

## Cardiac Pacemaker Infection: Management and Results

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### Summary

*We report on 18/1,500 (1.2%) pacemaker patients (pts) with complications of infection complications post implant. 15 pts presented with localized infections in the generator pocket, 2 patients with infected lead systems and 1 patient with both. For treatment, the pts were subdivided into groups. In group 1 (n = 12), all patients received a closed irrigating-suction system in the pocket in attempt to clear the local infection. In group 2 (n = 4), the infected pacemaker was acutely removed and a new pacemaker was implanted at a different site. In 6 pts from group 1, first treatment was ineffective, which caused us to additionally apply "group 2" treatment with replacement of the pacemaker. In group 3 (n = 3), all infected leads were removed under cardiopulmonary bypass (CPB). One pt from group 3 died 6 days post operation as a result of severe pulmonary complication. All other patients have shown no further signs of infection after a mean follow-up of 28.3 months. We conclude that treatment of acute generator pocket infection should consist only of local debridement and pocket irrigation within the first week of onset. If these conservative measures are ineffective, a removal of the infected pacemaker is the correct alternative for management. A new transvenous pacemaker system should be implanted at a different site. Removal of infected leads and complete recovery with high effectiveness could only be achieved during CPB.*

### Key words

Pacemaker infection, local treatment, systemic treatment

### Introduction

The incidence of infection after implantation of pacemakers is a rare, but dangerous complication [1-4]. Pacemakers are used very commonly for treatment and prevention of the cardiac arrhythmia. Together with the increase in the total number of implants the incidence of infections will grow. In this article, we present our experience with pacemaker system infection in 18 patients.

### Materials and Methods.

From January 1992 to July 1998, 18/1,500 patients (1.2%, 8 male, 10 female) with an average age of  $64.8 \pm 8.7$  years presented infections of the pacemaker systems. All patients had been provided with single-chamber pacemakers.

At the time of diagnosis, 11 patients presented symptoms and signs of infection at the generator site, 4

showed up with erosion along the lead or over the pacemaker, 2 without any local signs of inflammation or erosion along the pacing system, but with symptoms of sepsis (temperature and bacteremia). One patient was admitted with both localized and systemic infection.

Five patients developed an early infection at a mean of 3 days after implant. No reports exist regarding infections during or after lead revisions (lead dislodgements). One patient (5.6%) needed temporary pacing prior to chronic pacemaker implant.

twelve patients showed up with late infections 1 to 4 years post implant: erosion of the pacemaker or of the leads (n = 5); pocket infection after trauma (n = 2); primary pocket infection; bacteremia with no identified focus (n = 2); bacteremia with identified focus (n = 1). In all patients specimens of purulent material, cultures from infected sites and blood cultures were obtained

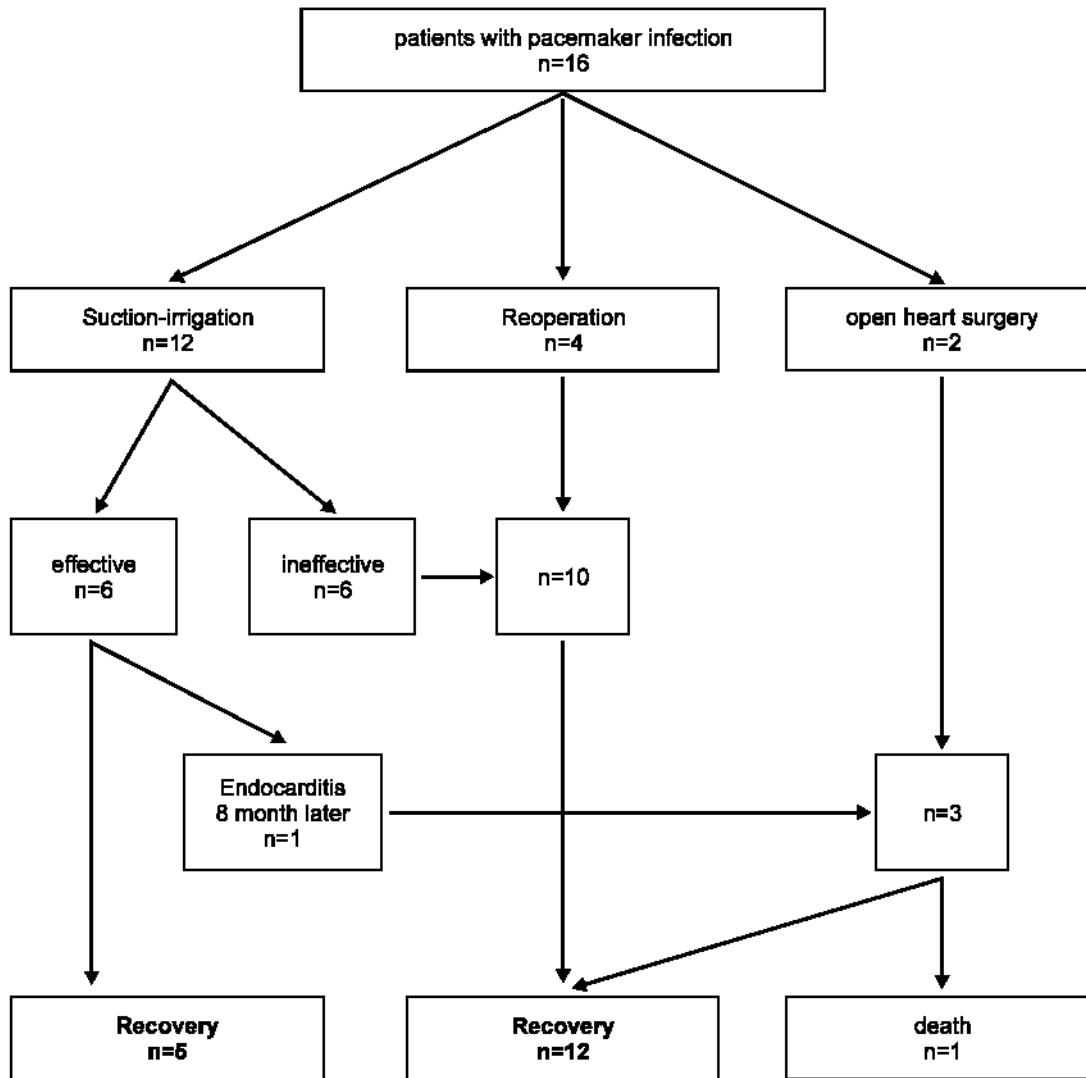


Figure 1. Management of patients with pacemaker system infection.

for Gram's staining. The main cause for infection were *Staphylococcus aureus* (n = 8) and *Staphylococcus epidermidis* (n = 7), then nonhemolytic *Streptococcus* (n = 1) and *Pseudomonas aeruginosa* (n = 1).

Treatment protocols (Figure 1): In group 1 (n = 12), patients were treated systemically with antibiotics. In all patients, a closed irrigation-suction system was placed in the pocket to attempt further local clearance of the infection. In 6 patients from group 1, the same procedure followed after initial unsuccessful treatment. In group 2 (n = 4), the infected pacemaker was immediately removed and another pacemaker was implanted in a different site.

In 6 patients, pacemaker relocation to the other side was performed acutely. Four patients received a new pacemaker 2-5 days after explant of their infected devices. These 4 patients were fully dependent on their systems. Three of these patients received temporary endocardial leads when the infected pacemakers were removed. In one patient, we used the chronic endocardial lead for pacing with an external pulse generator. In group 3 (n = 2), all infected leads were removed under cardiopulmonary bypass (CPB). Total normothermic CPB was performed by cannulating the ascending aorta and superior and inferior venae cavae. Intracardiac surgical procedures were performed after

cardioplegic heart arrest and right atriotomy. Using this access, all leads surrounded by masses or vegetations could be removed from the intracardiac cavity.

## Results

6/12 patients (50%) in group 1 did not require reoperation but only pocket irrigation. The mean duration for irrigation of the infected pocket was  $7.2 \pm 3.4$  days (ranged 3-14 days).

The other 6 patients in group 1 underwent a revision with simple debridement of the pocket and reimplantation of the new system in a different area. Endocardial leads were removed 4-8 weeks after revision. Mean duration for irrigation of the infected pocket in this subgroup was  $14.2 \pm 3.9$  days (range 10-23 days), which was significantly longer in comparison to the first 6 patients ( $p = 0.01$ ). The mean duration of hospitalization for patients without need of reoperation was  $29.3 \pm 8.2$  days versus  $58.5 \pm 20.5$  days ( $p = 0.082$ ) for the subgroup with the need of reoperation.

One patient from group 1 developed pocket infection after trauma 8 months post discharge. The pulse generator was removed and temporary pacing was performed via the chronic endocardial lead. The patient then developed a temperature and further symptoms of bacteremia. After unsuccessful intravenous antibiotic treatment, the infected leads were removed by open heart surgery. The patient died 6 days after operation as a result of severe pulmonary complications.

Group 2 presented no complications. The mean duration of hospitalization was  $14.7 \pm 9.2$  days.

In group 3, two patients with septicemia were operated under CPB with removal of the endocardial electrodes. The leads were surrounded by vegetation masses in the cardiac cavities. In 1 patient, the tricuspid valve needed to be reconstructed after partial leaflet resection had become necessary to remove an entrapped lead. The postoperative course with a mean follow-up period of 28.3 months is without further complications.

## Discussion

With the increase in cardiac pacemaker implantation the incidence of infection complications is estimated at or below 5%, but should be below 2% [1, 2, 9]. In

our 1,500 patients who have received pacemakers the infection rate was calculated at 1.2%.

Predisposing factors for infection are diabetes mellitus, long or repeated operations and pocket hematoma. Among all the factors repeated surgical interventions due to the pacemaker system seems to be the most likely to cause infection [10].

Infection risk is identical at first implant and at replacement. Infection of the pacemaker system may be limited to the pocket, it may involve only the leads or it may include the whole pacemaker system. Pacemaker endocarditis is a less common, but very severe complication that might even threaten the patient's life. This can also be associated with temporary pacing.

The most common causal microorganisms in pacemaker infection are *Staphylococcus aureus* [8, 11-13] and *Staphylococcus epidermidis* [14, 15] that physiologically colonize the skin. Also a wide spectrum of other microorganisms has been described. In case of pocket infection, one way of treatment may include debridement and irrigation of the pocket [5, 6, 16, 18, 21]. This method can be effective and has been our policy as a first approach to the infection in the first week after occurrence. However, in our evaluation this treatment failed in 50% of the cases.

The next stage would then be explantation of an infected pulse generator with or without removal of the electrodes [2, 11, 17, 22]. The leads can be removed by simple manual traction in case of early infection, i.e. less than 2 months post implant [19, 20]. In relation to the time from implant endocardial leads have the tendency to develop a firm attachment to the tricuspid leaflets [23], to the right atrial and ventricular walls. Various techniques and devices had to be used for removal of the leads. Regarding this issue, the United States Leads Database has shown a serious complication rate of 2.5% and a mortality rate of 0.6% for patients who undergo intravascular lead extraction.

The present study shows that after incomplete removal of a pacemaker system, part of the lead can be left in the patient's body without causing the infection to continue. The lead is easier to treat with antibiotics once the pulse generator is removed.

We prefer to remove infected leads during open heart operation, because this approach has several advantages over intravascular "blind" extraction methods [7].

## Conclusion

In case of pocket infection, treatment may consist of local debridement and irrigation of the pocket within the first week after occurrence. If these conservative measures are ineffective, removal of the infected pacemaker is a good alternative for management. A new transvenous pacemaker system should be implanted at a different site. The removal of infected leads and complete recovery with high effectiveness can only be achieved only during cardiopulmonary bypass.

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