Long-term temporary pacing with an active fixation lead

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Abstract

Background: Ensuring a haemodynamically effective cardiac rhythm is a challenge in patients waiting for pacemaker reimplantation after transcutaneous lead extraction due to an infection of the implanted system.

Aim: The authors report a retrospective analysis of temporary pacing with an active fixation lead (AFTP) connected to an externalised pacemaker in patients after transvenous lead extraction (TLE) due to an infection.

Methods: AFTP was used in 34 patients (12 women) aged from 38 to 88 years (mean 67.5 years). This represented 24.5% of the population of patients undergoing TLE due to infective indications. In 32 cases, the indication for temporary pacing was atrioventricular block, and in 2 patients sick sinus syndrome. The lead was implanted via the internal jugular vein puncture into the right ventricle in 33 cases and into the right atrium in 1 case. Leads were secured to the skin and attached to externalised pacemakers.

Results: AFTP was used for 4 to 26 days (average 14.5 days). Re-implantation was performed in 29 patients (85.3% of the study group). There was no early infection recurrence. Three patients died during AFTP (8.8% of the study group), including two due to septic shock, and a cardiac arrest due to pulseless electrical activity in another patient.

Conclusions: Temporary pacing with an active fixation lead is an effective and safe method to ensure a hemodynamically stable heart rhythm for a period ranging from a few to several days after the surgery in patients after transcutaneous lead extraction due to infective indications.

Key words: temporary pacing, transcutaneous lead extraction, implanted device infection

Kardiol Pol 2015; 73, 12: 1304–1309

INTRODUCTION

Ensuring a haemodynamically effective cardiac rhythm is a challenge in patients waiting for pacemaker reimplantation after transcutaneous lead extraction due to an infection of the implanted system. In such cases, simultaneous implantation of a new system with its pacing leads is not an option, particularly with systemic infection. If the native cardiac rhythm is haemodynamically effective, temporary pacing may be avoided. Unfortunately, some patients require constant pacing both in the periprocedural period and during healing after the procedure. Temporary pacing used for several days should be effective but also allow patient mobilisation and nursing care. We report a retrospective analysis of temporary pacing with an active fixation lead (AFTP) connected to an externalised pacemaker in patients after transvenous lead extraction (TLE) due to an infection.
METHODS

Active fixation temporary pacing after TLE was used in 34 patients (24.5% of all patients who underwent TLE due to an infection and 9.2% of all patients who underwent TLE in the authors’ centre in 2008–2014).

The study group included 12 women (35.3%). Patient age ranged from 38 to 88 years (mean 67.5 years). TLE procedures were performed in a cardiac surgical or hybrid operation room using a previously described protocol [1]. Pacemakers or defibrillators were removed together with leads due to infective endocarditis in 11 cases (32% of the study group), and in the remaining cases the indication was an infection involving the device pocket. Indications for temporary pacing included symptomatic second or third degree atrioventricular block in 32 patients (including 3 patients after atrioventricular node ablation and 1 patient after surgical repair of the ascending aorta using a valved conduit), and sick sinus syndrome in 2 patients. The need for pacing was evaluated both before the TLE procedure based on device interrogation and evaluation of the native rhythm during the TLE procedure. In 33 patients with haemodynamically insufficient native rhythm, temporary pacing through the femoral vein access route was used during TLE procedures, followed by lead implantation through the internal jugular vein, with fixation in the right ventricle in 32 cases and in the right atrium in 1 case. A novel active fixation lead was used, usually with the length of 52 cm. The lead was secured to the skin and connected to an externalised pacemaker (Figs. 1, 2). The pacemaker retrieved from the patient was programmed into a bipolar pacing mode and cleaned and disinfected during the procedure using an antibacterial solution. In 1 patient, AFTP with a ventricular lead was used 24 h after the procedure due to symptomatic paroxysmal complete heart block (which was previously the indication for pacing). The decision not to proceed with temporary pacing during TLE was related to the diagnosis of infective endocarditis, effective native rhythm during TLE, and a very low proportion of ventricular pacing, below 1%, found at device interrogation.

Cannulation site care was analogous to that during central venous cannulation.

The patients were mobilised within the bed during the first postoperative day, and later mobilised within the ward. Complete patient mobility allowed easier nursing care and

Figure 1. A pacing lead implanted by a puncture of the internal jugular vein. Above the puncture site, the lead can be seen secured to the skin to prevent lead dislocation. Following connection to a pacemaker, the area was covered with a sterile dressing.

Figure 2. X-ray images in patients with temporary pacing using an active fixation lead placed in the right ventricle (A) or the right atrium (B).
rehabilitation. The goal of early mobilisation was also to avoid thromboembolic complications in the study group.

Following normalisation of inflammation markers, a device with transvenous leads was implanted in 29 patients (85.3% of the study group), including 21 single- or dual-chamber pacemakers, 2 single- or dual-chamber cardioverter-defibrillators, and 6 cardiac resynchronisation therapy devices (Fig. 3). Temporary pacing lead was removed after obtaining stable transvenous permanent pacing.

RESULTS

Duration of AFTP ranged from 4 to 26 days (median 15 days). No complications of AFTP were observed. Three patients died during AFTP (8.8% of the study group) at the 2nd, 10th, and 18th day of follow-up. Two patients died due to septic shock which developed before TLE. In 1 patient, a cardiac arrest due to pulseless electrical activity occurred at 18 days of AFTP. The cause of the cardiac arrest remained unclear as autopsy was not performed.

An improvement of atrioventricular conduction was observed in 2 patients (5.9% of the study group) with permanent atrial fibrillation. After medications affecting atrioventricular conduction were withdrawn, indications for permanent pacing were re-evaluated. A decision was made to remove the temporary pacing lead. Follow-up investigations showed no symptomatic pauses and implantation of a new pacemaker during the hospital stay was not deemed necessary.

The approach to antibacterial treatment was not uniform. Antibiotic therapy was initiated at the time of the diagnosis of infective endocarditis (after cultures were taken), and after TLE in patients with a local infection. Antibiotic therapy was initially empirical and later modified according to the results of antibiotic susceptibility testing. In all patients, antibiotic therapy was continued until implantation of a new device and removal of the temporary lead, and usually extended for another 4 days.

Management in the study group was guided by the clinical indications and was in agreement with the generally accepted management principles. An additional study approval by the Bioethics Committee was thus not required.

DISCUSSION

Current guidelines and clinical experience clearly indicate that removal of the implanted device including TLE in patients with a systemic or local infection is clearly beneficial for the patients [2–6].

The most commonly used approach to temporary pacing via the femoral vein access route allows effective pacing for several hours to days. If a longer pacing period may be expected, pacing through the basilic, subclavian, or jugular vein access route should be considered.

Possible complications of prolonged pacing using a temporary pacing wire include the risk of cardiac perforation with a stiff wire, wire dislocation, and also thrombotic complications related to the presence of a pacing wire inserted through the femoral vein in a bedridden patient.

In the study group, pacing using a temporarily inserted wire was used only during the procedure, as this was thought to be a more advantageous approach despite a higher risk of perforation and dislocation. If a stiff pacing wire is dislocated, reposision is easier. In addition, the risk of a subtle dislocation of the active electrode that may manifest several hours after the procedure can be avoided, and the system is supposed to provide effective pacing for several days. Due to insufficient literature data, the management approach was based on authors’ experience.

Use of AFTP may significantly reduce the risk of thrombotic complications related to both patient immobilisation and a foreign body dwelling in a large vessel with slow blood flow. No such complications were observed in the study group.

Temporary pacing using an active fixation lead through the jugular venous access route, connected to an externalized pacemaker, may be used for several days. It provides a haemodynamically effective cardiac rhythm, at the same time allowing free patient movements and nursing care. In addition, it facilitates patient care due to a lower risk of lead dislocation. This approach is less demanding for the healthcare personnel and is more cost-effective in patients who require temporary pacing for many days [7]. Use of a new lead and the externalised pacemaker results in only small additional treat-
ment costs but even if a new single-chamber pacemaker were required, this would not constitute a major cost compared to the overall financial burden associated with the treatment of infective endocarditis.

Patient groups with physiological temporary pacing (VDD or DDD) were also reported. In our study group, single-chamber pacing for several days did not result in a significant impairment of cardiac function. In contrast, use of several temporary leads might render elimination of infection more difficult [8–10].

If temporary pacing is required for a longer period of time, outpatient care for such patients until implantation of a permanent pacing system was reported in the literature [8]. In our centre, such a solution was not taken into consideration, particularly in pacemaker-dependent patient. In this group, mortality risk related to the loss of effective pacing is so high that discharging such patients home seems unreasonable.

Although use of this approach has been reported previously, our increasing experience in this area allows systematic improvement of patient care and popularisation of such an approach in both newly created centres and those using alternative strategies of temporary pacing [11–13].

A significant limitation of AFTP is an indwelling foreign body in the vascular system which may render complete elimination of the pathogen more difficult, particularly with systemic infections [14, 15]. In 2 patients in whom the infective process could not be controlled despite TLE, the effect of AFTP on outcomes is unknown although it seems that the use of a different approach to pacing, e.g. epicardial pacing, would add to the operative risk in severely ill patients. Available data indicate that a systemic infection increases mortality risk regardless of the pacing method used [16]. It seems that the use of AFTP combined with intravenous antibiotic therapy is associated with a low risk of infection recurrence, as development of a bacterial biofilm on the implanted foreign material seems to play a decisive role in the recurrences of the inflammatory process [17]. With an active fixation temporary lead, the ability to remove it after implantation of the permanent pacing system may decrease the risk of recurrent infection. In our study group, we did not observe any early infection recurrences, and long-term data require further follow-up.

An alternative approach is permanent epicardial pacing, which should also be considered in case of a systemic infection, but a major limitation is the need to provide surgical access to the pericardium. It should also be noted that pericardial pacing systems, particularly those more sophisticated, such as cardioverter-defibrillators and cardiac resynchronisation therapy devices, are characterised by a limited effectiveness and durability. In addition, any complication affecting such a system, mechanical or infective, would require repeated cardiac surgical intervention within the pericardium. Currently, available literature data are insufficient to compare the transvenous and epicardial access in patients after TLE.

The opinions presented above are based on the personal experience of the authors.

Limitations of the study
A major study limitation was related to its retrospective nature. In a single-centre registry, indications and the approach used depend significantly on the experience and views of the operators, which may affect patient selection. A small sample size may limit the ability to perform statistical analysis to evaluate such important but rare complications as cardiac wall perforation, lead dislocation, embolisation, or infection.

CONCLUSIONS
Temporary pacing with an active fixation electrode is an effective and safe method to ensure a haemodynamically stable heart rhythm for a period ranging from a few to several days. This approach may be used after transcutaneous lead extraction due to infective indications, giving time for effective elimination of the inflammation before reimplantation of a conventional transvenous pacing system.

Conflict of interest: none declared

References


Długoterminowa stymulacja czasowa elektrodą o aktywnej fiksacji

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Streszczenie

Wstęp: Zapewnienie wydolnego hemodynamicznego rytmu stanowi szczególne wyzwanie u pacjentów oczekujących na powtórne implantację po zabiegach przezżylnego usunięcia elektrod z powodu infekcji wszczepionego układu.

Cel: W niniejszej pracy przedstawiono restropektywną analizę zastosowania czasowej stymulacji elektrodą o aktywnej fiksacji (AFTP) podłączoną do wyłonionego stymulatora w grupie pacjentów poddanych zabiegom usuwania elektrod (TLE) ze wskazań infekcyjnych.

Metody: AFTP stosowano u 34 pacjentów (12 kobiet) w wieku 38–88 lat (śr. 67,5 roku). Stanowiło to 24,5% populacji pacjentów poddanych zabiegom TLE ze wskazań infekcyjnych. W 32 przypadkach wskazaniem do zastosowania stymulacji czasowej był blok przedsionkowo-komorowy, a u 2 pacjentów — niewydolność automatyzmu węzła zatokowego. Elektrodę implantowano z nakłucia żyły szyjnej wewnętrznej do prawej komory w 33 przypadkach oraz do prawego przedsionka w 1 przypadku. Elektrodę mocowano do skóry, a następnie podłączano do wyłonionego stymulatora.

Wyniki: AFTP stosowano 4–26 dni, średnio przez 14,5 dnia. Ponownie wszczepiono urządzenia z przezżylnymi elektrodami u 29 pacjentów (85,3% grupy badanej). Nie zaobserwowano wczesnego nawrotu infekcji. Trzy osoby zmarły w trakcie stosowania AFTP (8,8% grupy badanej); dwoje pacjentów z powodu wstrząsu septycznego, a u kolejnego wystąpiło nagłe zatrzymanie krążenia w mechanizmie aktywności elektrycznej bez tętna.

Wnioski: Czasowa stymulacja serca elektrodą o aktywnej fiksacji jest skuteczną i bezpieczną metodą zapewnienia stabilnego hemodynamicznie rytmu serca wśród pacjentów poddanych zabiegom usuwania elektrod ze wskazań infekcyjnych, w okresie od kilku do kilkudziesięcio dni po zabiegu.

Słowa kluczowe: stymulacja czasowa, przezskórne usunięcie elektrod, infekcja wszczepionego urządzenia

Kardiol Pol 2015; 73, 12: 1304–1309

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