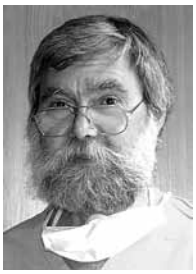
Multi-stage, complicated lead-dependent infective endocarditis treatment: good and bad decisions



Skomplikowane wieloetapowe leczenie odelektrodowego zapalenia wsierdzia – dobre i złe decyzje

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Abstract

Indications to surgical treatment of patients with lead-dependent infective endocarditis are clearly defined in guidelines, but technical and logistic issues are not given precisely. The present state of knowledge about pathophysiology of patients' reaction to pacemakers and leads shows that preoperative percutaneous lead evacuation or at least complete liberation inside the venous system before a surgical intracardiac procedure is an optimal solution. Complete lead removal through the right atrium is often impossible and partial removal is a potential source of infective endocarditis. The case is an illustration of this sad truth.

Key words: lead-dependent infective endocarditis, percutaneous lead removal, surgical lead removal.

Streszczenie

Wskazania do leczenia chirurgicznego pacjentów z odelektrodowym zapaleniem wsierdzia zostały jasno sprecyzowane w obowiązujących standardach. Nie określają one jednak rozwiązań technicznych i organizacyjnych. Wiedza o wrastaniu elektrod w ścianę układu żylnego u pacjentów z wieloletnimi elektrodami wskazuje, że optymalnym rozwiązaniem jest wcześniejsze usunięcie całego układu stymulującego techniką przezskórną lub uwolnienie elektrod z przyrostów łącznotkankowych aż do prawego przedsionka w przypadku dużej wegetacji. Usunięcie elektrod w całości podczas operacji kardiochirurgicznej drogą prostego pociągania bywa często niemożliwe, a pozostawienie fragmentu elektrody może skutkować nawrotem choroby, co zilustrowano opisem przypadku.

Słowa kluczowe: odelektrodowe zapalenie wsierdzia, przezskórne usuwanie elektrod, chirurgiczne usuwanie elektrod.

Introduction

The lead-dependent infective endocarditis (LDIE) is becoming a more often and severe complication of permanent heart stimulation [1, 2]. The main rule, constant for years, is the complete system removal, including leads and even fragments of them [3-6]. At the beginning of heart electrotherapy in the 60's to 80's, leads were evacuated by cardiac surgeons, just with simple traction through the opened right atrium. At present, the average age of leads being removed is significantly older (15-20 years or older) and patients usually have more than one lead.

Every lead introduced to the heart and venous system is, after some time, covered by endothelium (endothelisation), later connected to the walls of veins and heart chambers and then surrounded with joint tissue (tunnelisation). Tissue joints can fix a lead to the wall or to other leads excluding part of the vein lumen. In the case of multiple leads it can even cause a complete vein obstruction with opening of collateral circulation, if it is present.

The fixing tissue usually makes it impossible to remove a lead by simple traction and different cutting catheters working around a lead are necessary for its liberation and complete removal. The catheter itself gives an opportunity of lumen recovery for a new lead implantation or introduction of devices for lead distal free fragments removal.

It has been proven that the strongest connections are formed in the subclavian, anonymous and beginning of the superior caval veins. Their calcification makes the whole procedure even more difficult [7, 8].

The sequence of manoeuvres in the case of surgical intervention is not described by guidelines [3-6]. We have previously proposed such sequence based on our experience

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[9, 10]. The case presented in the paper can be a perfect illustration of the wrong decision-making process in a patient treated for months because of LDIE.

Case description

A 59-year-old female patient had a DDD pacemaker (PM) implanted in 1997 because of the sick sinus syndrome. The PM was replaced and a new atrial lead was added to the right atrial appendage because of the old lead dysfunction in 2004. The dysfunctional lead was secured at the PM site and left.

It has then slid in and a free loop of it arose near the tricuspid valve. In the meantime the patient had hemicolectomy and chemotherapy because of the colon cancer and suffered from left-sided nephrolithiasis with pyonephrosis treated with nephrectomy.

Problems with the PM system begun in summer 2010 with a fever. The patient was admitted to an internal diseases department and successfully treated with amoxicillin. No echocardiography examination was performed and the patient was discharged.

The fever came back after a few days and triple blood cultures revealed the presence of methicillin-resistant staphylococcus aureus (MRSA). The patient was readmitted with fever episodes up to 40°C and next one positive blood cultures. Transthoracic echocardiography (TTE) revealed the presence of leads in the right atrium and soft, moving structure suspected to be a vegetation connected to leads. The diagnosis of LDIE was suspected and the patient was transferred to the regional electrotherapy centre where repeated TTEs confirmed the presence of a structure (2 cm long thrombus or vegetation) surrounding the ventricular lead and having two mobile 6-17 mm long parts entering the right ventricle during the heart diastole.

The coexisting severe (III/IV°) mitral regurgitation has been found with thickened mitral leaflets and posterior leaflet perforation during transesophageal echocardiography (TEE). The mitral annulus diameter was 36-38 mm. The entering of superior caval vein into the right atrium was constricted and a loose loop of atrial lead entering the right ventricle was also found. The presence of vegetation-like structures (longer than 10 mm) on both leads was confirmed.

The diagnosis of right-sided LDIE with endocarditis on the mitral valve with its posterior leaflet perforation and severe regurgitation was made.

The patient was scheduled for the cardiac surgical procedure after coronarography in the regional cardiac surgery department.

The cardiosurgical procedure was performed six weeks after the first fever episode. During the procedure both atrial leads tips were removed. The ventricular lead was cut off at

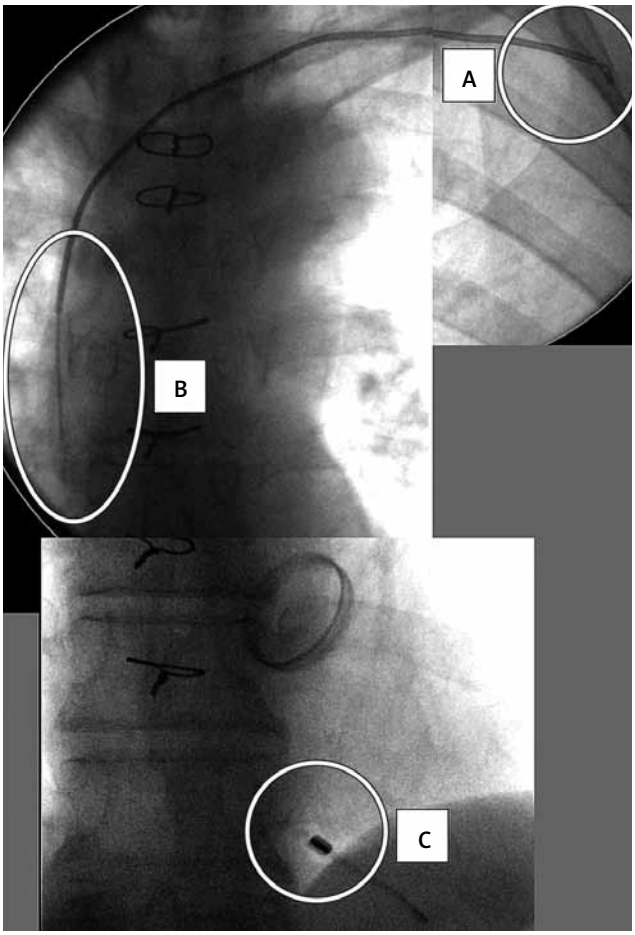

Fig. 1. Chest fluoroscopy on admission. Ends of the left lead fragments: A – PM site, B – superior vena cava, C – right ventricle

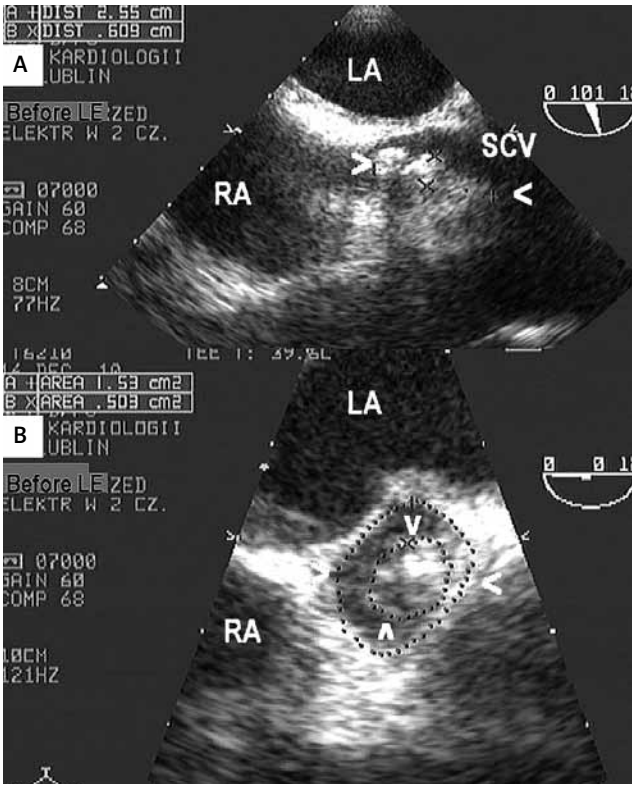

Fig. 2A.–B. Transesophageal echocardiography before lead extraction: A. Longitudinal view, RA – right atrium, LA – left atrium, SCV – superior cava vein, >, < irregular shape of vegetation (2.55 cm × 0.6 cm) with marked participation of fibrotic tissue (sign of very long lasting infection). B. Transversal view, RA – right atrium, LA – left atrium, >,< bigger circle: superior cava vein (SCV), ^v smaller circle: the same vegetation inside SCV

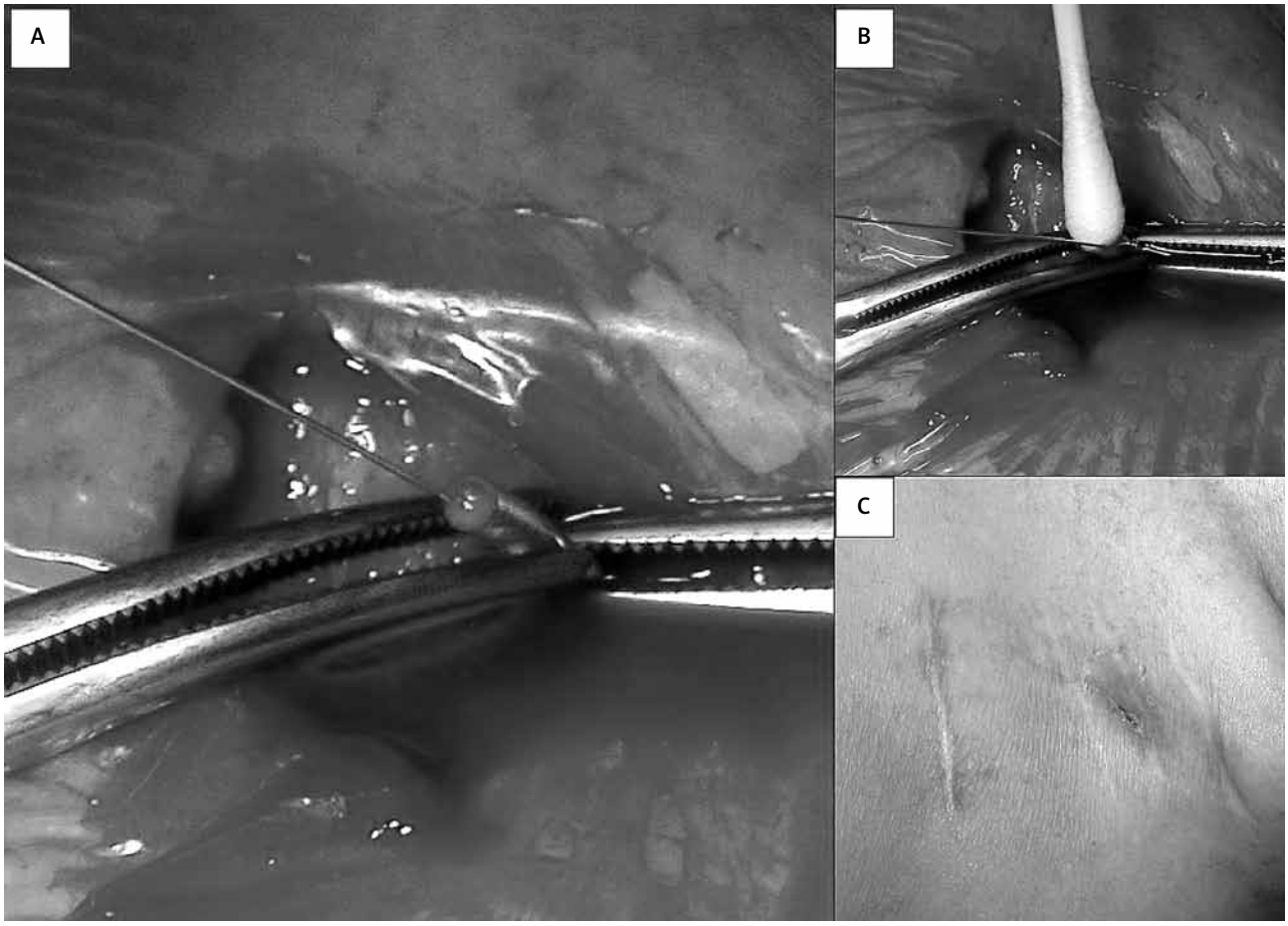

Fig. 3A.–C. The pacemaker site: A – pus evacuated from the lead canal, B – cultures, C – inflammation

the right ventricle with its tip was left in place. All three leads were cut off in the superior caval vein. The mitral valve replacement with mechanical prosthesis was performed. The site of PM was then opened during the same procedure. The PM and atrial leads were removed. The ventricular lead was not mobile in the venous system so its connector was cut off and the lead body was left at the PM site.

The resternotomy for bleeding and transient left-side paresis were postoperative complications. The patient received vancomycin, netromycin and fluconazole during the postoperative period.

The Holter exam showed neither rhythm disturbances nor other indication for PM reimplantation. The patient was discharged on the 25th postoperative day with oral anticoagulants.

After three weeks the patient was readmitted to the regional electrotherapy centre because of recurrent fever and local PM site inflammation. Recurrent LDIE with mild renal insufficiency and anaemia was diagnosed. The CRP level was 62 mg/l and blood cultures confirmed the presence of MRSA. The mitral prosthesis function was normal.

Pathological structures connected to Eustachian valve, the presence of remains of the ventricular lead and mild tricuspid regurgitation were found in TTE. Because of clear recurrent LDIE diagnosis, it was decided to remove all the remains of the ventricular lead. The patient was referred to our centre which is a reference centre for treatment of electrotherapy complications.

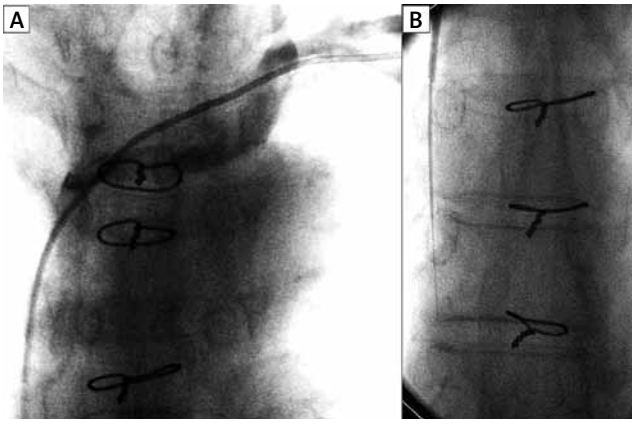

Fig. 4A.–B. Venography: A – extraluminal lead course, B – leader introduced through the lead to the right atrium

The chest fluoroscopy (Fig. 1) and TEE confirmed the previous findings and showed the presence of vegetation-like structure in the entering of superior caval vein into the right atrium (15 × 5 mm) (Fig. 2).

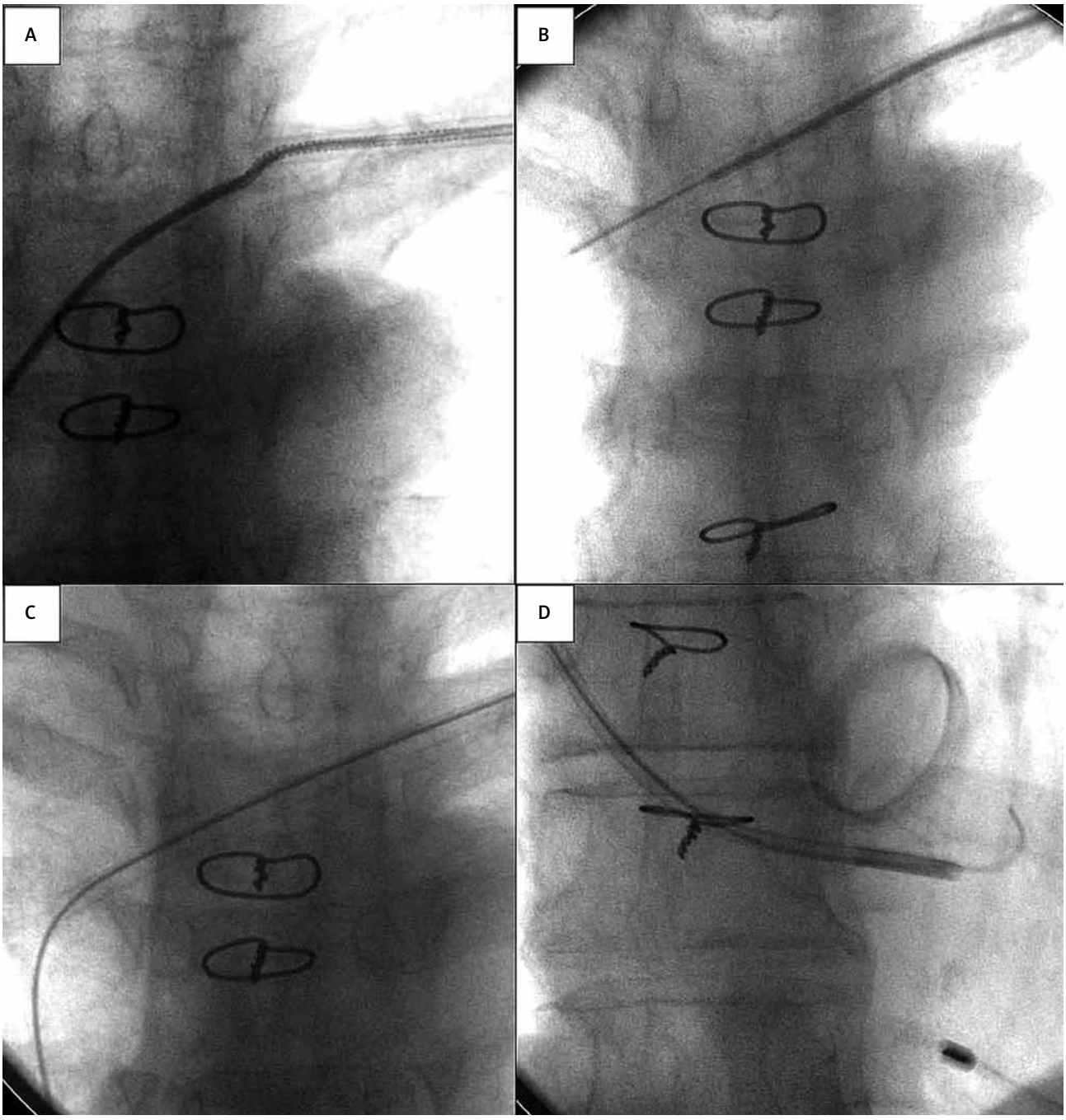

Fig. 5A.–D. The lead removal with Byrd dilatators (A, B) and venous access recovery (C, D)

Acute indications for the lead (acting as an anchor for bacteria) removal were confirmed.

The PM site was opened (Fig. 3). The purulent fluid came from the lead canal after introduction of a leader (Fig. 3A). The culture was collected (Fig. 3B). The stylet entered the right atrium without any obstacle so the communication between the infected PM site and superior caval vein was confirmed (Fig. 4). Venography showed how the lead was ingrown into the vein wall (Fig. 4).

Then, the proximal fragment of the lead was removed with a pair of Byrd dilatators (Cook®) (Fig. 5A, B) and the venous access to the right atrium was recovered with a soft-tip sealed catheter (Attain CS set) (Fig. 5C, D). It was not possible to grasp the lead tip or even to move it with different tools so the tip looked as if it was completely covered by joint tissue in the ventricle (Fig. 6A–D).

The procedure was terminated with a conclusion that the surgical tip removal can be justified only if LDIE symptom recur. The removed lead fragment was covered with partially calcified joint tissue (Fig. 7).

The control echocardiography showed the presence of vegetation smaller than before the procedure in superior vena cava with a hole inside (Fig. 8).

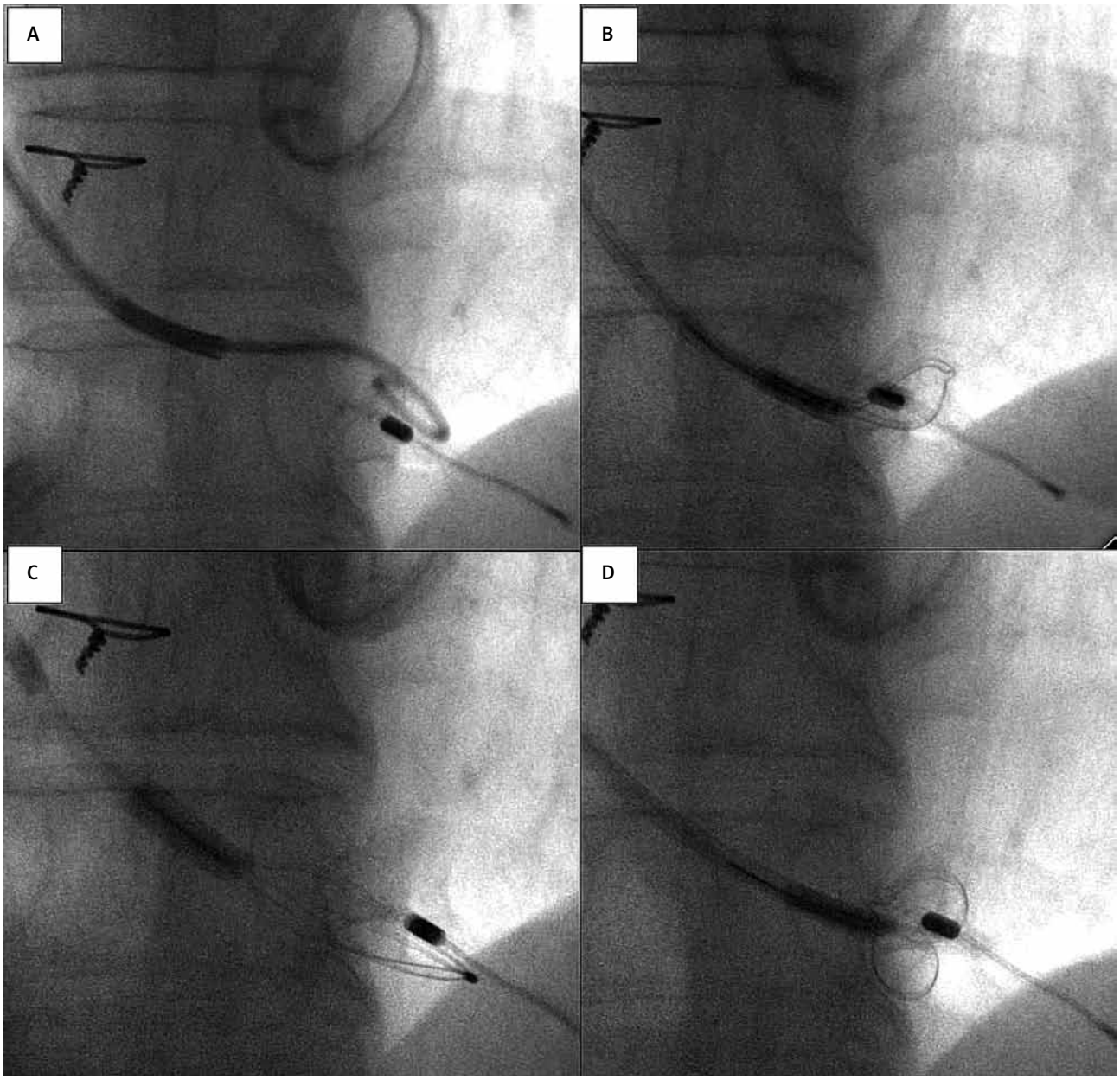

Fig. 6A.–D. Failed trial of tip handling. A – pig-tail catheter; B, D – basket; D – lasso

The patient was sent back to the regional cardiological department on antibiotics for further treatment.

Discussion

The valid guidelines of LDIE treatment point out to only four indications to surgical treatment: huge vegetation (2-3 cm), coexisting heart pathology requiring surgical correction, failure or complications of percutaneous lead removal [3, 4]. In our case, the coexisting mitral regurgitation was the indication.

The guidelines do not specify technical and logistic issues of leads which are fixed in the venous system removal.

In our centre, being the oldest one removing PM and leads in Poland, the process of PM and lead extraction begins outside the cardiothoracic operating room. In the first stage, the PM is removed and leads are mobilized in the venous system down to the right atrium. The ligatures in the PM site and connectors are cut off, the mobility of leads is confirmed and, if leads are fixed intravenously, mobilisation is achieved with Byrd dilatators. The cultures from the site and leads' central canals are collected and the site is drained and closed.

In our opinion, simultaneous opening of PM site for PM removal and sternum for the intracardiac procedure is the worst solution. In such situation, there is a high possibility of heparin-depending site bleeding, transmission of infection from the infected pocket to mediastinum, bacteraemia and moreover, leads which are not mobilized cannot be removed entirely from the right atrium [9, 10].

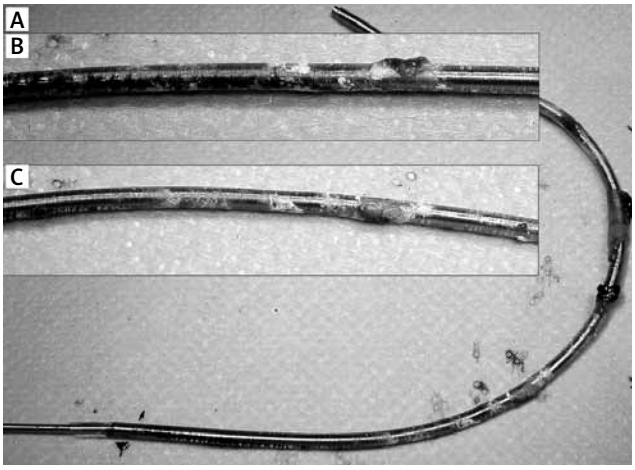

Fig. 7A.–C. The removed lead with it' external silicone tube lacerations and calcifications

Closed and drained site is less vulnerable to haematoma. Old leads (15-25 or even more years after implantation) are very difficult to be mobilized. Bacteraemia during sternotomy or concomitant epicardial leads implantation and extracorporeal circulation is always dangerous and can cause mediastinitis or new leads colonisation.

Thus, it is better in our opinion to perform the first stage a few days before the surgical stage of treatment [9, 10].

Conclusions

Echocardiographical findings in our case may suggest that the fragment of the lead with a vegetation inside the vena cava was a crucial point of the recurrence. It was inaccessible for the cardiac surgeon and its removal was a condition for recovery.

The case is a good illustration of our paper about logistic and technical issues of LDIE treatment taken together by cardiologists and surgeons.

A patient with LDIE diagnosis and indications for cardiosurgical treatment (huge vegetation, other indications for surgery, failure or complications of percutaneous leads removal) should be referred to electrotherapy complications treatment centre for PM removal and all leads intravenous mobilisation.

Patients without four indications mentioned above should not be referred to cardiac surgeons.

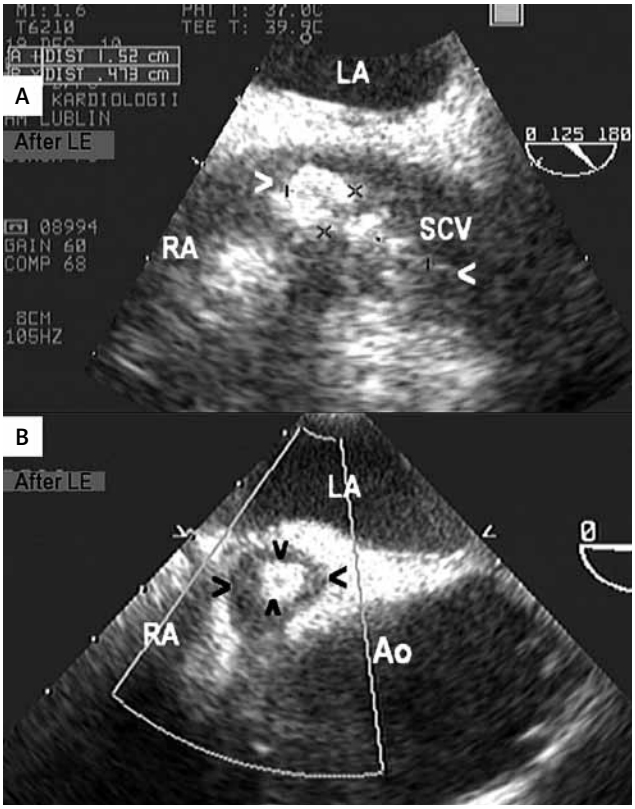

Fig. 8A.–B. Transesophageal echocardiography after lead extraction: A. Longitudinal view, RA – right atrium, LA – left atrium, SCV – superior cava vein, vegetation is shorter (1.5 cm × 0.5 cm). B. Transversal view, RA – right atrium, LA – left atrium, AO – aorta, > < superior cava vein (SCV), ^ – transversal cut of this structure with a hole

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