

IMPLANTABLE CARDIOVERTER-DEFIBRILLATOR (ICD) LEADS EXTRACTION IN INFECTIVE ENDOCARDITIS USING OPEN HEART SURGERY: A CASE REPORT

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DM conceived idea, did literature review and final drafting. AB reviewed case report. All authors contributed significantly to the submitted manuscript.

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ABSTRACT

Implantable cardioverter-defibrillator (ICD) endocarditis is a rare but potentially lethal complication. Chronically implanted transvenous leads adhere to the venous endothelium and endocardial tissues over time due to fibrosis. Removal of such leads can be a significantly complex procedure. There are several approaches to remove transvenously introduced ICD leads. Failure to retrieve transvenous leads, as well as large endocarditic vegetations, is commonly accepted indications for open heart surgery using cardiopulmonary bypass.

We present a case of an infective endocarditis in a 44-year-old man. He had a history of implantable cardioverter defibrillators (ICD) implantation. He was admitted with high grade fever, dyspnea and cough with sputum. In evaluation there was a 24x32mm sized vegetative mass on the leads situated in the right atrium. Antibiotic therapy with vancomycin and meropenem was started. The patient was considered a candidate for surgical removal of ICD Leads because of chronically implanted transvenous leads and large size of vegetation. With cardiopulmonary bypass (CPB) but without cardiac arrest, vegetations and leads were removed. This method prevents the risk of pulmonary embolisation associated with vegetation and mechanic injury to the tricuspid valve and right ventricle.

Key Words: Implantable cardioverter-defibrillator (ICD) endocarditis, Cardiac device-related endocarditis (CDE), Lead extraction.

INTRODUCTION

The use of implantable cardiac devices has increased in the last 30 years being a dynamic field and an interesting challenge.¹ As a consequence, the number of ICD leads with malfunction, structural failure, and infection rose and is still rising. Moreover, advances in technology additionally have promoted system upgrades and device exchanges.^{2,5} About 0.4-1.1 % of patients having permanent pacemaker implantation suffer serious infections leading to endocarditis.³

Generally accepted mode of therapy in this group of patients is removal of the infected pacemaker and lead that has caused endocarditis and accomplishing

long term antibiotic therapy and accompanied by implantation of a new pacemaker to another anatomic site.³

There are several approaches to remove transvenously introduced ICD leads. Failure to retrieve transvenous leads, especially when they are firmly attached to the myocardial wall or tricuspid valve, as well as endocarditic vegetations exceeding 10 mm in size, is commonly accepted indications for open heart surgery using cardiopulmonary bypass.^{4,5}

CASE REPORT

A 44 year old man was admitted with the complaints of fever, dyspnea and cough with sputum. He had history of heavy smoker, opium addiction, hypertension and congestive heart failure. He had a high grade fever (39-40°C).

He had history of implantable cardioverter defibrillators (ICD) implantation via left subclavian vein due to severe left ventricular dysfunction and ventricular tachycardia 6 years ago. About 4 months ago ICD generator was replaced and dual chamber ICD was converted to three chamber ICD.

Laboratory findings including elevated white blood cell count of 21100/dl with an elevated neutrophil count (87%), elevated serum C-reactive protein and elevated erythrocyte sedimentation rate.

Chest X-ray revealed normal lead placement without lead fracture or dislodgement but consolidation of middle and lower lobes of right lung was seen (pneumonia) (Figure 1)

Figure 1: Chest-X-Ray Shows Middle And Lower Lobes of Right Lung Pneumonia



Transthoracic echocardiography revealed a 24 x 32 mm sized vegetative mass on the leads situated in the right atrium, ejection fraction (EF) was 15-20%, severe left ventricular dilation, moderate mitral regurgitation (MR) and tricuspid regurgitation (TR). Transesophageal

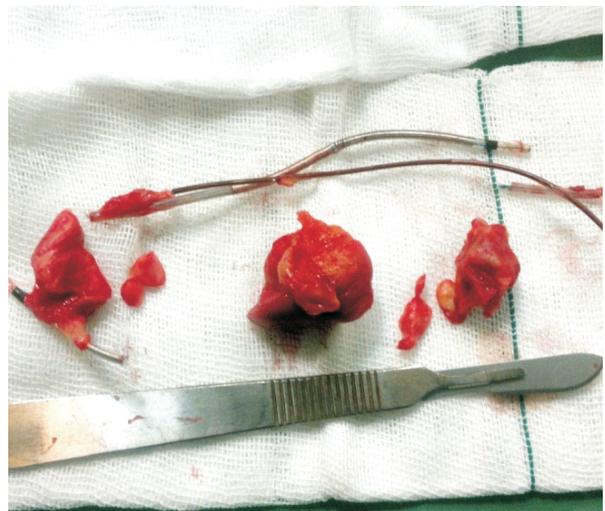
echocardiography (TEE) was tried for patient but he couldn't tolerate the procedure.

Empiric antibiotic therapy with vancomycin and meropenem was started immediately after obtaining blood samples for microbiologic examination. After five days of hospitalization, the results of the blood cultures were negative but only minimally improvement was observed and did not observe any change in the size of the vegetation.

With Cardiac surgery consultation, the patient was selected for surgical removal of ICD Leads Causing Infective Endocarditis. Initially ICD pulse generator was turned off and with subclavicular incision was removed from the chest wall pocket.

Standard median sternotomy was performed. Following aortobicaval cannulation cardiopulmonary bypass (CPB) was performed and both caval veins were encircled with tapes and occluder snares were applied. Without cardiac arrest, right atriotomy was made by inflow occlusion. Backflow from coronary sinus was aspirated for bloodless field. ICD leads that entered from SVC into the right atrium were not adherent to septal leaflet of the tricuspid valve but adherent through right ventricular apex. Multiple and different sizes (1-3 cm) vegetations were seen adherent to all the three leads (Figure 2).

Figure 2: Multiple and Different sizes of Vegetations



All vegetations were removed and remaining particulates were aspirated.

Coronary sinus and Right atrium leads removed easily. But right ventricular lead had relatively firm adhesions and its removal was difficult. Adhesive structures were dissected and the lead was retracted.

Cardiopulmonary bypass weaning was done easily. The patient was extubated after 9 hours of operation and the

length of ICU stay was three days.

Immediately after surgery, high grade fever settled and general condition significantly improved. Cultures on the distal intravascular lead segments were negative. An echocardiographic examination showed no vegetations, no pericardial effusion (PE), EF was 15-20%, mild to moderate TR and MR. Antibiotic therapy was continued for 6 weeks.

The patient was discharged on postoperative 20th day and follow up examination on the 5th weeks revealed no signs of recurrent infection.

DISCUSSION

With the growing number of pacing and defibrillator implantations, it is to be expected that demand for lead extraction will increase as well.^{1,2} While infection may occur in less than 1% of new implants, the incidence increases to more than 3% for subsequent interventions.²

In our case, the patient had history of ICD generator replacement and conversion of dual chamber ICD to three chamber ICD 4 months ago. Although pacemaker related endocarditis is relatively rare and is reported to account for 10% of the pacemaker-associated infections, it carries a high risk of mortality if left untreated.^{3,4,10}

The mortality rate in patients with pacemaker/ICD endocarditis treated with antibiotics alone ranges from 31% to 66%. In contrast, the mortality rate in patients who had combined antibiotics and electrode removal was only 18% (range, 13% to 33%).^{4,9}

To remove failing or infected implantable cardioverter defibrillator leads, percutaneous techniques and open heart surgery are two common approaches. However, well-defined indications for either technique are not available. In a literature review: A total of 1,391 transvenously introduced implantable cardioverter defibrillator systems were implanted during ten years (1995-2005). In 21 patients (1.5%) open heart surgery, and in 53 patients (3.8%) a percutaneous lead removal was performed.⁵

The Heart Rhythm Society defines "extraction" as the removal of any transvenous lead implanted in excess of 1 year, a lead that requires tools beyond standard stylets included in the typical implant package, or a lead removed from a route other than via the implant vein. To clarify, lead removal is defined as removal of a lead by any technique. Lead explant is the removal of a lead implanted less than 1 year via the implant vein using the tools typically supplied for lead implant.^{6,12} It is generally accepted both by surgeon and cardiologist to prefer the percutaneous extraction as first attempt.^{7,8,10} The overall success rate of percutaneous extraction in a large Series of procedures at 89 hospitals in United States was 90%.¹¹

There are several approaches to remove transvenously

introduced ICD leads. Direct (manual) traction, Telescoping sheaths, and Excimer laser sheaths.^{6,7,11,12}

The connections between the lead and endovascular structures can be more substantial with ICD leads than pacemaker leads. ICD leads are larger and have additional components (coils) that provide a greater surface area for adherence. Adhesions between endovascular structures and leads become stronger over time. Leads that have been in place less than one to two years can usually be extracted with relatively low risk. Leads in place for greater periods of time become progressively more difficult to extract with a higher risk of endovascular injury. Also in young patients, usually develop fibrotic adhesions earlier than elderly.^{7,8}

In our case, the patient was 44 years old man with ICD implantation 6 years ago. While simple traction is often successful in newly placed leads, it can be problematic with chronic leads and cause catastrophic complications, ranging from septic embolic phenomena to tricuspid valve injury, right ventricular perforation or peeling of the vegetation located on the tip of the lead, subclavian vein laceration, hemothorax, pocket hematoma, massive hemorrhage, and lead fracture requiring urgent surgical intervention.⁸ Risk of pulmonary embolism is higher especially when the size of the vegetation is more than 10mm.³ In the large published studies on lead extraction, the rate of major complications was 1.6% to 2.0%, or approximately 1 in 50 patients.¹¹ Failure to retrieve transvenous leads, as well as large endocarditic vegetations, are commonly accepted indications for open heart surgery using cardiopulmonary bypass.^{2,5} Large vegetation is defined as vegetation more than 10 to 25 mm in diameter.^{2,5,8} In our case, vegetation size was greater than 30 mm. Overall recommendation of a large study is "Leads with implant time of less than 2 years and vegetation size of <10 mm on TEE were initially tried with percutaneous simple traction. If it was unsuccessful or implant time was more than 2 years or vegetation size was >10 mm on TEE an extraction with cardiopulmonary bypass was performed".⁹

Surgical extraction of the lead under direct vision via surgical procedure using cardiopulmonary bypass is a more comfortable and safer way. This method eliminates the risk of mechanical injury to the tricuspid valve and right ventricle besides embolisation of the vegetation to the lungs. This method also prevents the arrhythmia that can occur during percutaneous transvenous extraction of the lead.³

The need for the replacement of device must be carefully assessed. We thought that the risk of CDE outweighs the benefit of the device in these patients. In published series, up to 50% of patients do not require further implantation after device removal.^{4,8,9} Long term antibiotic therapy is appropriate in these cases starting from the preoperative period and continued after lead removal.

Some series have recommended 6 weeks of therapy after device removal. However, with most cases of device-related endocarditis limited to the right heart, some authors have suggested 4 weeks of therapy should be adequate.^{9,10}

CONCLUSION

Infection of Implantable cardioverter-defibrillator leads is a rare but fatal complication. Because of less invasiveness and short hospital stay, transvenous approach is the first choice for ICD leads extraction.

But Surgical removal is a good alternative in failed cases or large and multiple vegetations that prevent the risk of pulmonary embolization and reduce risk of endovascular injury.

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