Early sudden distal conductor fracture of a stylet-driven lead implanted for left bundle branch area pacing

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CASE REPORT - Title page

Title

Early sudden distal conductor fracture of a stylet-driven lead implanted for left bundle branch area pacing

Short Title

Lead fracture in Left bundle branch area pacing

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Introduction
Left bundle branch area pacing (LBBAP) is an emerging technique of physiological pacing. It promises to improve clinical outcomes by sparing the decremental effects of right ventricular (RV) pacing 1,2, and to overcome the limitations of His bundle pacing (HBP) like poor pacing thresholds and low RV Sensing amplitudes3. Recently, the Biotronik Solia S60 stylet driven, extendable helix lead delivered via a Biotronik Selectra 3D sheath was described in a case series. In this small comparative study as an alternative to lumen-less fixed helix leads, the stylet driven lead yielded comparable implant success4,5. Adverse events observed with stylet driven leads for LBBAP are scarce. Here, we report a case of a delayed conductor fracture of the stylet driven extendable helix lead Solia S60 (Biotronik) encountered 6 months after LBBAP implant.

Case Report
A 79-year old man presented to his cardiologist with new onset of dizziness and fainting in July 2021. Six months before, the patient had a pacemaker placed in the setting of 3rd degree AV block after TAVR with pre-existing right bundle branch block. For physiological pacing, LBBAP was established using the stylet driven, active helix Biotronik Solia S60 lead delivered via the Biotronik Selectra 3D 55-39 sheath. Implantation was performed as previously described by Huang et al., 2,6 resulting in stable and good pacing thresholds, pacing impedance and sensing amplitudes (0.5@0.4ms; 351Ω unipolar, 526Ω bipolar, 13.5mV; Figure 1A) after a 3rd positioning
The sheath was carefully peeled after retraction of the stylet, and pacing values remained stable. No special occurrences were noted. The procedure duration was 125min (fluoroscopy time 15.3 min, 10ml contrast dye). Pacemaker interrogation 3 month after implantation revealed constant lead parameters (0.6@0.4ms; 351Ω unipolar, 565Ω bipolar 12.8mV).

At presentation at the cardiologist’s office, the ECG showed an intermittent higher degree AV-block. Pacemaker interrogation revealed loss of capture and a lead impedance >2000Ω. At maximum pacing output, intermittent capture was achieved. Chest X-ray revealed no obvious lead anomaly or fracture. The patient was promptly admitted for pacing lead revision.

By fluoroscopy, the lead was in place in the ventricular septum, but a possible conductor fracture was visualized by a suggestive lead movement just before the ring electrode at the entry point into the septum (Figure 2A, 2B, 2C and supplementary video). RV capture could be restored by reinserting a stylet in the pacing lead. The lead was subsequently extracted using the inserted stylet, unscrewing, and slight traction. A new LBBAP lead (Biotronik Solia S60) was inserted as described above in slightly more apical direction with a deeper penetration into the RV septum using a Biotronik Selectra 3D 40-42 sheath, resulting in physiological pacing (Figure 3A and 3B). A detailed investigation of the extracted lead by the manufacturer confirmed the conductor fracture at the described site, possibly provoked mechanically by the septal contractions with every heartbeat. No further damage or lead anomalies were revealed.
Discussion

We present a case of delayed distal Solia S60 conductor fracture 6 months after implant for LBBAP. According to the manufacturer’s performance report 2021, the rate of conductor fractures in Solia leads is low (0.01%). However, the need for lead revision in physiological pacing is a known disadvantage of this technique, especially for HBP (about 4% compared to 0.5% for RV pacing). In most instances, pacing capture loss has been described either within the first 30 days after implant or was accompanied by progressive increases in pacing thresholds.

Implantation of stylet driven lead via curved delivery sheaths for LBBAP is an attractive alternative to the widespread use of lumen-less leads. Due to the additional stylet support, high implant success rates have been reported for LBBAP and HBP. Yet, the Solia S60 lead as used in the presented case comes with a more complex design and has a larger diameter of 5.9 French compared to 4.1 French in lumen-less leads. To date, only limited experience is available informing the performance of the Solia stylet system for LBBAP. In the presented case, the pacing lead was implanted at a depth of less than 12mm, resulting in constant movement of the part between the ring and tip electrodes. Such mechanical stress may have provoked the observed conductor fracture (Figure 1 and Figure 2). Also, the more basal implantation site close to the tricuspid valve, as in the presented case, might have resulted in a higher degree of motion stress on the lead.

According to published data, the mean LBBAP implantation depth, measured by echocardiography, was described as about 14mm. It may thus be speculated that a deeper implantation depth, covering the ring electrode with myocardial tissue, might protect the inter-electrode space and might help avoiding mechanical stress-mediated
lead fracture. Careful clinical observation is warranted to identify an excess rate of lead fractures at the culprit location in patients who underwent LBBAP. Whether this could be a specific problem of stylet-driven leads or might also apply to lumenless leads needs further surveillance. As a perspective, it might be advisable to ensure implantation at an oblique angle for sufficient implantation depth or select patients in whom at least some degree of septal hypertrophy is present to allow for the required implantation depth for stylet driven LBBAP.
**Figure legends**

1. **Figure 1** LAO projection demonstrating implantation depth during contrast dye injection at primary implantation.

2. **Figure 2** (A) schematic structure of the Solia S lead highlighting the conductor breaking point (black arrow); (B) RAO projection demonstrating lead fracture distal to ring electrode (white arrow); (C) image of the explanted lead breaking point marked with white arrow.

3. **Figure 3** (A) LAO projection demonstrating implantation depth during contrast dye injection at lead revision; (B) LBBAP in 12 Lead ECG after lead revision (50mm/s).

**References**


AV dual-stimulierter Rhythmus
Abnormes EKG
wenn verglichen mit dem EKG von 17-FEB-2022 10:17,
Ventr. Frequenz hat sich verringert
UM 15 S/M

50mm/s
10mm/mV
150Hz
9.0.7
12SL
241
Gerät: 46

19-AUG-1943 (78 J.)
Männlich
Zimmer:GF22114
Abt:110

Indikation:
notiz:

A
B

LAO
Key teaching points

- Solia S60 lead conductor fractures can occur after 6 months despite constant parameters at pacemaker interrogation
- An implantation depth of at least 12 mm covering the ring electrode might be advisable to reduce mechanical strain on the lead.
- Early lead conductor fracture can suddenly occur despite uncomplicated implantation procedure