

A rare complication of transvenous lead extraction - pulmonary embolization with a broken distal lead fragment

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Introduction

During transvenous lead extraction (TLE), the extracted lead can be broken, causing further problems for both the operator and the patient. It may occur during continuous traction, using different mechanical systems, and also if energy-equipped catheters are used^[1-3]. A lead fracture may happen in places of previous partial conductor fracture or in the location of particularly strong adherence of the lead to the vessel wall caused by presence of excessive fibrotic tissue^[2]. In

general, the tip of a broken lead remains fixed to the myocardium with a variable length of lead fragment, usually with an anodal ring in the case of bipolar (BP) leads. In extremely rare situations, the lead liberated from the endocardium is broken in its distal part (distally from the anodal ring) and wanders with the blood stream into the pulmonary circulation. Among 2269 procedures of lead extractions, we registered two such events (0.09%).

Key words:

complications of lead extraction, lead breakage, lead fragment pulmonary embolisation

Case 1

In a 67-year-old Caucasian man with obstructive hypertrophic cardiomyopathy (intraventricular gradient 110 mmHg), a dual chamber (DDD) pacing system (with two passive fixation leads) was implanted due to hemodynamic indications. Pacemaker (PM) replacement was performed after 8 years without X-ray-scscopy at the time of the procedure. Recurrent fever began six months after the procedure. During the next several months, the patient underwent 2 hospitalizations in medical departments but a proper diagnosis was not established. During the third hospitalization, a chest X-ray revealed focal signs in the lungs which were further investigated in the angio-CT. Infected multifocal pulmonary embolism was confirmed; it was caused by lead-related infective endocarditis (LRIE) with 2 vegetations present in the right atrium (RA). The patient was referred to our department for system extraction with all LRIE symptoms. During the extraction procedure we found the PM pocket without signs of infection, but X-ray

scscopy revealed multiple unnecessary loops of both leads, passing the tricuspid valve (Figure 1A) caused by both leads' ligatures failure. During introduction of stylets into both leads, the outflow of a purulent fluid was observed. Both leads were extracted with a mechanical system (polypropylene telescopic Byrd Dilators, Cook) using the subclavian lead venous entry approach. The atrial lead was extracted without any complications, unbroken. The ventricular lead was bodily liberated (with its tip), but during dissection of connective tissue bridges which formed adhesions with the RA wall (Figure 1 B,C) the tip of a lead with a 2 cm distal fragment was lost. It appeared on a lung shadow immediately (Figure 1D). The remaining part of a lead was removed via a Byrd dilator (Figure 1E). Both silicone tubes of extracted leads showed severe multiple abrasions. The procedure duration was approximately 100 minutes. After incomplete system extraction intermittent fever was observed; we were unable to determine its basis (preserved purulent pulmonary focus? infected lead embolus?). Due to

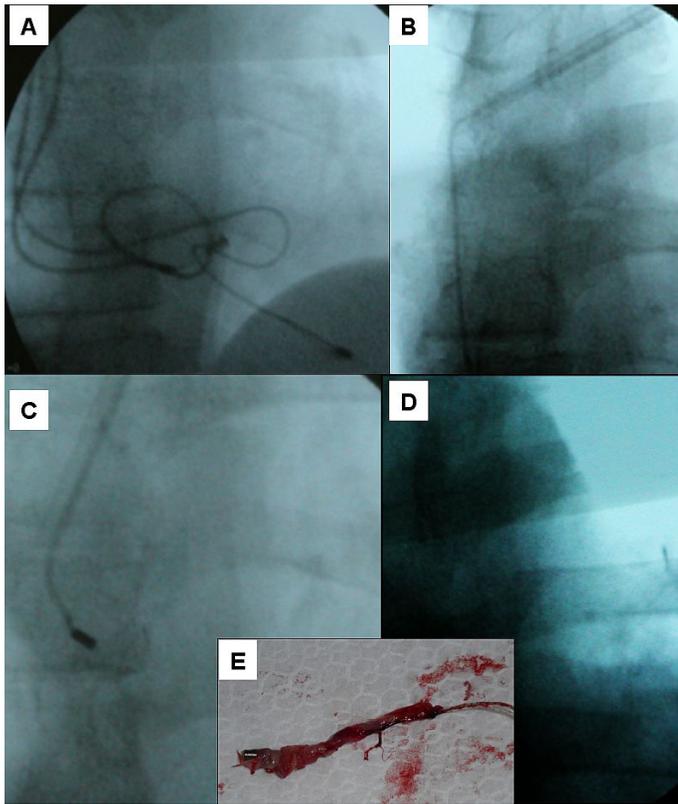


Figure 1 Lead loops crossing tricuspid valve (A). During ventricular lead extraction the lead was broken and dislocated into pulmonary artery (B,C,D). Main fragment of extracted ventricular lead (E)

clinical manifestations we decided to remove the remnant of the broken ventricular lead two weeks after primary intervention (Figure 2). The fever and laboratory signs of infection

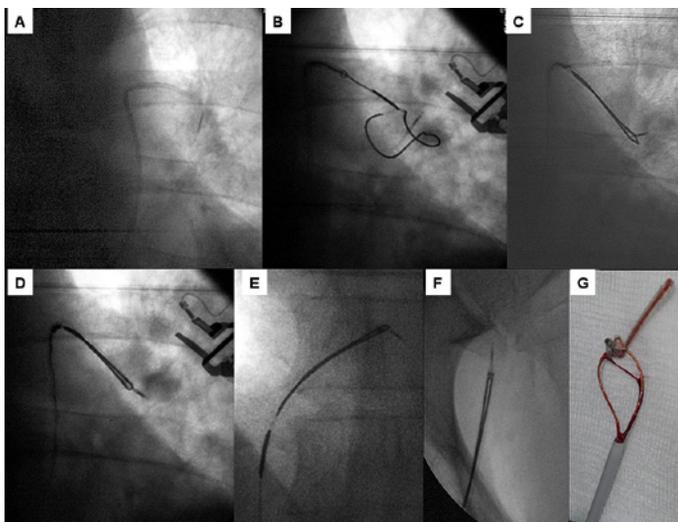


Figure 2 Using femoral approach with 6Fr sheath we introduced cobra catheter (C2, 5Fr) to left pulmonary artery (segment 6). Over 0,035" guidewire we changed C2 to GooseNeck snare catheter (4Fr, 10mm, Covidien), which was used to remove foreign body through the sheath in femoral vein. There was no complication and no need for surgical intervention (A-G).

suddenly disappeared after 2 weeks. Reimplantation of a new DDD system due to hemodynamic deterioration (rise of intraventricular gradient, poor exercise tolerance) took place

5 months later. During two years of follow-up, the patient's general condition has remained satisfactory.

Case 2

A 63-year-old Caucasian man with ischemic heart disease (IHD) and a DDD pacing system was referred to our department due to dysfunction of a previously functional ventricular lead (pacing threshold > 3.5 V). The right-sided DDD system was implanted 4 years earlier, due to sinus node disease (SND) with paroxysmal second degree atrioventricular (AV) block. On the left side of the chest, the patient had two abandoned leads (atrial – 18 years old, and ventricular – 11 years old). The X-ray-scopy showed the excess leads in the superior vena cava (SVC) and RA (Figure 3 A). The venography revealed the occlusion of the anonymous vein and the right brachiocephalic vein stenosis. The long life expectancy, the necessity of following lead implantations, the excess leads and thereby high risk of SVC occlusion were the clinical indications for extraction of as many unnecessary leads as possible.

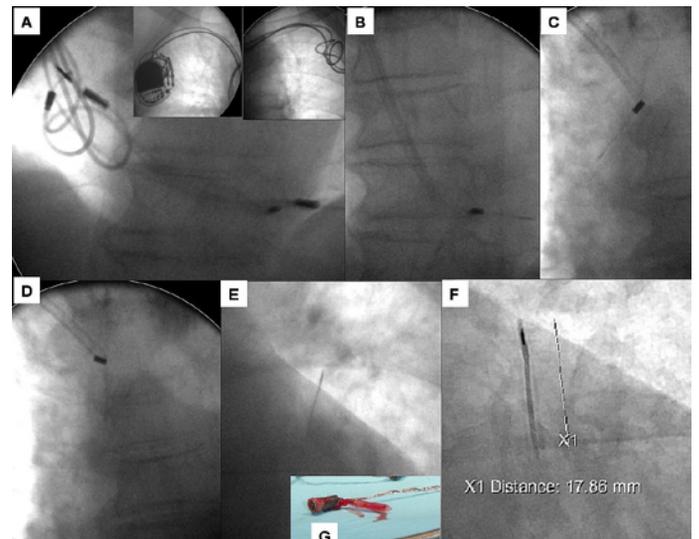


Figure 3 The consequence of numerous lead implantations (A). Liberation of the remaining ventricular lead, difficulties during insertion of electrode's ring into internal (green) Byrd dilator (B,C,D). Lead fracture and dislocation (E,F). Extracted lead fragment (G).

The extraction process was performed using the same technique as in the previous patient, all leads having passive fixation. The oldest, left-sided leads were extracted without complications, unbroken. Similarly, the extraction of the right-sided atrial lead did not cause difficulties. The liberation of the remaining ventricular lead, up to the right atrium, was unproblematic (Figure 3 B,C,D). At that point the distal part of the lead spontaneously bounced from the right ventricle apex region, but difficulties occurred during the insertion of the electrode's ring into the internal (green) Byrd dilator. During the attempt to use the external sheath, the distal part of the lead suddenly disappeared and some seconds later appeared in the left lung shadow (Figure 3 E,F). This procedure was very complex and long (approximately 4 hours). Having previous experience and considering the patient's long-term survival, we decided to remove the lead fragment using the previous technique within two days (Figure 4). The patient remained

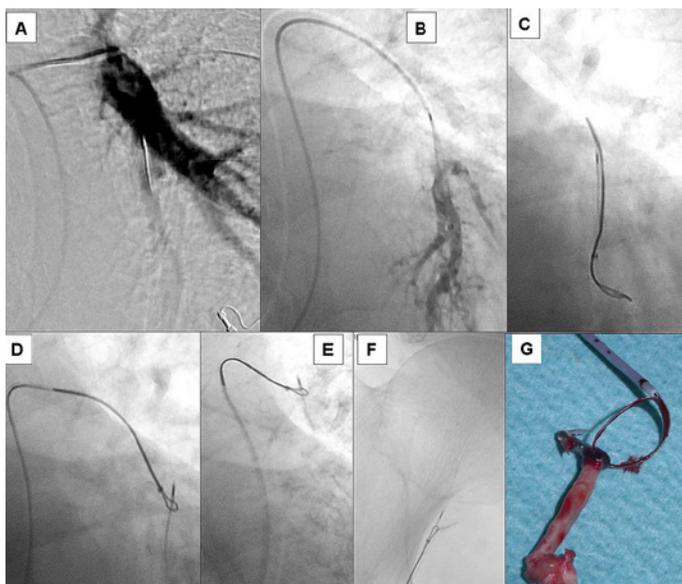


Figure 4 Using femoral approach, cobra catheter and GooseNeck snare catheter (4Fr, 10mm, Covidien), we removed distal part of a lead from left pulmonary artery (segment 6). There were no complications and no need for surgical intervention (A-G).

under observation. After a few months, due to recurrence of symptomatic second degree AV block, the patient received another (left-sided) DDD system. Fortunately, the patient did not develop significant venous stenosis on the left side of the thorax. His condition remained stable during 3 years of follow-up.

Discussion

In the literature we can find reports of only a few similar events with a different broken lead fragment length [4-10]. The first case was described in 1977 [4]. In five reported cases the lead fragment was left in the pulmonary vascular bed and the patients remained under observation due to lack of clinical signs [4-7]. Three patients only underwent the procedure of remaining lead fragment extraction using transvenous tools such as an Amplatz goose neck snare kit for intravascular foreign body retrieval, basket or lasso catheters [8-10]. All procedures were successful, without any complications.

Exceedingly interesting remains the fact that a distal lead part was broken while at the time it was free from fibrotic tissue adhesions fixing it to the myocardium. The only explanation derives from the active role of the wedged anodal ring (covered with fibrotic tissue) inside the distal part of the Byrd dilator. The Byrd dilator's rotational movement connected with the perpendicular distal fragment lead position caused the sharp metal ring edge to cut off the lead fragment. In both described cases it happened when we tried to shift the already liberated distal part of the lead into the Byrd dilator. The old type, passive fixation lead with a relatively long ring-tip diameter and different thickness (along the course of the lead) might be predisposed to lead breakage. At present we have much more experience in this matter. Therefore during extraction procedures we avoid unnecessary rotational movements and use another Byrd dilator with a larger diameter instead. This gives us the possibility to liberate the proximal lead's ring from surrounding connective scar tissue. Since changing our man-

agement of lead extraction, we have seen no similar fractures of the leads. We believe that in every similar case, our duty is to try to extract the whole lead only if it does not significantly increase the risk of the procedure. Local arteriography enables localization of the proper branch of the pulmonary artery. The use of a snare catheter and a flexible, gentle catheter does not increase the risk of the procedure and gives the opportunity to remove a potentially infected lead fragment.

Conclusions:

Although it is a rare complication (2/2269; 0.09%), during the procedure of lead extraction, the tip of the lead with a lead fragment might be cut off from the lead body and dislocated into a branch of the pulmonary artery. Cooperation of the cardiologist performing lead extraction and an experienced interventional radiologist with a wide spectrum of tools enables successful removal of the embolizing lead fragment. The mechanism of this rare complication remains unclear, but the cutting role of the anodal ring cannot be excluded. Application of specifically designed tools into the pulmonary artery does not increase the risk of the procedure and gives the opportunity of removing a potentially infected lead fragment.

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