DEVICE THERAPY

COMPLEX CASE STUDY

A Rare Complication Following ICD Implant; Can it Happen Twice?

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ABSTRACT. A 70-year-old male with severe ischemic cardiomyopathy had an implantable cardioverter-defibrillator (ICD) placed via the left subclavian vein for primary prevention. Three days later he developed a right-sided pneumothorax, and a right thoracostomy tube was placed with complete resolution. The pneumothorax was believed to be secondary to the atrial lead perforation into the pleural space. A computed tomography (CT) scan did not confirm this finding. Revision of the right atrial lead was not attempted and the patient was discharged home. The patient returned to the emergency room (ER) 5 days later complaining of worsening shortness of breath, neck and facial swelling along with mid-ternal chest discomfort. A CT scan of the chest revealed a right pneumothorax, pneumomediastinum, and severe subcutaneous emphysema in the neck, right shoulder, and right lateral chest wall extending down to the right flank. The right atrial lead of the ICD was protruding into the pleural cavity. A chest tube was placed with relief of symptoms. The atrial lead was then repositioned and the subcutaneous emphysema gradually resolved.

KEYWORDS. right atrial lead perforation, right-sided pneumothorax.

Case report

A 70-year-old male patient with ischemic cardiomyopathy and severely depressed left ventricular function and an estimated ejection fraction of 15% underwent an uneventful implantation of a Medtronic dual-chamber ICD (model D154AWG) and active fixation leads (right ventricle (RV): Medtronic model # 6949–65; right atrium (RA): Medtronic (St. Paul, MN) model # 5076) were implanted using active fixation. No repositioning was required at implant.

Three days later the patient reported to the implanting physician with mild dyspnea and cough. Chest radiography showed a right-sided pneumothorax. A thoracostomy tube was inserted. A computed tomography (CT) scan of the chest was performed to investigate the etiology of the pneumothorax, but the exact position of the tip of the right atrial lead could not be visualized. The study was limited by motion and metallic artifact. The pneumothorax resolved and the chest tube was removed. Follow-up chest radiographs did not show any evidence of recurrence of the pneumothorax. ICD parameters remained within normal limits and were minimally changed from the time of implant and were as follows: RA/RV sensing: 1.7/6.8 mV, impedance: 490/620 ohms and pacing threshold: 0.9/0.5 volts at 0.5 ms; hence, no attempt was made to reposition the RA lead and the patient was sent home.

Five days later the patient presented to the ER complaining of worsening shortness of breath associated with substernal chest discomfort and swelling of the face and neck. On physical examination, the patient appeared in moderate respiratory distress. Vital signs were notable for tachypnea at 20 bpm (breaths per minute.) Subcutaneous emphysema and crepitus was noted at the right lateral chest wall extending down to the right flank and diminished air entry on the right lung field was auscultated.

Chest radiograph revealed no pneumothorax, but severe subcutaneous emphysema on the right and left...
aspects of the neck (more pronounced on right side), right shoulder, and right lateral aspect of chest wall was seen (Figure 1). CT scan of the chest confirmed the plain radiographic findings, and showed a right-sided pneumothorax, pneumomediastinum, subcutaneous emphysema extending down to right flank, and evidence of the right atrial lead protruding outside the cardiac chamber into the pleural space (Figure 2, arrow). A thoracostomy tube was inserted, with relief of symptoms. A single wide-base subcutaneous drain produced gradual improvement of symptoms and of the subcutaneous emphysema. The patient underwent repositioning of the right atrial lead. The pneumothorax resolved and the patient was discharged home. On follow-up visits, the patient remained asymptomatic and the subcutaneous emphysema gradually resolved. Chest radiographs and ICD interrogation were within normal limits (Figure 3).

Discussion
Since the advent of modern ICD leads, the incidence of complications has been reported to be as low as 3.17% in dual-chamber devices implanted in 64,489 patients
and according to a recent report from the National Cardiovascular Data Registry (NCDR) ICD registry. The incidence of pneumothorax accounted for 0.53% of such complications. Indeed, the complication rate and adverse events, driven for the most part by an increased incidence of pneumothorax, was noted to be higher in dual-chamber ICD recipients owing to the need for additional electrode fixation and a possible second venipuncture. Pneumothorax as a result of ICD lead implant is usually an early complication during cannulation of the subclavian or axillary vein and is usually on the ipsilateral side of venous access. Pneumothorax on the contralateral side to the subclavian vein puncture is a rare complication, and we are aware of only four reports of such cases after ICD implant and several for permanent pacemaker implant in which the atrial lead perforated both pericardium and pleura and resulted in a right-sided pneumothorax. Risk factors for this complication include small body habitus, right atrial disease (enlargement), pulmonary disease, chronic steroid use, and overtorquing of the atrial lead by the operator during implantation.

We report the first case of recurrent pneumothorax secondary to right atrial lead perforation after adopting a conservative approach in management as recommended. Asymptomatic right atrial lead perforation is not an uncommon finding, and rarely results in electrophysiologic consequences. The initial chest CT in this patient did not clearly demonstrate protrusion of the atrial lead tip into the pleural space, but was limited due to both metallic and motion artifact. Consequently the lead was not revised as it was felt that lead fibrosis had already begun, there was no persistent air leak, and ICD interrogation revealed unchanged atrial sensing, pacing thresholds, and lead impedance. Nonetheless, the patient had a recurrent pneumothorax. He presented with pneumomediastinum and subcutaneous emphysema, which required immediate intervention to relieve his symptoms. Repeat CT scan of the chest clearly showed the protruding right atrial lead into the right pleural space. The right atrial lead was then promptly repositioned.

In order to maintain AV synchrony, a right atrial lead was placed, as it was noted on an electrophysiology study performed prior to ICD implantation that the HV interval was prolonged. However, it is worth noting that there is no clear indication for placing an atrial lead in up to 60% of patients undergoing dual-chamber ICD implantation, according to the recent NCDR ICD registry. It is not clear if the active fixation method used in our case increased the incidence of lead perforation. Few data are available on procedural and short-term safety of active versus passive fixation leads. A recent interesting retrospective analysis showed similar safety profiles of both leads with a higher atrial lead dislodgment rate for passive fixation leads. Nevertheless, the risk of lead perforation and in-hospital mortality is directly proportional to the number of leads placed.

In a previous report by Sebastian and his colleagues, a clearly defined atrial lead tip position was often difficult to identify because of a movement artifact. In our patient, three-dimensional (3D) reconstruction of the CT images using coronal oblique cuts minimized the metallic and movement artifact and revealed the protruding atrial lead. Device interrogation, echocardiography, fluoroscopy, and recently CT, with possible 3D reconstruction, have been useful modalities aiding identification and confirming the diagnosis of lead perforation complications, including pneumothorax.

As this case demonstrates, detection of contralateral pneumothorax to the site of venous access after pacemaker/ICD placement should prompt consideration of atrial lead perforation. A CT scan with 3D reconstruction may be a helpful diagnostic tool and may assist in determining the need for lead revision. Unless there is a compelling indication for dual-chamber ICD implant, avoiding the additional unnecessary complication risk of an atrial lead is advised.

References

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