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DEVICE THERAPY

CLINICAL DECISION MAKING

Percutaneous Extraction of Active Fixation Lead in a Case of Delayed Right Ventricular Lead Perforation

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ABSTRACT. The chance of subacute and delayed perforations has been reported to be a very rare complication of permanent placement of pacemakers. They are thought to be increasing due to the increased flexibility of leads that cause increased force per unit of area on the ventricular wall. Surgical and percutaneous lead extraction was the accepted management option available. In this case, we describe the management of delayed right ventricular lead perforation by percutaneous lead extraction with strong surgical back-up.

KEYWORDS. active fixation lead, lead perforation, percutaneous lead extraction, pericardial effusion, permanent pacemaker.

Introduction

Delayed right ventricular (RV) lead perforation, which may occur 30 days after the placement of the pacemaker, is one of the rare complications of permanent pacemaker implantation. The chances have been reported to range between 0.1% and 1%.1 The accepted management options are either surgical or percutaneous lead extraction. However, the management decision in lead perforation is always a dilemma. Lead perforation extending far beyond the cardiac margins has rarely been reported in the literature.2 It is a serious complication following pacemaker implantation, which could potentially lead to catastrophic outcomes.3 Proper diagnosis and management of lead complications are vitally important. In this case, we describe the management of delayed RV lead perforation in a pacemaker implanted in a 66-year-old female patient.

Case report

A 66-year-old female with symptomatic degenerative complete heart block underwent permanent pacemaker implantation at a peripheral hospital 3 months ago. The patient presented with progressive worsening of chest discomfort and breathlessness. On admission, the patient had stable vital signs, elevated jugular venous pressure, and short mid-systolic murmur at the base. Baseline investigation showed an intermittent loss of capture and sensing, with one episode of ventricular tachycardia due to asynchronous pacing. Device interrogation revealed loss of capture with increased threshold. Transthoracic echo confirmed a perforated active fixation lead tip outside the RV border but inside the pericardium (1 mm from the pericardium) along with minimal pericardial effusion, confirmed by the subcostal view (Figure 2). Immediate fluoroscopy confirmed lead perforation (Figure 1). As the patient’s vital signs were stable and the lead was 1 mm inside the pericardium but outside the RV border, percutaneous lead extraction with strong surgical back-up was considered. Temporary pacemaker implantation was performed through the femoral route which was followed by pericardial tapping. About 30 ml of blood-stained fluid was drained followed by 300 ml of straw-colored fluid through a pigtail catheter placed in situ. Since the vital signs were stable after pericardial tapping, percutaneous lead extraction was planned. Lead

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Management of Delayed RV Lead Perforation

Figure 1: (a) Right anterior oblique (RAO) view showing a perforated lead tip with the temporary pacemaker *in situ* (arrowhead) and (b) RAO view showing newly placed permanent pacemaker lead in the mid-septum with *in situ* pigtail catheter for pericardial tapping (arrowhead).
extraction was performed by opening the pacemaker pocket followed by slowly unscrewing the active fixation lead from the RV apex. The procedure was completed by placing a new lead in the mid-septum. The position of the lead was confirmed by fluoroscopy in the anterior-posterior view, and subsequently by leads connected to a pulse generator which had previously been placed from outside. The post-procedure condition was uneventful. Pericardial tapping through the pigtail catheter in situ was performed regularly till there was a minimal amount of straw-colored fluid remaining. The pigtail catheter was removed after 2 days and the patient was discharged.

Discussion

The three different categories of ventricular lead perforations are acute, subacute, and delayed. Subacute perforations occur within 24 h of placement, with an incidence of 1–7%. Subacute perforations occur within 5–29 days of placement, and delayed perforations occur more than 30 days after placement. Rates of perforation are higher with active fixation leads. Subacute and delayed perforations are thought to be increasing due to the greater flexibility of leads, which cause increased force per unit of area on the ventricular wall. There are several factors, like smaller, thinner leads, that exert an increased force per unit area on the ventricular wall and which could contribute to acute perforations. Late perforation is due to increased lead slack and increased tension on the free wall. Active fixation leads have a higher incidence of perforation due to lead thickness and over-torquing. The interaction of the lead tip forces and the ventricular wall when unbalanced can result in perforation. Acute complications of both kinds of wire placement include cardiac tamponade, pneumothorax, hemothorax, pericardial and pleural effusions, and lead perforations. Late complications can include infection, superior vena cava thrombosis, failed sensing, failed pacing, and erosion of the lead or generator. In a suspected case of lead perforation there can be diaphragmatic pacing, pericardial

Figure 2: Transthoracic two-dimensional echo showing a perforated active fixation lead tip outside the right ventricular border inside the pericardium (arrowhead), with minimal pericardial effusion confirmed by the subcostal view.
friction rub, intermittent or failed pacing or sensing, muscle stimulation, or increased pacing threshold, or the lead tip may be less than 3 mm from the radiolucent stripe of epicardium. Normal impedance and pacing parameters do not exclude perforation. For suspected lead perforation, evaluation should include pacer interrogation, chest radiograph, and echocardiogram. Treatment of ventricular lead perforation varies as to the timing of the perforation. In acute lead perforation, the lead can be repositioned and followed with serial echocardiograms to monitor resolution of the perforation and to detect deterioration that would require immediate intervention. Delayed and subacute perforation management is controversial. If there is no bleeding in the mediastinum, the lead can be left in place and another lead inserted for use. If there is bleeding within or outside the mediastinum with a risk of vascular or pulmonary damage, the lead must be extracted within 30 days. Active fixation leads can be removed transvenously under observation with an echocardiogram. Passive fixation leads have bulky tips that can cause damage during transvenous extraction.

Conclusion

Ideally, lead perforation should be avoided, and all precautions taken. To minimize the risk of perforation, the lead should be placed along the septal wall or in the RV outflow tract whenever possible. Proper diagnosis of lead perforation is vitally important for its management. Percutaneous transvenous extraction of a perforated lead is difficult and its role is debatable.

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