions (30% and 19% respectively).
ICDs were inserted using the left subclavian vein. The left ventricular lead was positioned at the left posterior epicardial vein.
One patient presented with intractable hiccups and abdominal cramps 3 weeks after the procedure. The other patient presented with only abdominal cramps one day after the procedure.
On physical examination, vital signs were stable, abdominal examination was remarkable for visible and palpable contractions of the upper abdominal wall musculature.
Chest x-ray of both patients revealed the leads to be intact with no displacement. There was no rotation of the generator in its pocket. (Figures 1 and 2)

Figure 1

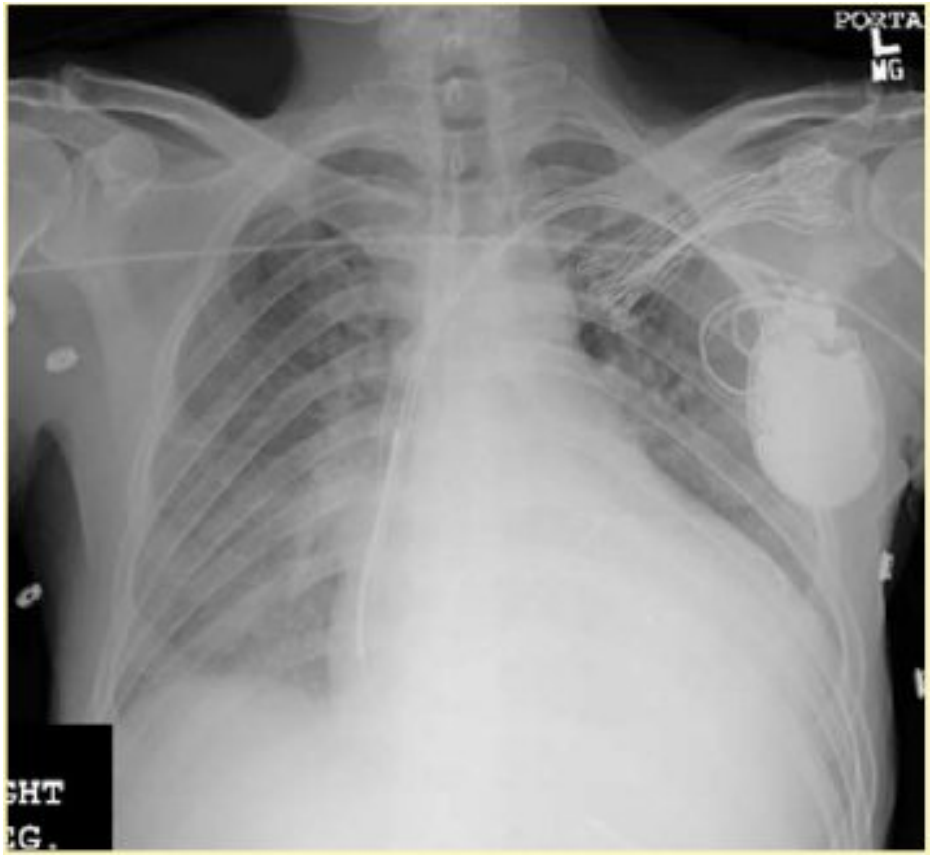

Figure 2

A clinical suspicion of diaphragmatic contraction due to inadvertent phrenic nerve stimulation by the left ventricular lead was confirmed upon ICD interrogation.
Both patients' symptoms resolved immediately after decreasing the amplitude of the left ventricular lead at the bedside non-invasively.

Discussion:

Stimulation of phrenic nerve due to displacement of the lead, known as Twiddler's syndrome, has been well described in the literature.
Twiddler's syndrome, a rare complication of pacemaker and ICD is a result of twisting or rotation of the device in its pocket.[6,7]
It most likely occurs in an elderly and obese patient. The presence of loose subcutaneous tissue allows for more rotation of the device.[8]
Diaphragmatic pacing usually occurs with lead perforation of the right ventricle, however ipsilateral phrenic-nerve stimulation due to Twiddler's syndrome should be considered as a potential cause.[9]

When the leads are dislodged, continuous reeling of the leads around the generator can cause ipsilateral phrenic nerve stimulation. This results in diaphragmatic pacing and the sensation of abdominal pulsations.[6]
The simplest and the most important diagnostic tool is chest X-ray, where the leads can be seen wrapped around the pulse generator.
In the two patients we described above, there was no lead displacement on chest X-ray.
We believe that the anatomical location of the phrenic nerve in relation to epicardial veins makes it susceptible to stimulation by high amplitude of the left ventricular lead even without displacement.[10]
Non-invasively decreasing the pacing output at the bedside can eliminate stimulation of the phrenic nerve and resolve the symptoms.[11]

Conclusion:

Phrenic nerve stimulation after ICD placement is an unusual complication that can be effectively managed non-invasively.

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