

# Long-Range Real Migration of Implantable Cardioverter Defibrillator Lead

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## Abstract

### Keywords

- implantable cardioverter defibrillator
- lead extraction
- transmural migration

The need for pacemaker and implantable cardioverter defibrillator (ICD) lead revisions and extractions is steadily increasing. Despite the lack of representative studies, the risk of lead extraction is frequently considered to be lower than leaving nonfunctional leads in situ.

We report the case of a patient who was referred to our institution for exchange of a malfunctioning ICD lead. The diagnostic work-up revealed a long-segment transmural migration of the ICD lead at the site of the subclavian and innominate vein. Due to the unpredictable risk of vein perforation, we abandoned the extraction procedure.

## Background

The need for pacemaker and implantable cardioverter defibrillator (ICD) lead revisions and extractions is steadily increasing.<sup>1,2</sup> With increasing confidence in lead extraction techniques, the risk of complications when extracting superfluous leads may be considered to be comparable to leaving nonfunctional leads in situ.<sup>1,3</sup> Representative studies are lacking. The reported complication rate associated with these procedures is estimated to be 1.7%.<sup>4</sup> A life-threatening complication during lead extraction resulting in pleural and/or pericardial effusion and tamponade is transmural migration of the lead.<sup>5</sup>

We report the case of a young male patient who was transferred to our institution for ICD lead exchange. Diagnostic work-up revealed a long-segment transmural migration of the ICD lead at the site of the subclavian and innominate vein.

## Case

A 21-year-old male patient with a history of Brugada syndrome (idiopathic ventricular fibrillation) was referred to our institution for right ventricular ICD lead exchange, which had been implanted at the age of 7 years. An ICD lead (Medtronic

Sprint [Minneapolis, Minnesota, United States] [sprint fidelis single coil defibrillation lead 6932]) had been implanted via lateral puncture of the left subclavian vein in Seldinger technique according to the operation record then. He had had a device exchange 6 years later with documented multiple adequate shocks for ventricular fibrillation. Now, 8 years later, he experienced an inappropriate shock due to lead malfunction in consequence of lead fracture. In addition, the ICD battery had reached replacement criteria. The patient presented no further conspicuities; tricuspid valve insufficiency was excluded by echocardiography. With regard to patient age and after balancing the risk/benefit ratio, a lead exchange with removal of the nonfunctional lead was aspired. In preparation for lead extraction, a chest X-ray was obtained (►Fig. 1). Due to the atypical lead position of the stretched transvenous ICD lead suspicious for transmural lead migration, a phlebography was added. Computed tomography was not performed to limit the radiation exposure (►Fig. 2). Phlebography revealed long-segment real transmural migration of the ICD lead at the site of the subclavian and innominate vein. Therefore, we refrained from lead extraction and left the malfunctioning ICD lead in situ (►Fig. 3). The left subclavian vein was punctured laterally under ultrasound control. A new lead was implanted using an introducer

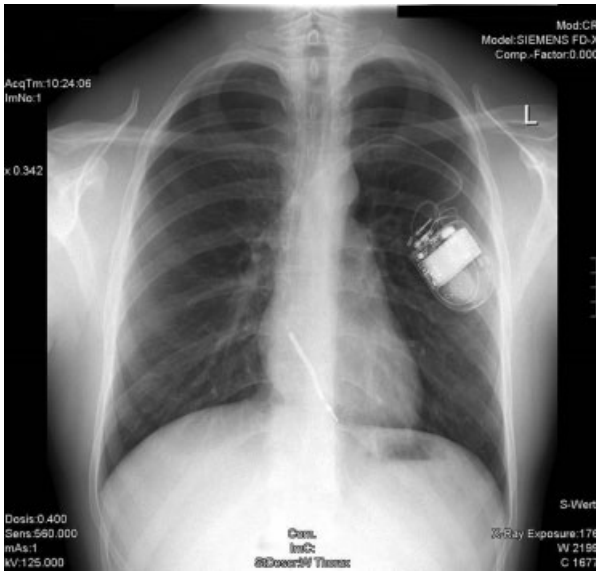
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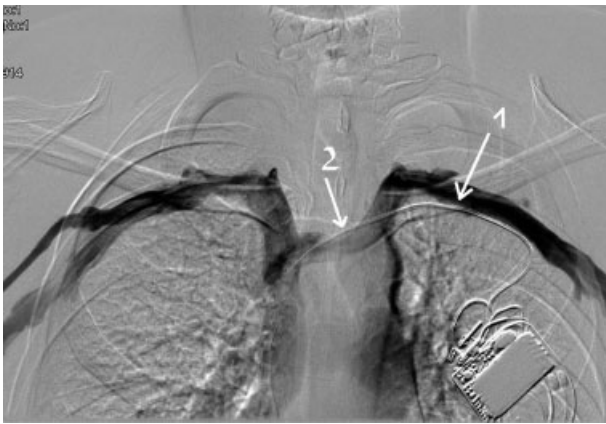
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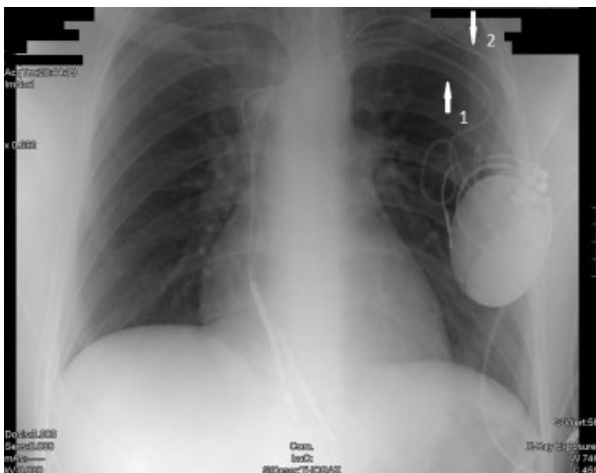




**Fig. 1** Chest X-ray showing malfunctioning ICD lead 14 years after implantation.



**Fig. 2** Phlebography demonstrating long-range migration of the ICD lead at the site of the subclavian vein (arrow 1) and migration of the ICD lead at the site of the innominate vein (arrow 2).



**Fig. 3** Chest X-ray after ICD lead exchange; the old ICD lead (arrow 1) and the new ICD lead (arrow 2) in place.

sheath, and the device was exchanged. Intraoperative testing with a 10-J safety margin was successful. After uneventful surgery, the patient was discharged home 1 day later.

The publication of medical data and images from the patient has been authorized by the patient himself.

## Discussion

In this patient, an ICD lead implanted during childhood came under considerable growth-related tension, which was probably the cause for transmural migration. Relying only on the chest X-ray, replacement of the ICD lead was initially favored with removal of the malfunctioning lead, thus avoiding a nonfunctional lead in situ, particularly in this 21-year-old man. Although the indications for lead extraction are well defined in the Heart Rhythm Society guidelines of 2009,<sup>6</sup> the risk/benefit ratio, respectively, advantages of lead extractions in case of Class II (a/b) indications, and the profit of timely lead extraction in case of technical lead malfunctions without guideline-based indication are yet frequently discussed.

In general, several methods for lead extraction can be employed depending on the indication, time of lead implantation, and the clinical conditions. Leads which had been implanted less than 1 year ago can usually be retrieved by simple traction. In contrast, extraction of older leads usually needs refined techniques including sheaths in combination with a nonlocking or a locking stylet, powered sheaths such as electrosurgical dissection sheaths, mechanical dilator sheaths, and Excimer laser sheaths.<sup>7–9</sup> All these tools are appropriate, but they are also associated with dreadful complications such as perforation of central veins and cardiac cavities.<sup>4,8</sup> Therefore, close attention should be paid to these complications and suitable diagnostic preparations prior to surgery are mandatory to avoid them. For the sake of the patients, lead extraction including powered extraction tools should be performed in specialized centers with adequate experience in lead extraction and complication management. It is reasonable to perform these interventions in a cardiac surgery operation theater, or cardiac surgery should be promptly available.

Externalization and migration of lead conductors in the area of the right atrium, superior cava, and innominate vein have been published, which recently applied to Riata, Kentrox, and Lenox ICD leads (Saint Jude Medical ICD leads Riata 8 French and Riata ST 7 French models, St. Jude Medical, Saint Paul, Minnesota, United States, Biotronic ICD leads Kentrox, BIOTRONIK SE & Co. KG, Berlin, Germany and Biotronic ICD leads Lenox) BIOTRONIK SE & Co. KG.<sup>10–12</sup> In the context of these ICD leads, the term “transmural” concerned the integrity of the lead itself—an extravascular or extracardiac migration of leads or parts of a lead have not been described.

Multiple cases of transmural lead migration have been reported; however, most of them describe a tip penetration into the myocardium.<sup>5,13</sup> Computed tomography well documents the penetrations of the lead tips. Extravascular location of an ICD lead at the site of the innominate vein has been described by Marrazzo et al.<sup>14</sup> So far, true transmural migration of a temporary epicardial lead diagnosed by computed tomography has only been reported once.<sup>15</sup> We omitted

computed tomography to limit radiation exposure. The question as to whether transmural migration is present was adequately answered by phlebography, which presented a long-segment transmural migration of the ICD lead. Certainly, a cephalic vein cutdown could have ruled out any inappropriate lead course in our patient. Marrazzo et al's case showed an extravascular location of an entrapped part of a lead due to the unintentional percutaneous puncture of the innominate vein after piercing the subclavian vein.<sup>14</sup> Yet the course of the old lead topographically compared with the new lead may as well argue against any inappropriate lead course in our patient. Even more, rather the subclavian vein itself has migrated with growth of our patient and has left the stretched ICD lead behind.

Kennergren et al published their single-center experience with a failure rate of 0.7%, a major complication rate of 0.9%, and no extraction-related mortality in more than 1,000 leads, thus indicating that the paradigm of abandoning redundant leads, instead of removing them, should be reconsidered.<sup>1</sup> Yet, a long-segment transmural lead migration in a subclavian or innominate vein as in our case bears incalculable bleeding risks following vessel perforation.

Other arguments favoring lead extraction are venous obstruction and electrical interference. Venous obstruction as a consequence of superfluous leads is speculative, and at least a couple of studies have argued against an increased risk of venous occlusion with multiple leads.<sup>16,17</sup> The fear of electrical interference is unsubstantiated.<sup>18</sup> Having no substantial argument to remove the ICD lead in our patient, we decided to leave the malfunctioning lead in situ. Intraoperative testing of the new device with a 10-J safety margin was successful.

## Conclusion

Long-segment transmural migration of pacemaker and ICD leads may occur in patients growing up. Patients scheduled for lead extraction should be carefully selected, missing investigations should be adequately completed, obscurities eradicated, guidelines reviewed, and risk/benefit ratio should be critically checked before performing lead extraction. This should especially be done in patients who received cardiac implantable electronic devices in childhood.

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