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CASE REPORT

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Difficult dual stage transcutaneous lead extraction complicated by fracture of both leads

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Abstract

Extraction of two long-implanted (11 year-old) active leads due to local infection was complicated by the fracture of both leads with a metal sheath. The presence of a temporary pacing lead, inserted due to pacemaker dependence, made extraction even more difficult. The fixation of both proximal extracted lead endings in the occluded subclavian vein was much stronger than the connection of the tips of the leads with the RAA and RVA endocardium. The disintegration of both leads caused by drawing upon the distal ending added additional technical complications to the final procedure. The presented case underscores the necessity of having a full set of tools to hand even during what appears to be a routine lead extraction procedure. The importance of proper lead implantation on its extraction (in what may be the distant future) is discussed. (Cardiol J 2012; 19, 4: 412–417)

Key words: lead extraction, extracted lead fracture, basket catheter, usability, femoral approach for lead extraction

Introduction

Implanted system infection fulfills a class 1 indication for its removal and transvenous lead extraction is the generally accepted solution [1]. The presented case illustrates unusual technical complications of infected lead extraction in the shape of accidental simultaneous snapping of both leads with a metal sheath and the unusual secondary technical problems caused by a strong connecting tissue scar inside the occluded subclavian vein. Looping and drawing down the extracted lead usually liberates its proximal end. In the described case, the leads were trapped in the venous entry region which did not permit the use of the Bongiorni technique [2] or other techniques we have previously described [3–5].

Case report

A 45 year-old male with a dramatic cardiac history, in the course of aortic valve disease and infective endocarditis, complicated by severe acute aortic valve failure and Valsalva sinus rupture 11 years previously, had received a mechanical aortic valve and DDD system (Botronik leads TIJ 53 JBP and TIR 60 BP) due to a probably post-operative third degree atrioventricular (AV) block. Five months later, the patient was re-operated upon due to subsequent endocarditis with a perivalvular leak. The mechanical valve was replaced with a biological one and the patient remained in NYHA class II for several years. Three years ago, a pocket infection appeared after simple unit replacement. It was treated unsuccessfully with 'plasty of the pocket' two months ago

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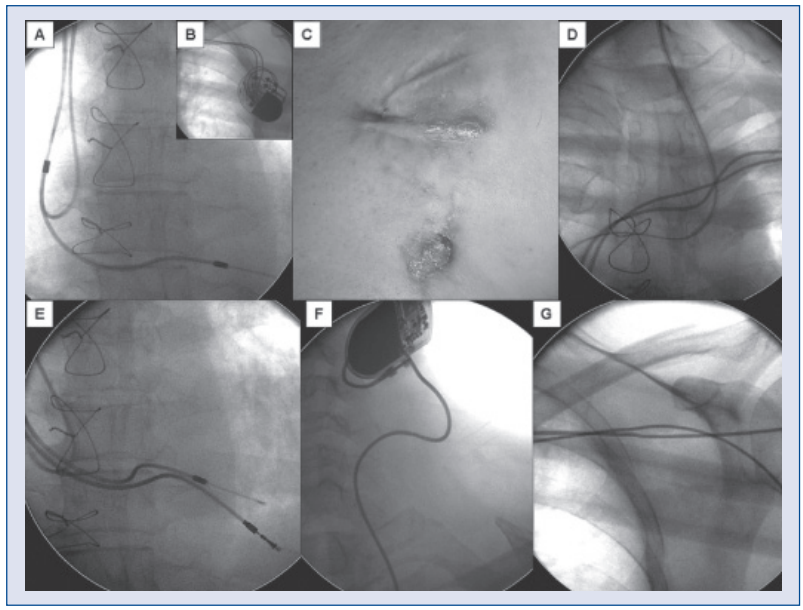

Figure 1. DDD pacing system (**A**, **B**) and chronic severe local infection (**C**). Pacemaker dependence. The screw-in lead for prolonged temporary pacing is introduced (**D**, **E**, **F**). Pacemaker removed, proximal endings of lead liberated (**G**).

followed by treatment with ciprofloxacin. Because of two old permanently implanted leads, both 11 years of age, co-existing pacemaker-dependence and a history of two episodes of infective endocarditis, he was referred to the Polish Reference Centre for extraction of the infected leads with pacemaker (Figs. 1A, B).

He did not have fever on admission, but two weeks of fever had been the reason for his admission to his regional hospital. After one week of treatment with vancomycin, his ESR was 42 mm/h, WBC 9.700, CRP 4.45 mg/L and procalcytonin 0.06 ng/mL and blood culture — negative (but on long-term antibiotic therapy). Echocardiography (TTE) showed: normal heart diameters, left ventricular ejection fraction 55%, normal function of biological aortic valve, slightly enlarged ascending aorta, no vegetations reported. There were signs of chronic pocket infection (Fig. 1B).

First operation

This began with a prolonged temporary screw-in implantation, intentionally via the internal jugular vein. It was very difficult to pass with guidewires into the superior cava vein (SCV) but finally it proved possible (Figs. 1D, E) and the new lead was connected with a VVI unit (Fig. 1F). The pacemaker was extracted, the pocket cleaned, and leads prepared for extraction with polypropylene Byrd dilators intentionally (Fig. 1G).

We encountered both leads strongly ingrown within the vein wall, and they could not be shifted. We had the strong impression that both had been implanted via a single venous approach (two guidewires through a single venous puncture) which had been made extremely close to the sternum. Finally, a metal sheath (Cook) had to be used (Figs. 2A–C). Disastrously, both leads were accidentally snapped in the subclavian region (Figs. 2D, E). Venography confirmed that it was impossible to grasp their proximal ends to recapture them for a venous approach (Fig. 2E). The pacemaker pocket was closed and suction drainage was applied (Figs. 2F, G). It was decided to postpone the second part of the planned procedure until the next stage.

Second operation

The femoral vein approach was used. A pig-tail catheter with standard guidewire and a basket Dotter catheter (Cook) from separate venous punctures of the same femoral vein were introduced to the right atrium (Fig. 3A). The atrial lead was planned to be extracted first, and it was looped with the guidewire/pig-tail catheter and Dotter basket catheter with retentive ending of guidewire (Fig. 3B). Shifting the pig-tail catheter over the angiographic guidewire to make the loop slide was very important. This permitted steady withdrawal of both extracted lead endings (Fig. 3C). Traction applied to both endings of the loop liberated unexpectedly the ingrown tip of the atrial lead, while the proximal end remained in the subclavian vein (Figs. 3D, E).

The liberated atrial lead was captured the using the previously inserted basket Dotter catheter (Fig. 4A). But pulling on the tip caused lead frag-

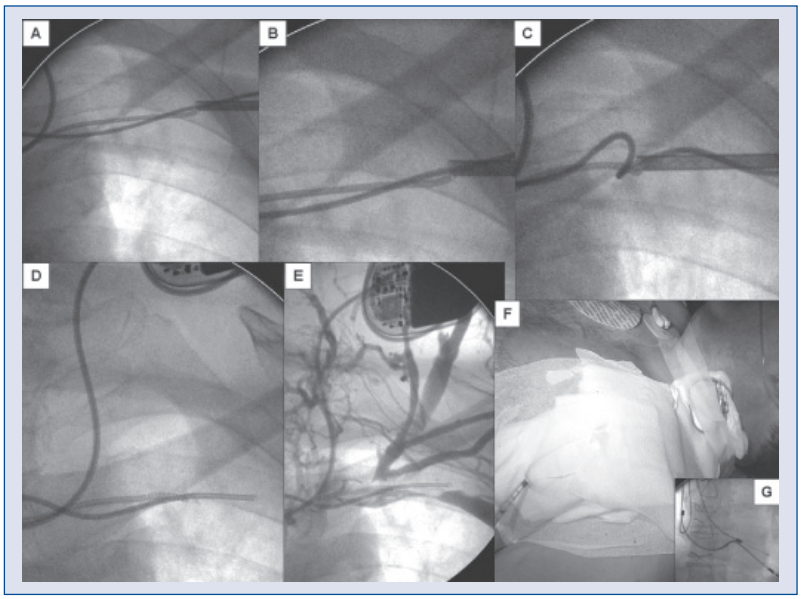

Figure 2. Both leads inserted very closely to sternum strongly fixed with connecting tissue scar, not sleding. Polypropylene sheaths ineffective and metal sheaths had to be used (**A**, **B**, **C**). Unexpectedly, both of the leads are snapped (**D**, **E**). Impossible to use a venous approach to grasp their proximal ends (**E**). Patient prepared for adjourned second part of procedure (**F**, **G**).

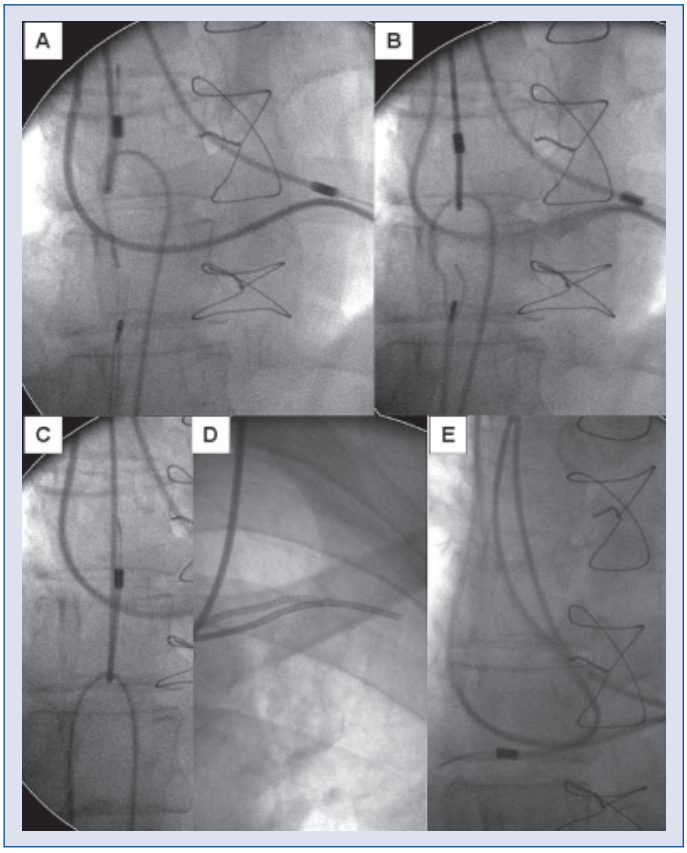

Figure 3. Extraction of the atrial lead — the first stage. **A.** A pig-tail catheter with standard guidewire is introduced to the right atrium; **B.** The arms of the loop are shifted over the atrial lead and the distal part of the guidewire is grabbed by a Dotter basket catheter; **C.** Essential element is to make the loop slide over the lead. Steady withdrawal of both extracted lead ends; **D**, **E.** Manual traction liberates unexpectedly the tip of the atrial lead, while the proximal end remains in the subclavian vein.

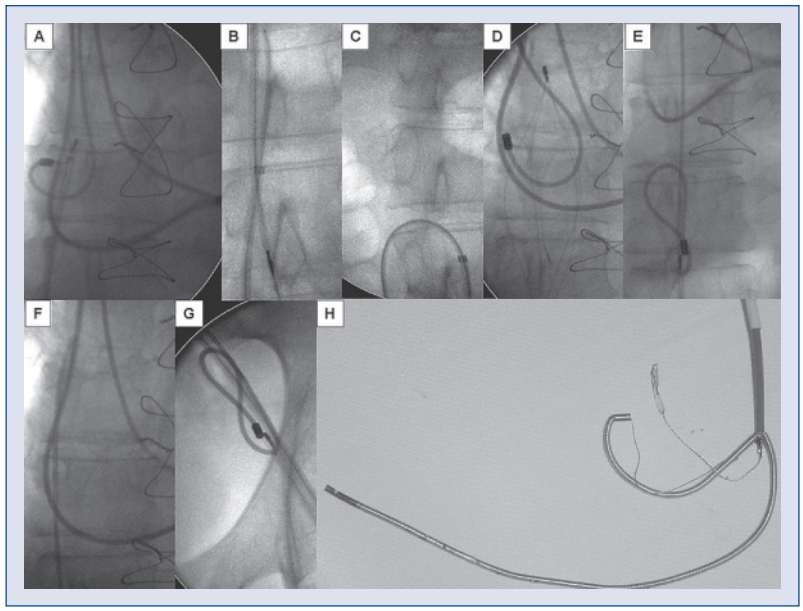

Figure 4. Extraction of the atrial lead — the second stage. Using basket catheter — the liberated atrial lead is grasped (**A**) but pulling upon the tip causes the lead to disintegrate with stretching of the internal coil (**B**, **C**). The basket catheter is used again to grasp the distal part of the atrial lead containing the ring electrode (**C**). This time, the grip is very steady (**E**) and allows removal of the proximal end from the subclavian vein (**F**, **G**). A special sheath has to be used to pass the lead via the femoral venous entry (**H**).

mentation and stretching of the internal coil (Figs. 4B, C). The basket Dotter catheter was used then to grasp the distal part of the atrial lead with its ring electrode (Fig. 4C). This time, the gripping was very steady (Fig. 4E) and made possible the removal of the proximal end from the strong connecting tissue block in the subclavian vein (Figs. 4F, G). A special larger short external sheath had to been used for passage via the femoral venous entry (Fig. 4H). The same femoral venous approaches were used for the next one — ventricular lead extraction.

Setting a similar loop over the ventricular lead was more difficult because of its more vertical route and the higher risk of accidental dislodgement of the temporary pacing lead. A multipurpose catheter was introduced to the SCV using the femoral vein approach with a standard guidewire (Figs. 5A, B) and the end of the guidewire was grasped with the Dotter basket catheter (Fig. 5C).

They formed the loop shifted over non-functional ventricular lead which enabled equable drawing for both extracted lead endings (Fig. 5D). Manual loop traction liberated the ingrown tip of the ventricular lead in a similar way to the atrial lead. The proximal end remained in the subclavian vein (Fig. 5E), and this tip was drawn down with the basket catheter (Fig. 5F).

Pulling upon the ventricular lead tip provoked the lead to fragment (Fig. 6A), and the whole internal conductor with its silicone tube and tip were removed from the patient's body (Fig. 6B). The basket Dotter catheter was used again to grab the remainder of the ventricular lead with its ring electrode (Figs. 6C, D). Very steady grip allowed the removal of the proximal end of the extracted lead from the scar tissue in the subclavian vein (Figs. 6E, F).

Finally, no unnecessary lead was left behind, the functional lead for temporary pacing remained (Fig. 7A), and the extracted leads were removed via the femoral venous entry (Fig. 7B). The lengthy duration of the procedure contributed to the overheating of the X-ray machine, which explains the low quality of the X-ray images from the final part of the procedure (Fig. 7C). The Dotter basket catheter proved to be an essential tool for this very difficult lead extraction.

The patient received a new DDD pacing system into the right side of the chest two weeks later. He presented no symptoms of venous occlusion or infection during one year of follow-up.

Discussion

Extracting endocardial leads can cause complications connected to rupture [2, 6, 7]. In our patient, the connecting tissue surrounding both of the leads in SCV was very strong, perhaps partly caused by chronic long-tem pocket infection. Perhaps a sub-

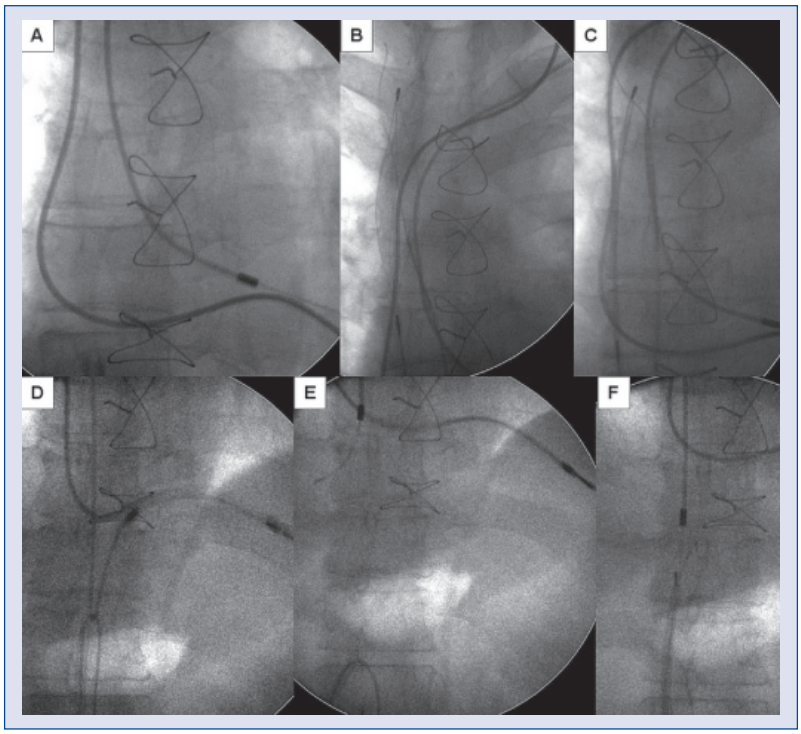

Figure 5. Extraction of the ventricular lead — the first stage. The multipurpose catheter is introduced to the superior cava vein with a standard guidewire (**A**, **B**) and its ending is grasped by the basket catheter (**C**). The loop over the ventricular lead is closed, which enables withdrawal of both extracted lead endings (**D**). The traction for the loop liberates the tip of the ventricular lead (**E**) and this tip is drawn down with the basket catheter (**F**).

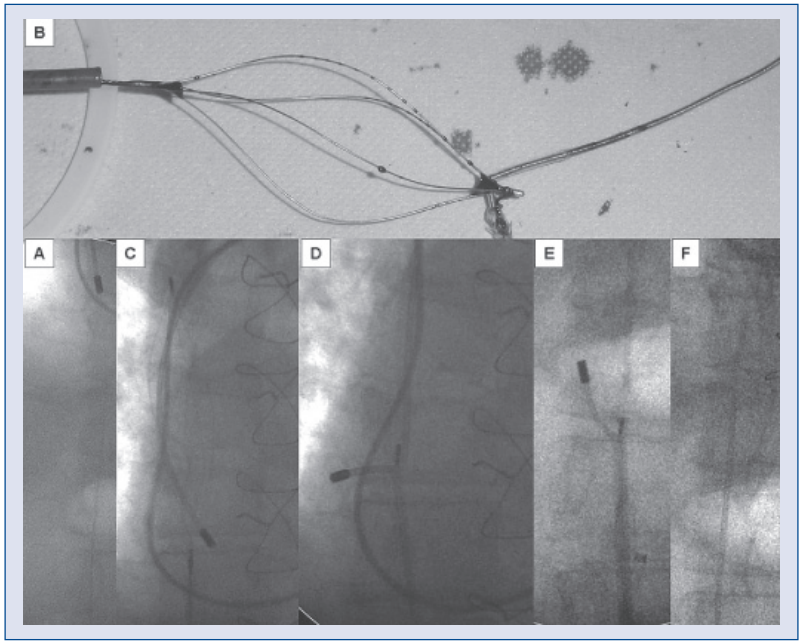

Figure 6. Extraction of the ventricular lead — the second stage. **A.** Lead fragmentation; **B.** Internal conductor with silicone tube and tip is removed. Basket catheter is used once again to grab the remainder of the ventricular lead (**C**, **D**) and a steady grip allows the removal of the proximal end of the lead from the subclavian vein (**E**, **F**).

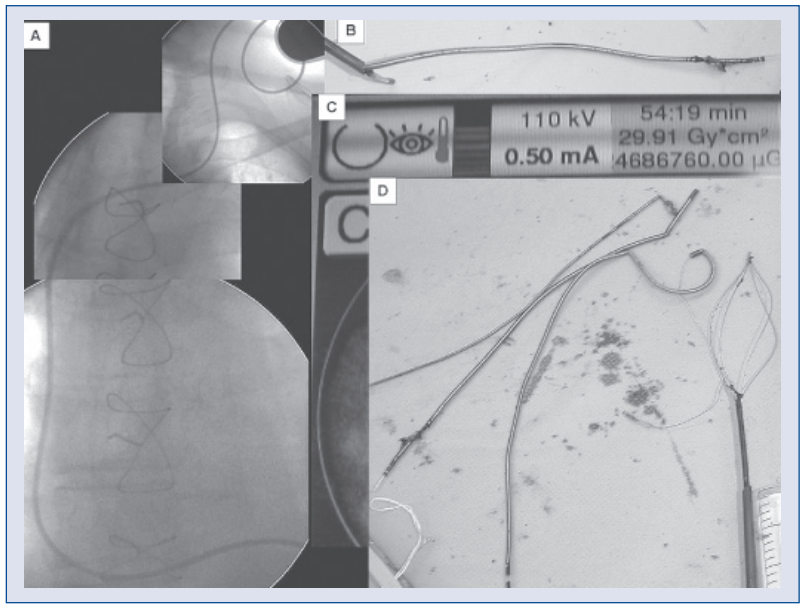

Figure 7. Landscape after the battle. **A.** Finally, both leads are extracted and only the lead for temporary pacing remains; **B, D.** All the extracted leads with all tools are removed; **C.** Slight overheating of X-ray machine during complicated procedure is visible.

optimal mode of insertion of both leads played a role in the very strong lead stabilization in their common venous access. '"Frozen' or 'connate' leads passing ligaments connecting the clavicle, first rib and sternum are nearly impossible to free using relatively gentle tools. Byrd propylene dilators and a special metal tube has to be used as a tool of last resort. Such a situation makes the use of the Bongiorni technique impossible [2], likewise the application of the 'loop technique' in our previously described modification [3–5]. It proved to be very effective and safe, but the events surrounding the final removal were surprising and somewhat problematic. The distal part of the lead was the first to be retrieved and its atypical extraction had surprising results. We want to underscore the utility and universality of the Dotter basket catheter; after steadily gripping the lead, continuous gentle tension makes it possible to use it alone as a 'guidewire' and to introduce and replace over them necessary tools (any sheaths and introducers) from proximal ending.

Conclusions

The presented case illustrates rare but serious lead extraction complications when extracted leads break in inaccessible parts of the venous system. The case reveals the significance of lead implantation technique when the time comes for its future extraction. It confirms the utility of the femoral approach for non-typical lead extraction procedures and the significance of close co-operation between the lead explantor and the interventional radiologist.

Conflict of interest: none declared

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