Surgical pacemaker lead extraction: 10 years of experience

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Chirurgische Schrittmacher-Sonden-Extraktion: Erfahrungsbericht 1911–2001

Zusammenfassung Aufgrund der weltweit steigenden Zahl von Schrittmacher-Patienten, erhält die Schrittmachersondenextraktion mit ihren spezifischen Schwierigkeiten und potentiellen Komplikationen steigende Aufmerksamkeit. Primär sollte eine Sondenentfernung immer perkutan versucht werden. Sollte diese fehlslagen oder sollten Kontraindikationen für eine solche vorliegen, vor allem Vegetationen mit einem hohen Embolierisiko (Größe >10 mm), wird ein chirurgisches Vorgehen notwendig.

Von 1991–2001 führten wir bei 16 Patienten (Durchschnittsalter 62,1 ± 15,0 Jahre; 13 männlich; 3 weiblich) eine chirurgische Sondenextraktion durch. Alle Patienten wurden mit einer Sondeninfektion und klinischen Zeichen eines sepsischen Krankheitsbildes in einem mehr oder weniger fortgeschrittenen Stadium vorstellig. Im Durchschnitt stellten sich die Patienten 7,0 ± 8,8 Monate nach Beginn der klinischen Symptome in unserer Klinik vor. In 13 Fällen führten wir eine offene Sondenentfernung mit Hilfe der extrakorporalen Zirkulation durch. In 3 Fällen wurde eine Extraktion ohne Herz-Lungen-Maschine durchgeführt. Die perioperative Letalität betrug 0%. In 100% der Fälle wurden die Schrittmachersonden erfolgreich entfernt. Reinfektionen wurden bis zum jetzigen Zeitpunkt nicht berichtet.

Die chirurgische Schrittmachersondenextraktion ist ein äußerst effektives Verfahren mit einer hohen Sicherheit für den Patienten ohne signifikante Letalitätsraten. Ist ein chirurgisches Vorgehen indiziert, sollte dies so früh als möglich durchgeführt werden.

Schlüsselwörter Chirurgische Schrittmachersondenextraktion – Schrittmacherinfektion – Schrittmacher

Summary Due to the worldwide increasing number of patients with pacemaker implants, the problem of lead extraction with its potential difficulties and complications has gained enormous importance. Primarily lead extraction should be attempted percutaneously; however, in case of failure or contraindications for percutaneous extraction, such as vegetations with a high risk of embolization (size >10 mm), a surgical approach is necessary.

From 1991 until 2001 we performed surgical lead extraction in 16 patients (mean age 62.1 ± 15.0 years, male 13, female 3). All patients presented with lead infection and clinical symptoms of septicemia at a rather ad-
Advanced stage, in average $7.0 \pm 8.8$ months after the onset of symptoms. In 13 cases we performed an open heart approach with the use of cardiopulmonary bypass, in 3 a closed heart approach. Perioperative mortality was 0%. Pacemaker leads were successfully removed in 100%. No reinfec-
tions were reported.

Surgical pacemaker lead extraction is a highly effective tool and can be safely performed without significant mortality. If surgery is indicated it should be performed as early as possible.

**Key words** Surgical pacemaker lead extraction – pacemaker endocarditis – pacemaker

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### Abbreviations/Abkürzungen

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>CPB</td>
<td>cardiopulmonary bypass (Kardiopulmonaler Bypass)</td>
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<tr>
<td>ICD</td>
<td>implantable cardioverter-defibrillator (implantierbarer Cardioverter-Defibrillator)</td>
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<td>NASPE</td>
<td>North American Society of Pacing and Electrophysiology</td>
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<tr>
<td>TEE</td>
<td>transesophageal echocardiography (transösophageale Echokardiographie)</td>
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<td>TTE</td>
<td>transthoracic echocardiography (transthorakale Echokardiographie)</td>
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### Introduction

Pacemaker implantation has become a safe and routine procedure nowadays and is frequently performed worldwide everyday. The Achilles' tendon of a pacemaker system is the lead, which is responsible for the majority of complications, with systemic infection being the worst. Around 10% of the approximately 500,000 permanent pacemaker leads implanted worldwide each year may fail or become infected and consequently may need to be removed (1). Since it is neither predictable to what extent the lead is encapsulated with fibrous tissue, nor how much traction – with the associated risk – is required for removal, the extraction may be accompanied by problems. It is possible that a lead is entrapped at the ventricular apex or that the intravascular part is encapsulated to 100% by fibrous tissue, binding the lead to the vein and/or heart wall. As a specific problem of ICD leads, the anode may be caught in the wall of a great vein (2).

In general the least invasive technique is preferred initially for lead extraction, which means percutaneously via the implantation site, if possible. In case of fragmentation a femoral removal may become necessary. Due to uncontrollable traction, immobilization of the patient, and the unpredictable risk the method of continuous traction is obsolete and merely of historic importance. Today, the ongoing evolution of extraction devices allows a relatively safe extraction with extremely high success rates.

As an alternative to the transvenous removal, there has always been the surgical extraction via thoracotomy with or without the use of cardiopulmonary bypass. However, one must be aware of the fact that the associated morbidity of this invasive approach is not negligible. It should therefore be reserved for patients in whom the lead removal is mandatory and percutaneous techniques have either failed or are contraindicated.

### Indications for surgical lead extraction

Indications for pacemaker lead removal are mainly class-I and class-II indications with regard to the NASPE guidelines (3). Once the indication for lead extraction is given, it should primarily be attempted percutaneously. Only in case of failure does surgical approach become necessary.

A special case is the patient with a high risk of embolization during percutaneous extraction in case of vegetations. In our opinion a surgical extraction without a prior transvenous attempt should be preferred in this specific situation.

Patients in need for cardiac surgery besides the lead removal should be planned for a surgical approach at the same time.

### Surgical technique

Basically the open or closed heart technique have to be distinguished. In case of a failed percutaneous extraction, the closed heart approach should be attempted first. Surgical access may be either obtained by a small right-sided thoracotomy or by median sternotomy. A pledget-supported purse-string suture is placed in the right atrium and subsequently an atriotomy is performed. The lead is extracted manually or with the use of a clamp and finally cut. The distal part is removed through the atriotomy by direct traction. The proximal part of the lead is removed at the primary implantation site. The transatrial approach was first described by Byrd et al. in 1985 (4). As an alternative to the transatrial approach Dubernet et al. introduced in 1986 a surgical technique using a purse-string secured ventriculotomy to extract the lead (5).