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Case Report Open Access

Temporary Pacing with an Active-Fixation Permanent Bipolar Pacing Lead as an Emergency Treatment of Acute AV-Block

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Abstract

Management of patients with systemic infections and concurrent need for acute pacing due to new-onset of hemodynamic relevant bradycardia such as at high grade AV-block is very difficult. Implantation of a permanent pacemaker is contraindicated in the case of ongoing sepsis. As a bridging therapy temporary pacing is needed in patients with life-threatening bradycardias. The complication rate of a temporary pacing like dislodgement of the pacing wire increases significantly in a time-dependent fashion. Therefore, in cases requiring long-term antibiotic treatment such as endocarditis, a different approach might be considered.

We have treated two patients with acute infective endocarditis and new onset of hemodynamically relevant bradycardia with a temporary permanent active-fixation bipolar pacing lead connected to a second-hand disinfected pacemaker in VVI mode. In addition, we provide an overview of other published cases. The use of active-fixation permanent pacing leads connected to an externalized pacemaker for temporary pacing in patients requiring intermediate to long-term antibiotic treatment provides a safe and effective method for prolonged temporary pacing as a bridge to permanent pacing or recovery.

Keywords Endocarditis; AV block; Temporary pacing; Permanent active-fixation pacing lead; Case report; Review

Introduction

Management of patients with systemic infections and concurrent need for acute pacing due to new-onset of hemodynamic relevant bradycardia such as at high grade AV-block can be very difficult, since implantation of a permanent pacemaker is contraindicated.

Current guidelines [1-4] for the treatment of infected cardiac implantable electronic device (CIED) recommends a minimal time interval in patients with valvular endocarditis or lead vegetations of minimal 14 days after removal an infective CIED. In patients with no evidence of valvular endocarditis or lead infections, a (new) permanent device can be implanted after control of local infection, if blood cultures obtained within 24 hours after device removal remain negative for 72 hours. In the absence of specific recommendations this can be applied to the situation of systemic infections.

In short-term treatable infections conventional transvenous pacing is possible to achieve a complete recovery from infection. Conventional transvenous temporary pacing leads are usually inserted via the internal jugular vein, subclavian vein or femoral vein through an introducer. If necessary, an active-fixable temporary pacing lead can be used to avoid dislocations [5,6]. After an infection-free interval, a permanent pacemaker system could be implanted, if necessary.

In need of intermediate to long-term antibiotic treatment of systemic infections such as endocarditis or else, the complication rate of temporary pacing increases significantly up to 37% [4,7-12]. Beyond the implantation-related complications there were dislocations of the lead (up to 19%), perforation, changes of pacing threshold or sensing, malfunction, faulty programming and unnoticed battery depletion. But also local infection or thrombosis (up to 34%) [13,14] during temporary pacing occurred. Immobilization and the associated risks and complications such as thrombo-embolic events and pneumonia added.

Furthermore, patients have to be treated on an intensive care unit or intermediate care station with continuous heart rhythm monitoring. Therefore the costs are rising due to the necessary increase in monitoring of these patients [15].

In cases of expected intermediate to long-term antibiotic treatment, a different approach as the conventional transvenous pacing should be considered.

Two Case Reports

We have treated two patients with acute infective endocarditis and new onset of hemodynamically relevant bradycardia with a temporary permanent active-fixation bipolar pacing lead connected to a second-hand disinfected pacemaker in VVI mode.

The target was a bridge to definitive permanent pacemaker implantation after antibiotic treatment of endocarditis with healing of the infection.

Due to the expected long duration of antibiotic treatment and the increased risk of dislodgement we decided to use a permanent active-fixation bipolar pacing lead connected to a second-hand disinfected pacemaker.

First patient was a 69 year old man transferred from a rehabilitation clinic with acute AV block grad 3 with resulting heart rate of 30-35 bpm (Figure 1) and suffered from dizziness. The patient had previously

suffered 3 week earlier a craniocerebral trauma with narrow subdural hematoma right occipital and small subarachnoid hemorrhage right temporobasal. And the patient was transferred in a rehabilitations clinic after completion of the acute treatment. As an emergency intervention patient received immediately a conventional temporary pacemaker inserted via the internal jugular vein through an introducer. We used a 5F (90 cm) bipolar pacing catheter (Edwards Lifesciences) via a 6F introducer sheet connected to an external pacemaker typ Reocor S (Biotronik). Initial laboratory test showed significantly increased infection parameters (leucocytes 12.2 * 10^3/µl, CRP 17.1 mg/dl) without elevated temperature (36.1°C). INR was spontaneous elevated to 1.34, creatinine, Troponin T, CK or CK-MB was within the normal range. We started calculated antibiotic therapy with cefuroxime. A transesophageal echocardiography showed 2 * 1.2cm big fresh vegetation at the tricuspid valve with high suspicion of endocarditis. We then extended antibiotic therapy to gentamicin. In the blood culture, a multi sensitive Staphylococcus aureus was isolated, then in the course of receiving the MSSA-finding then conversion of antibiotic therapy to flucloxacilline.

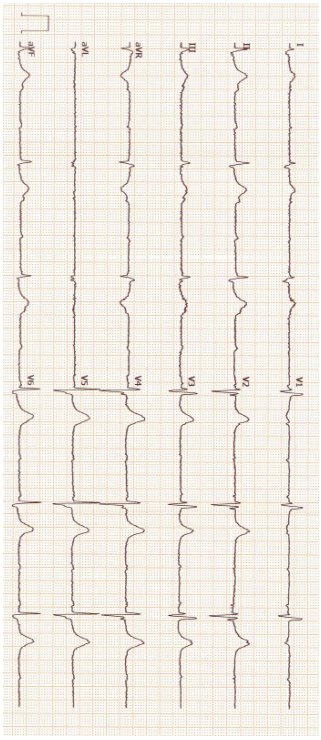

Figure 1: First patient with acute AV block grad 3 with resulting heart rate of 35 bpm (25 mm/s).

Due to agitation of the patient and a delirium repeatedly pacing lead dislocations occurred. After the third dislocation within 7 days we decided to implant a temporary permanent active-fixation bipolar pacing lead connected to a second-hand disinfected pacemaker in VVI mode. The lead (5076 58 cm; Medtronic) was inserted percutaneously into the subclavian vein using a peel-away introducer sheath and Seldinger technique and placed in the right ventricle under fluoroscopic control meeting standard sensing / pacing criteria (threshold 0.9 V at 0.5 ms; impedance 694 Ω, sensing 14.0 mV). The lead was secured to the skin by using a conventional suture sleeve and covered by a surgical plastic wrap. The permanent pacing lead was connected to a permanent disinfected second-hand pacemaker (Talos DR; Biotronik) in VVI-modus at 60 bpm (Figure 2). Using a disinfected second-hand pacemaker is a cost-effective solution after only 18 hours in a cost model used in a study by Chihrin et al. [15]. The pacemaker device was fixed unsterile at site.

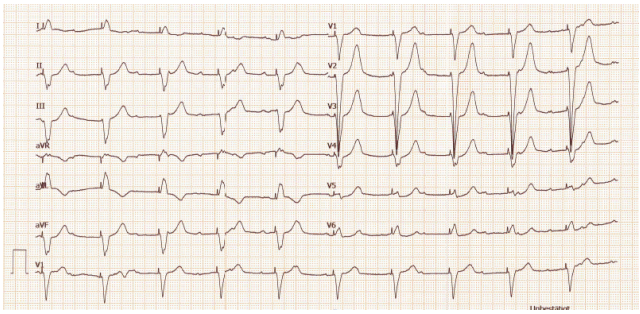

Figure 2: First patient with a permanent pacing lead was connected to a permanent disinfected second-hand pacemaker (Talos DR; Biotronik) in VVI-modus at 60 bpm (25 mm/s).

No further dislocations of the pacemaker lead or other pacemaker dependent complications occurred. During the further hospitalization, the patient was hemodynamically stable. In the further course we transferred the patient to a cardiac surgical hospital for tricuspid valve replacement. During tricuspid valve replacement an epicardial pacemaker was implanted. The patient recovered well after tricuspid valve replacement, resistance equitable antibiotic therapy postoperatively continued for another 6 weeks.

Second patient was an 89 year old woman who presented at hospital with bradycardia due to sinus arrest and slow junctional escape rhythm with 35-40 bpm resulting in syncope. Two weeks earlier, the patient was hospitalized for visual hallucinations and an antipsychotic treatment with quetiapine started. Diagnostic evaluation previous time by computer tomography and magnetic resonance imaging of the head showed no evidence of a cause. As an emergency intervention patient received immediately a conventional temporary pacemaker inserted via the internal jugular vein through an introducer as described above. Initial laboratory test showed significantly increased infection parameters (leucocytes 9.4*10^3/µl, CRP 20.3 mg/dl) also without elevated temperature (37.1°C). Creatinine did increase to 2.1 mg/dl; INR was spontaneous elevated to 1.26. Troponin T was elevated to 1.670 ng/ml without elevated CK or CK-MB. Due to the age and the overall situation a cardiac catheterization was initially omitted. Further investigation by echocardiography showed the urgent suspicion of mitral valve endocarditis (approximately 2 * 1 cm big swinging structure at the proximal posterior mitral leaflet) with moderate mitral regurgitation. Therefore we started calculated antibiotic therapy with cefuroxime and gentamicin. Due to the restlessness of the patient, there was a dislocation of the temporary pacing lead.

Thereupon we have implanted a temporary permanent active-fixation bipolar pacing lead (Solia S 60 cm; Biotronik) connected to a second-hand disinfected pacemaker (Talos DR; Biotronik) in VVI mode (60 bpm) as described above (Figures 3 and 4) meeting standard sensing / pacing criteria (threshold 0.5 V at 0.5 ms; impedance 649 Ω, sensing 7.4 mV). No further dislocations of the pacemaker lead or other pacemaker dependent complications occurred.

Figure 3: Temporary permanent active fixation bipolar pacing lead connected to a second-hand disinfected pacemaker inserted percutaneously into the subclavian vein of the second patient.

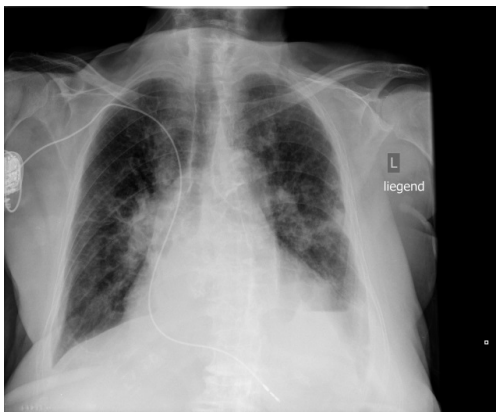

Figure 4: Chest x-ray of the second patient received an externalized permanent pacemaker.

Unfortunately, the patient has died a few days later from severe sepsis and multi organ failure.

Discussion

Lever et al. described for the first time a new technique for temporary pacing using a permanent active-fixation bipolar pacing lead [16]. The lead was inserted as described above and was tunneled subcutaneously approximately 10 cm and then secured to the skin by using a conventional suture sleeve and covered by a surgical plastic wrap. The permanent pacing lead was connected to a permanent disinfected second-hand pacemaker in VVI-modus. The described technique was used for prolonged temporary pacing in 20 patients with severe symptomatic bradycardia or pacemaker dependency. Immediate permanent pacing was contraindicated due to systemic infection or the likelihood that the bradycardia would resolve. Patients included in the series had infected permanent pacemakers, severe infections included endocarditis, post cardiac surgery sepsis, and septicaemia from other causes, post-infarction patients with high degree block and sinus bradycardia induced refractory ventricular tachycardia and tetanus with severe autonomic dysfunction. Median time of temporary pacing was 28 (9-81) days.

Further descriptions of externally placed permanent pacemakers connected to a percutaneously introduced active-fixation permanent bipolar pacing lead in the right ventricle for temporary pacing followed in small series from one to 60 patients.

Most of the case series was conducted in pacing dependent patients with severe CIED infections for bridging to re-implantation after complete removal of the infected device and antibiotic treatment [17-22]. This technic was also used in patients with systemic infections included endocarditis, septicemia or sepsis from other causes or due to other reasons [15,21,23-27].

The externally placed permanent pacemaker was usually programmed in VVI mode. If a patient needed a mandatory atrio-ventricular sequential pacing due to hemodynamic reasons, a second active-fixation bipolar pacing lead was placed in the right atrial appendage and connected to a permanent pacemaker with the ability to DDD mode [20,21]. Alternatively, a pacemaker system with a single VDD pacing lead connected to a permanent VDD or DDD pacemaker can be used [27].

Mean time of temporary pacing in the most series was 12-19 days, but there was descriptions of prolonged temporary pacing over a period of four months [23] due to aortic endocarditis and acquired tri-fascicular block with total recovery under successful antibiotic treatment.

After full recovery from infection with antibiotic treatment in most of the patients a (new) permanent device was implanted and the temporary pacing system was removed. But some of the patients which were not primary pacing dependent have recovered from life-threatening bradycardia and removing the temporary pacing system was done without implantation of a permanent system [21,23].

There is only one study [24] comparing a conventional temporary pacemaker with a temporary permanent active-fixation bipolar pacing lead connected to a permanent pacemaker. This study included 49 patients 26 patients received a conventional temporary pacemaker, and 23 patients received an externalized permanent pacemaker. There were 24 pacing-related complications in the conventional temporary pacemaker group compared to only one event in the externalized permanent pacemaker group ($p<0.01$). In the group with temporary permanent active-fixation bipolar pacing lead connected to a permanent pacemaker there was no lead dislocation, no need for resuscitation, or significant worsening of sensing or stimulation parameters during time of temporary pacing. There were only few local infections in patients with prolonged pacing time but no evidence of systemic infection related to the pacing system. Also there were no thrombosis occurred in any of the patients.

Conclusion

The use of active-fixation permanent pacing leads connected to an externalized pacemaker for temporary pacing in patients requiring intermediate to long-term antibiotic treatment provides a safe and effective method for prolonged temporary pacing as a bridge to permanent pacing or recovery. Active-fixation leads improve lead stability and reduce complications while allowing greater patients mobility and comfort. Patients with temporary permanent active-

fixation bipolar lead connected to an externalized pacemaker can be handled on regular ward or even ambulatory management is possible, if there were no other reasons for hospitalization. This strategy improves quality of life and reduces risks and complications that are caused by immobilization. On the other hand it appears to be cost-effective.

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