



Original article

# Intra-cardiac pacemaker infection: Surgical management and outcome

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## Abstract

**Background:** Pacemaker infections are rare, but serious complications of pacemaker therapy. The generator pocket, the pacing leads, or both may be involved.

**Methods:** We report 21 patients with infected pacemaker systems. All had infected pacemaker and pacemaker leads with tricuspid valve endocarditis. Pacemaker systems were completely removed in all patients. Extracorporeal circulation with beating heart was employed for the explantation of infected pacing leads, generator and removal of vegetations on tricuspid valve and repair of tricuspid valve. Then a permanent epicardial pacemaker lead was inserted.

**Results:** No complications occurred in patients with localized generator pocket infections. Two patients with infected leads, who were preoperatively already in a serious clinical condition, died of septic shock in the early postoperative period. No recurrent infections were observed.

**Conclusion:** Explantation of the complete pacemaker system has proved a reliable method to eradicate infection. Complications were rare, except in patients who present lately in a critically ill condition and septic shock.

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**Keywords:** Heart (general subjects); Pacemaker; Endocarditis; Pacemaker lead infection; Tricuspid valve

## 1. Introduction

Since the first implantation of a completely implantable pacemaker by Elmqvist and Senning in 1958, pacemaker implantation has rapidly become a routine procedure. Most frequently, pacemaker leads are introduced through the cephalic or subclavian vein using direct exposure or introducer techniques and advanced into the right atrium and ventricle. Pulse generators are placed above or beneath the pectoralis major muscle. Alternatively, the leads can be fixed to the epicardium and the generator stored in the anterior or posterior sheath of the rectus abdominis muscle. Among possible complications, infective endocarditis of intracardiac pacemaker leads is of particular clinical importance. It is a rare, but serious, complication and can become life-threatening [1].

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The clinical use of permanent pacemakers has grown considerably over the past 2 decades. A growing list of indications for permanent pacemakers and the increase in the geriatric population mean that more patients undergo pacemaker insertion. Therefore, there is a larger population at risk of infection [2].

Cardiac device infective endocarditis (IE) is an infrequent but potentially lethal infectious complication of pacemaker. Infection of the pacemaker pouch and wire may occur in 1–7% of implanted pacing systems, and mortality rates in cardiac device endocarditis have been reported to be 30–35% [3]. Risk factors for cardiac device endocarditis include chronic conditions such as diabetes mellitus, malignancies, immunosuppressive therapy, and local factors related to the pacing system such as erosion of the pacemaker pouch, and the number of previously inserted leads. Despite advances in diagnostic approaches, treatment of cardiac device endocarditis is still controversial. Medical treatment has been reported to be successful in some cases [4,5]. However, there is increasing evidence that the entire pacing system should be removed to achieve complete infection eradication [6].

In this report we summarize our experience with pacemaker intracardiac lead infections and include recommendations for surgical treatment with or without tricuspid valve endocarditis.

## 2. Patients and methods

### 2.1. Patients' characteristics

All patients were referred to our cardiac surgery department in National heart institute, Cairo, Egypt from cardiology department with resistant infection of cardiac pacemaker, intra-cardiac lead vegetations and tricuspid valve endocarditis during 8 years duration from March 2007 to June 2015.

In this 8 years duration, 21 patients (12 males, 9 females) with an average age of 29 years ( $\pm 9.4$  SD) were referred to our institution for the treatment of infection of their pacemaker systems. In 5 patients, the original pacemaker was implanted in different hospitals and 16 patients had undergone pacemaker implantation at our institute. The indications for pacemaker implantation for the 16 patients initially implanted at our institute were sick-sinus syndrome ( $n = 3$ ) and third-degree atrioventricular block ( $n = 13$ ). In all patients, pacemaker leads had been implanted transvenously through the cephalic or subclavian vein and the pacemaker generators positioned on the pectoralis major muscle.

### 2.2. Clinical findings, complications and diagnosis

Six patients had history of infected generator pocket and 2 of them suffered from diabetes mellitus. At time of surgery; five patients presented with intracardiac infection without pocket infection and sixteen patients had infected leads with infected pocket (eleven patients had erosion of the skin of the pocket and five patients showed healed pocket infection with intact skin). All patients with a lead infection presented with symptoms of sepsis. 2 patients suffered from septic emboli to the lungs that had led to recurrent pneumonia.

Diagnosis was continued by obtaining blood cultures and the presence of vegetations on pacemaker leads was confirmed on the basis of transthoracic and trans-esophageal echocardiographic findings. All patients suffered from infected pacemaker leads with vegetations attached to them and the tricuspid valve. All patients were found to have vegetations attached to the tricuspid valve. Five of them had additional thrombi in the right atrium and three patients were found to have masses of thrombi extending from the pacing leads to both the right atrium and ventricle. (Fig. 1–3).

### 2.3. Perioperative management

Our perioperative strategy included adequate antimicrobial therapy which started when the diagnosis was established and altered when the causative microorganisms were identified. If cultures still grew no organisms, broad-spectrum antimicrobial therapy directed against organisms most commonly responsible for causing pacemaker infections was initiated. Operation was postponed until signs of infection and sepsis had disappeared.

### 2.4. Operation

Infected pacemaker leads in all patients were removed with the aid of extracorporeal circulation. Total cardiopulmonary bypass was instituted after cannulation of the ascending aorta and superior and inferior venae cavae. Intracardiac surgical procedures were performed on an empty beating heart without the application of cardioplegic solution or aortic cross-clamping. Bi-caval cannulation allowed the right atrium to be opened in a rather bloodless field, with a sufficient view and exposure of the infected leads, the

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