First experience in quadripolar active fixation coronary sinus lead extraction: a case report

Elhosseyn Guella *, Michael Brack, Khalid Abozguia , and Christopher John Cassidy

Cardiology Department, Lancashire Cardiac Centre, Blackpool Victoria Hospital, Whinney Heys Road, Blackpool, Lancashire FY3 8NR, UK

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Background The Attain Stability Quadripolar 4798 lead is a relatively new quadripolar active fixation coronary sinus (CS) lead. No cases of extraction of a chronically implanted 4798 lead have been published to date.

Case summary A 52-year-old man with a history of previous cardiac resynchronization therapy pacemaker (CRT-P) insertion and atrioventricular node ablation presented to our institution with a pocket infection 69 weeks after implantation. Directed intravenous antibiotic therapy was commenced and an extraction was performed the following day. Extraction of the right atrial and right ventricular leads was simple and achieved with gentle manual traction. Extraction of the CS lead was more difficult. Significant traction was required due to the formation of adhesions inside the CS but extraction of the lead was eventually successful without complication. Specialized extraction equipment was not required. A new contralateral CRT-P device was implanted, and the patient was discharged home. He remains well at 3 months of follow-up.

Discussion We present the first case of extraction of a chronically implanted active fixation Attain Stability Quadripolar lead. Our experience demonstrates that this has been performed successfully without specialist tools and with preservation of the CS branch. Significant adhesion was noted at the site of active fixation, however. Potential difficulty with this lead’s extraction should therefore be considered when contemplating its use.

Keywords Attain stability • Lead extraction • Active fixation lead • Device infection • Case report

Learning points

• Our experience demonstrates that the Attain Stability Quadripolar lead has been successfully extracted using simple traction with preservation of the coronary sinus branch.
• Difficulties with this lead’s extraction can be predicted in the future as we observed significant adhesion at the site of active fixation.
• Potential future difficulties with the 4798 lead’s extraction should be considered when contemplating its use.
Introduction

Modern quadripolar coronary sinus (CS) passive fixation leads come in a variety of shapes and sizes making them suitable for most cases. Increasing experience in their extraction has demonstrated that this can usually be achieved successfully using simple traction.\(^1,2\) Passive leads remain suboptimal for a subset of patients, however. These include those with very large or very small branches resulting either in all the electrodes sitting apically or in poor lead stability. Active fixation leads appear attractive in such circumstances, however, previous experience with the Attain StarFix\(^{V}\) 4195 (Medtronic Plc, Minneapolis, USA) has led to some reservation about active fixation inside the CS. Significant difficulty and morbidity was met when extracting these leads even after short implant durations.\(^3,4\)

Medtronic has recently developed the Attain Stability bipolar (20066) and quadripolar (4798) leads incorporating a new active fixation mechanism aiming to improve CS positioning whilst addressing concerns regarding extractability. The 4798 lead is a steroid eluting CS lead with an active fixation screw between its 3rd and 4th poles (Figure 1A). This extends 0.25 mm from the lead body and is actively fixed using clockwise rotation and disengaged using counter-clockwise rotation. The side helix is designed to straighten with the application of around 500 g of force (Figure 1B). Human experience extracting the newer active fixation CS leads is very limited. Six cases of 20066 lead explantation between 3 days and 8 months after implantation have been reported. Only one case of 20066 extraction has been reported after a 4-year dwelling time.\(^5-8\) All procedures were successful with simple traction. CS thrombosis requiring venoplasty occurred in one case.\(^6\) We present the first case of 4798 lead extraction.

Timeline

| Timeline | Events |
|----------|--------|
| Day 0    | Initial cardiac resynchronization therapy pacemaker (CRT-P) implant. |
| Day 99   | Atrioventricular node ablation. |
| Day 485  | Presentation. |
| Day 486  | Device and lead extraction. Five-day course of IV vancomycin commenced. |
| Day 491  | Swabs and blood cultures negative after 5 days incubation. Lead tip polymerase chain reaction positive. Patient changed to IV flucloxacillin for 9 days. |
| Day 499  | New CRT-P implant. |
| Day 500  | Patient discharged home on 2-week course of oral flucloxacillin. |

Case presentation

A 52-year-old man presented complaining of pain around his pacemaker site. His background included dilated cardiomyopathy with severe left ventricular systolic dysfunction (LVSD), left bundle branch block with QRS duration of 130 ms, permanent atrial fibrillation (AF) with previous cryoballoon AF ablation, hypertension, and previous transient ischaemic attacks. A Percepta\(^{TM}\) QUAD cardiac resynchronization therapy pacemaker (CRT-P) device (Medtronic Plc, USA) had been implanted 69 weeks prior to presentation. Active fixation 5076 leads were placed in the right ventricular (RV) apex and right atrial (RA) appendage. A 4798 lead was placed in the antero-lateral branch of the CS as per operator’s preference. Pacing parameters were satisfactory. Successful atrioventricular node ablation was performed 15 weeks after implantation with resultant improvement in New York Heart Association class (from III to II). The patient was on standard heart failure medications in addition to dabigatran.

He described a 3-week history of pain, swelling, and tenderness around the pacemaker site. Clinical examination was consistent with a localized collection. A small skin break at the lateral margin of the device site was noted but no sinuses or discharge was present. He was apyrexial with no stigmata of infective endocarditis. Clinical examination was otherwise unremarkable.

The diagnosis of a generator pocket infection was made. Investigations revealed mildly elevated inflammatory markers with neutrophilia (7.98 × 10^7/L) and an elevated C-reactive protein (16 mg/L). The chest X-ray was unremarkable, and the electrocardiogram revealed a paced rhythm. Three sets of blood cultures were...
taken followed by a single dose of intravenous (IV) gentamicin (6 mg/kg) and a dose of IV vancomycin. A subsequent transthoracic echocardiogram (TTE) was performed which was of high image quality with good visualization of the right heart. This revealed mild LVSD, a marked improvement compared to his previous TTE and showed no evidence of infective endocarditis. A clinical decision not to perform a transoesophageal echocardiogram was made in view of the good TTE image quality particularly as a systemic infection was not suspected.

An extraction was performed the following day by a high-volume extraction team including two experienced extractors. On-site 24-h cardiothoracic cover was available. Standby equipment included Liberator® locking stylets, One-Tie® compression coils, Evolution® range dilator sheath sets, and a femoral workstation (Cook® medical, IN, USA). A strict sterile technique was followed with defibrillator pads attached outside the sterile field to allow for externalized pacing or defibrillation if required. An adequate ventricular rate was present to support the procedure without temporary pacing.

Conscious sedation and local anaesthesia were used. A PlasmaBlade™ (Medtronic Plc, USA) was used for dissection. A localized collection of pus was identified, swabbed and drained. The leads were disconnected from the device and straight stylets were inserted. The RA and RV lead active fixation helixes were retracted followed by easy extraction using gentle traction. An Attain Hybrid™ guide wire (Medtronic Plc, USA) was inserted through the lumen of the 4798 lead and advanced through to the CS branch. A ‘push and pull’ movement was applied revealing that the lead was mobile through the vasculature but firmly adherent at the point of active fixation inside the CS. Counter-clockwise torque was applied but no rotation occurred inside the CS. The guide wire was exchanged for a firm stylet and continuous traction was applied with gentle counter-clockwise torque to prevent fixation screw penetration of the vasculature during extraction. The active fixation helix lengthened and the lead began to move back into the body of the CS. The lead was then removed intact without complication (Figure 2, Video 1). Temporary pacing was provided via an externalized VVI system. The total procedure time was 89 min.

IV vancomycin at a dose of 1 g once a day (guided by serum concentrations) was continued for 5 days. The blood cultures and swabs were negative. Polymerase chain reaction (PCR) of the lead tips identified a coagulase-negative Staphylococcus sensitive to flucloxacillin. The antibiotic regimen was changed to IV flucloxacillin 2 g four times a day (QDS) for 9 days.

The inflammatory markers normalized and the patient was listed for a contralateral new CRT-P device implantation. This was performed without complication 13 days after the extraction. A passive quadripolar lead was placed into a posterior branch on this occasion. Occlusive CS venography during the procedure revealed patency of the previously used antero-lateral branch (Video 2).

A further 2-week course of oral flucloxacillin 1 g QDS was commenced, after discussion with our microbiologist, in view of the positive lead tip PCR. The patient was discharged home.

He remains well at 3 months of follow-up. The left ventricular lead impedance at three months was 570 Ohms and the threshold was 1 V at 0.4 ms with a 3rd to 4th pole pacing configuration.

**Discussion**

We have presented the first case of 4798 lead extraction. The procedure was performed within 3 days of hospital admission as advocated by societal consensus documents. Complete procedural success was achieved using simple traction as described with the 20066 leads. In our case, the lead had been implanted for over 15 months. This is slightly longer than the mean dwelling time of StarFix® leads reported by Maytin et al. In that series extraction
sheaths were necessary in all cases. The limited experience in Attain Stability lead extraction to date does, therefore, suggest that they do not confer the same challenges as the StarFix\textsuperscript{®} in terms of extractability. This is likely related to the StraFix\textsuperscript{®} lead’s design. The StarFix\textsuperscript{®} lead incorporates deployable lobes designed for improved positioning and stability. These lobes provide a large surface area for tissue fibrosis to occur leading to significant adhesion inside target branches.

It is important to note, however, that we have observed considerably more adhesion inside the CS than we would have expected from a passive lead of similar implant duration. The lead could not be disengaged from the CS wall with counter-clockwise torque due to adhesions around the helix. Traction eventually allowed the helix to straighten sufficiently for it to pull off the vessel wall.

Venography 2 weeks post-extraction demonstrated patency of the previously used branch. This provides some reassurance as it has been demonstrated that extraction reduces the rate of successful CS lead replacement particularly when performed for infection.\textsuperscript{10} It is not clear whether simple extraction of the 4798 lead with side branch preservation will remain possible after longer dwelling times. It is possible that the large calibre of CS branches in which the 4798 lead is often used will be a protective factor.

Special consideration should be given to the approach to 4798 lead extraction should simple traction be unsuccessful. If a locking stylet were required to extract such a lead, consideration should be given to the stylet type and site of deployment. Some locking stylets such as the Lead-Locking Device (Spectranetics, Colorado Springs, USA) are deployed over the length of the lead whilst others such as the Liberator locking stylet (Cook Medical, USA) are deployed more focally. With focally deployed stylets, a decision must be made about whether to deploy at the distal tip of the lead or near the helix (Figure 1C). Focal deployment near the helix may help tackle adhesions at the site but might theoretically result in loss of lead integrity distal to the locking stylet, particularly should significant traction or counter-traction be required.

We feel more experience is required to establish the safety and ease of extraction of the 4798 lead. We believe its extraction should only be performed in experienced extraction centres. The limited extraction experience should be considered when choosing this lead especially in young patients and those at higher risks of infection.

**Conclusion**

We present the first case of extraction of a chronically implanted active fixation Attain Stability Quadripolar lead. Our experience demonstrates that this has been performed successfully without specialist tools and with preservation of the CS branch. Significant adhesion was noted at the site of active fixation, however. Potential difficulty with this lead’s extraction should therefore be considered when contemplating its use.

**Lead author biography**

Dr Elhosseyn Guella is a subspecialist trainee in heart failure and cardiac implantable electronic devices in the North-Western Deanery of England. He completed a BSc in basic medical sciences in 2010 and Doctorate in Medicine (MD) from the Arabian Gulf University in Bahrain in 2012. He undertook his Foundation and Core Medical Training in the north
of England and became a member of the Royal College of Physicians (MRCP, London) in 2015. He completed a post-graduate diploma in medical education from the University of Manchester and joined the North-Western Deanery’s cardiology training programme in 2016.

Supplementary material

Supplementary material is available at European Heart Journal - Case Reports online.

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Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as Supplementary data.

Consent: The author/s confirm that written consent for submission and publication of this case report including image(s) and associated text has been obtained from the patient in line with COPE guidance.

Conflict of interest: none declared.

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