Migration of an implantable loop recorder into the pleural space

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Introduction

Implantable loop recorders (ILRs) are most commonly used in patients with unexplained palpitations or syncope as well as suspected or known atrial fibrillation. The device most commonly being used today is the Medtronic Reveal LINQ (Minneapolis, MN); with a volume of <1.2 cc, it is designed for insertion using a greatly simplified technique. Specifically, the ILR is provided preloaded into an insertion tool that is used to deliver the device subcutaneously through a small incision, which is then closed using surgical glue, surgical tape, sutures, or staples.[1] The LINQ Usability study provided first in-human experience in an initial cohort of 30 patients followed for a month.[2] The only remarkable findings were implant site pain in 2 patients and a superficial wound infection in 2 patients. In this case report, we describe a patient in whom the ILR progressively migrated from the subcutaneous into the left pleural space.

Case report

A 78-year-old man with hypertension, hyperlipidemia, and obstructive sleep apnea presented with an inferior wall myocardial infarction. Urgent cardiac catheterization revealed total occlusion of the proximal right coronary artery as well as a 50%–60% lesion in the mid left anterior descending artery and a 60%–70% lesion in the mid left circumflex artery. Percutaneous coronary intervention with stenting of the right coronary artery was performed; the patient was started on aspirin and ticagrelor. After the procedure, the patient developed an episode of paroxysmal atrial fibrillation, which spontaneously terminated within an hour. No further atrial fibrillation was observed during the patient's hospitalization. Although the patient had a CHA_2DS_2-VASc score of 4, there was a desire to avoid adding an anticoagulant in someone already on dual antiplatelet therapy, especially if the episode of atrial fibrillation was a transient self-limited event. As a result, the patient underwent LINQ ILR implantation.

The patient had a height of 1.7 m and a weight of 86 kg, yielding a body mass index of 29.8. The ILR was implanted according to standard implantation technique using local anesthesia. The device was inserted with the insertion tool positioned at a 45-degree angle at the fourth intercostal space approximately 2–3 cm lateral to the sternum. After insertion of the device, the patient complained of some incisional site discomfort. A clean electrocardiographic (ECG) signal was observed; the measured R wave was 3.5 mV. The patient continued to complain of some discomfort at the insertion site the following day. The patient was discharged to home and then seen a week later for a wound check. At that time, the incision had healed, the device could be palpated under the skin at the incision site, and the patient reported no further pain. A clean ECG signal was again observed; the measured R wave was 2.95 mV. A month later, the patient underwent remote monitoring of his ILR and again a clean ECG tracing was recorded (Figure 1). In addition, the patient was seen by his cardiologist, who noted that the patient was feeling well.

On the 35th day following ILR insertion, the patient participated in a session at cardiac rehabilitation without difficulty. However, a few hours later, the patient developed a sudden onset of left anterior pleuritic chest discomfort, accompanied by shortness of breath and diaphoresis. He presented to the Emergency Room, where a chest radiograph revealed that the ILR had migrated into the left pleural space (Figure 2). This was confirmed by chest computed tomography (Figure 3). The ILR could no longer be interrogated with the programmer head.

The patient was taken to the operating room and video-assisted thoracoscopy was performed. A 5-mm port was

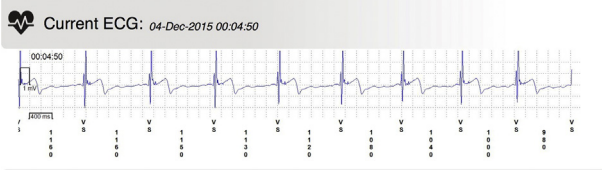

Figure 1 Electrocardiogram recording. This recording was obtained at the patient's remote monitoring session performed a month after insertion of the implantable loop recorder.

KEYWORDS Cardiac implantable electronic device; Complications; Implantable loop recorder; Atrial fibrillation; Anticoagulation
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KEY TEACHING POINTS

- In a patient who complains of excessive pain at time of insertion of a LINQ implantable loop recorder (ILR), physicians should consider repositioning the device.
- In a patient with a normal body mass index, a measured R-wave amplitude $>$ 1.5 mV should raise suspicion of improper device placement.
- In a patient who develops pleuritic chest pain, a chest radiograph should be obtained to assess location of the ILR.

placed posteriorly in the eighth intercostal space. The ILR was identified at the anterior costophrenic angle and was retrieved with forceps. No bleeding was identified within the pleural space. With the scope pointed superiorly and anteriorly there was an area of erythema on the pleural surface in the anterior fourth intercostal space. The patient had an uneventful recovery.

Discussion

The LINQ ILR is supplied preloaded into an insertion device. According to the clinician manual, the implant procedure is intended to deliver the device approximately 10 mm past the incision and 8 mm under the skin.[3] This places the device in the subcutaneous space, above the pectoralis major muscle. In the LINQ Usability study, the mean body mass index for the cohort was 26.7 $\pm$ 4.9 (like our patient) and the implanted depth of the device was 9.1 $\pm$ 6.2 mm.[2] Furthermore, over follow-up, there was minimal migration of the device in the longitudinal, lateral, or rotational directions. We had observed the same in the hundreds of LINQ ILRs we had implanted in our practice, until experiencing this complication.

To our knowledge, this represents the first known spontaneous migration of a LINQ ILR into the left pleural space. We hypothesize that the tip of the insertion tool penetrated the muscle fibers of the pectoralis major and potentially the external intercostal muscle; thus, it is likely that the tip of the ILR was located *below* the muscle. In retrospect, this explains the patient's discomfort at the implant site (which was more pronounced than what we have usually observed) and the relatively large measured R-wave amplitude (most commonly between 0.3 and 1.5 mV). In the LINQ Usability study, the mean R-wave amplitude was 0.584 $\pm$ 0.325 mV; thus, a measured R-wave amplitude of $>$1.5 mV would be more than 3 standard deviations above the mean. Repeated contraction of these muscles probably resulted in the device's eventual migration and erosion into the pleural space over the 35 days following implantation. The development of pleuritic chest pain and the inability to interrogate the device correlated with this migration.

Conclusion

The LINQ ILR has been miniaturized to the point where it can be inserted rapidly and is thus associated with minimal procedural-related complications. We describe a rare instance of a patient in whom the device migrated over a month into the left pleural space. This complication should be considered in any patient with this type of ILR who complains of the sudden onset of pleuritic chest pain.

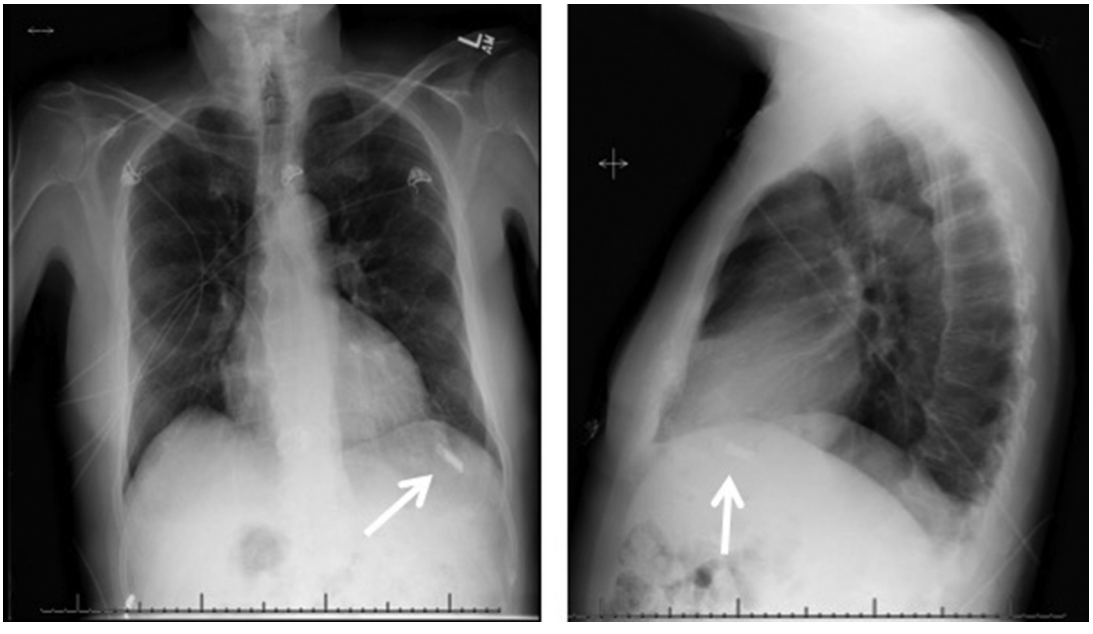

Figure 2 Posteroanterior (left) and lateral (right) chest radiograph showing migration of the implantable loop recorder (*arrow*) into the left pleural space.

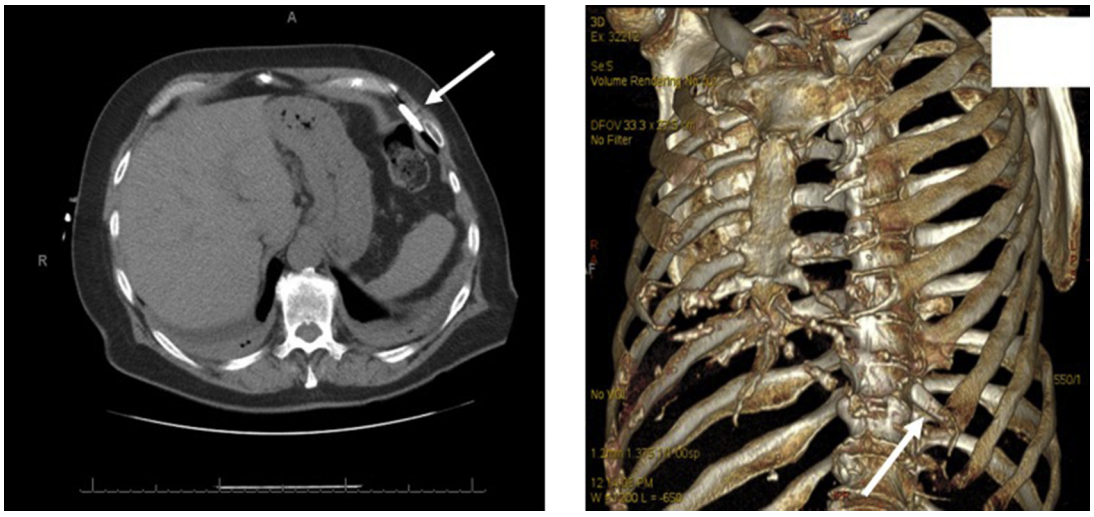

Figure 3 Chest computed tomography. Cross-sectional image (left) and 3-dimensional reconstruction (right) show the implantable loop recorder in the left pleural space.

References

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