Is There a Need to Remove an Old Pacemaker When Implanting a New Device in the Contralateral Side?

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Abstract

Background: Device replacement or revision may constitute 25% of pacemaker procedures. In patients needing pacemaker system replacement the usual approach is from the ipsilateral side of the previous system. In cases where the contralateral side is used the previous pulse generator is removed.

Objective: To test the feasibility of implanting a new system in the contralateral side without the removal of the old system.

Methods: We present 10 patients, age range 30–88 years (median 73), with clinical indication of pacemaker replacement where the contralateral side was used. In eight patients the replacement was lead-related, and in the remaining two was due to other clinical indications. In all cases the ipsilateral approach was felt to be contraindicated because of local vein and/or pocket complications. Following the new pacemaker implantation the old system was reprogrammed at the lowest rate, lowest output and highest sensitivity.

Results: All patients underwent uneventful implantation. Post-surgery monitoring and Holter recordings failed to show any interference by the old system.

Conclusions: In clinically indicated cases it is feasible to implant a new device in the contralateral side without removing the old pulse generator, thereby avoiding an additional surgical procedure and reducing periprocedural complications.

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The need for pacemaker replacement may be due to device malfunction, pocket or lead-associated problems. Among the most frequent causes are end of life of the device, infection, erosion of the skin in the implanted region, trauma, device malfunction or migration, the need for system upgrade, and lead replacement or revision [1].

In patients needing system replacement the usual approach is from the ipsilateral side of the previous system [1]. In cases where the contralateral side is selected, the previous pulse generator is usually removed. This procedure prolongs overall operation time and may be associated with additional complications. The aim of the present study was to test the feasibility of implanting a new system in the contralateral side without removing the old pulse generator.

Patients and Methods

We present 10 patients with a clinical indication for pacemaker replacement in whom the contralateral side was selected [Figure 1]. In all 10 patients the decision to intervene in the contralateral side and to add new leads was made before the surgery. All new implanted pacemakers were bipolar systems. Indications for replacement were: oversensing in four patients, battery end of life with problematic leads in four patients (advised by pacemaker company), and need for pacemaker function upgrade in two patients. The reasons for choosing the contralateral side for implantation of the new device were: deep venous thrombosis (subclavia) diagnosed by venous angiography or Doppler ultrasound in five patients, fibrotic scars (with transient local infection) from previous implantation in three patients, patient's candidacy for extensive orthopedic surgery of the shoulder (one patient), and deeply implanted abdominal pacemaker in the remaining patient.

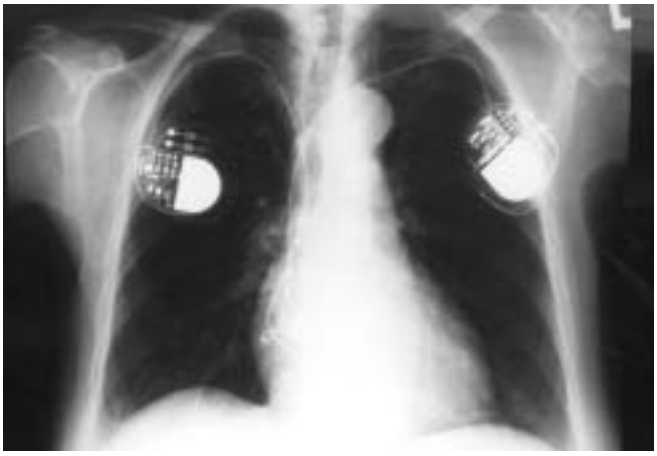

Figure 1. Chest X-ray of patient with an old and new pulse generator in place

Following implantation of the new pacemaker the old system was left in place and reprogrammed to the lowest rate, lowest output and highest sensitivity. All patients were followed with post-surgery monitoring, predischarge Holter at 1 and 6 months, and routine follow-up at the pacemaker clinic for detection of any interference between the two pacemakers.

Results

The patients, five females and five males, had an age range of 30 to 88 years (median 73). The mean time of system replacement after initial implantation was 8.25 $\pm$ 3.28 years. Nine of the old pacemakers were single-lead systems. In nine patients the initial pulse generator was located in the left infraclavicular region. The remaining patient had an abdominal pulse generator. All of the old pacemaker systems were bipolar except for the abdominal one which was unipolar and epicardial.

Initially the pacemakers were implanted for complete atrioventricular block in nine patients, and for 2:1 atrioventricular block in the remaining patient. Eight of the 10 patients were pacemaker-dependent.

Table 1. Parameters of old pulse generator after implantation of new pulse generator

Patient no.	Amplitude (v) pulse width (ms)	Sensitivity (mv)	Rate
1	0.8/0.05	0.62	30
2	0.8/0.05	0.62	30
3	0.8/0.05	0.62	30
4	1.2/0.125	1.0	30
5	0.8/0.05	0.62	30
6	2.5/0.25	1.25	30
7	0.9/0.03	1.0	30
8	0.2/0.05	0.62	30
9	0.2/0.05	0.62	30
10	0.8/0.05	0.62	30

v = volts, ms = milliseconds, mv = millivolt.

All patients underwent uneventful implantation. The old system was reprogrammed to the highest possible sensitivity and lowest possible output and rate [Table 1]. Post-surgery monitoring and Holter recordings for the mean follow-up period of 25.4 $\pm$ 7.4 months failed to show any interference by the old system. In addition, magnet application to the old pacemaker (causing asynchronous VOO pacing) at every pacemaker clinic visit failed to disturb the normal functioning of the new system (not sensed by the new pacemaker).

At the time of implantation six pacemakers were at elective replacement indicator voltage while the remaining four were at normal function voltages. At the time of the last pacemaker clinic visit, seven of the pacemakers were at end-of-life voltage while the remaining three had normal voltages. In no patient have we observed asynchronous pacing by the old pacemaker.

Discussion

Our experience with 10 patients in whom a contralateral site of implant was chosen without removal of the old system (both pulse generator and electrodes) has shown the procedure to be feasible thus far without complications. Programming the old system to the lowest rate, lowest output and highest sensitivity has shown no interference with the proper function of the new system during a follow-up of 25.4 $\pm$ 7.4 months.

Indications for removal of abandoned pacemaker leads are controversial. Suga et al. [2] conducted a retrospective study (from 1977 through 1998) of all patients with retained non-functional leads and identified 433 such patients in the Mayo Clinic database. The purpose of their study was to determine whether or not abandoned pacemaker leads should be extracted in the absence of pacemaker-related problems. A total of 531 non-functional leads were abandoned, of which 18 were later extracted. Complications associated with pacemakers were found in 24 patients (5.5%); these included pacemaker system infection (8 patients), and venous occlusion at the time of a subsequent procedure of new lead placement when abandoned pacemaker leads had already been in place (16 patients), which resulted in abandoned pacemaker lead removal (7 patients) or transfer of the pacemaker system to the contralateral side (9 patients). The authors concluded that with only 5.5% of patients having had pacemaker-related complications, the adverse outcome of abandoned pacemaker leads was small and that pacemaker-related complications more frequently occur in patients with three or more abandoned leads, four or more total leads, three or more procedures of new lead placement, and younger age at initial pacemaker implantation.

It is of note that in the experience of Suga et al. [2], no pulse generator was left in place together with the abandoned leads. Therefore, if up to three abandoned pacing leads are left in place with a low complication rate, there may be no apparent reason to remove the old pulse generator. Moreover, there may be some additional expected risks in removing the old pulse generator, such as increased pacemaker system infection and increased operation time [2].

On the other hand, some complications of leaving the old pulse generators in place may be observed during longer follow-up periods. Local infection [1] and unexpected pacemaker interference (such as runaway pacemaker) are possible examples. The question of what happens when the abandoned pacemaker truly reaches complete battery depletion is unknown. Also unknown is whether the abandoned pacemaker – reaching a point where it reverts to different programmed parameters (due to the markedly depleted battery) – will cause interference with the new pacemaker through sub-threshold stimulation or other unexpected mechanisms. This possibility has to be seriously considered and extended follow-up will be necessary to ensure the safety of this modification.

In conclusion, to the best of our knowledge our report is the first to address the question of retaining an old pulse generator in place while implanting a new one. In clinically indicated cases it seems feasible to implant a new device in the contralateral site without explanting the old pulse generator, therefore avoiding an additional surgical procedure and reducing periprocedural complications.

Limitations

The small number of patients and the lack of a control group are obvious limitations to our study. Another, and most important, limitation is that the follow-up period was relatively short; therefore we cannot rule out possible future interference from the old pulse generator.

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