Spinal cord stimulation for refractory angina in patients implanted with cardioverter defibrillators: Five case reports

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Patients implanted with a cardioverter defibrillator (ICD) who are suffering from refractory angina pectoris could benefit from spinal cord stimulation (SCS) due to the well-documented pain relieving effect. However, the combined treatment remains controversial.

The aim of the study is to report successful long-term treatment with SCS in five patients implanted with cardioverter defibrillators. The combined treatments with ICD and thoracic epidural electrical stimulation were used in five patients with refractory angina pectoris. During the procedure of the implantation, testing with the maximal tolerable level of stimulation was carried out to exclude interference with the ICD. The following treatment with SCS has in all cases been successful, with significant pain relief and improved quality of life. There were no incidences of inappropriate defibrillator shocks. Spinal cord stimulation for refractory angina pectoris can be performed in patients implanted with cardioverter defibrillators without interference. However, individual testing during implantation or re-programming the devices is mandatory in order to assess optimal safety in each patient.

Introduction

Patients who are suffering from ischaemic heart pain due to coronary artery sclerosis or coronary artery spasm have impaired health-related quality of life. Further, these patients may have an increased risk for developing malignant ventricular arrhythmias leading to sudden cardiac death (SCD), since ischaemic heart disease may be a predisposing factor. Ventricular arrhythmia and SCD in high-risk patient groups can be effectively prevented by an ICD, and the implantation rates in North America and Europe have significantly risen during the last years due to the implementation of ACC/AHA/ESC guidelines for management of patients with ventricular arrhythmias and the prevention of SCD from 2006.1

Chest pain may still persist in some patients who are not suitable candidates for coronary bypass grafting or intra-arterial invasive techniques and in maximal available pharmacological therapy. These patients can be described as suffering from refractory angina pectoris.2 Spinal cord stimulation in patients suffering from chronic refractory angina pectoris have well-documented and significant long-term pain relief with improved quality of life2 and SCS has become an established pain treatment in these patients.

An unknown number of patients with a high risk of developing ventricular tachycardia or SCD are also suffering from refractory angina pectoris. There exist a few case reports describing the combined treatment with SCS and ICD. In 2001, the ESES-Unit at the Odense University Hospital published the first case report from Europe about the combined treatment of an ICD and an IPG without interference.3 However, some concerns have been raised about the possible interaction concerning the spinal cord stimulator in patients already implanted with an ICD, since potential device interaction may cause an inappropriate shock from the ICD.4,5

Our previous experience in the combination of ICD and SCS encouraged us to continue this treatment, and we have been able to treat further five patients with the combined therapy.

Table 1 Patient demographics and history

<table>
<thead>
<tr>
<th>Patient number</th>
<th>Year of birth</th>
<th>Sex</th>
<th>Previous AMI (number)</th>
<th>EF</th>
<th>NYHA</th>
<th>Cardiac disease since</th>
<th>Previous PCI (number)</th>
<th>Previous CABG (number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1958</td>
<td>M</td>
<td>1</td>
<td>20% (2007)</td>
<td>II</td>
<td>2000</td>
<td>2</td>
<td>0</td>
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<tr>
<td>2</td>
<td>1950</td>
<td>F</td>
<td>0</td>
<td>&gt;50% (2008)</td>
<td>I</td>
<td>1994</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>1937</td>
<td>M</td>
<td>1</td>
<td>10% (2009)</td>
<td>III</td>
<td>1991</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>1955</td>
<td>M</td>
<td>2</td>
<td>50% (2004)</td>
<td>II</td>
<td>1995</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>1949</td>
<td>M</td>
<td>2</td>
<td>25% (2009)</td>
<td>III</td>
<td>1996</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

AMI, acute myocardial infarction; EF, ejection fraction (according to the last measurement); NYHA, New York Heart Association functional classification; PCI, percutaneous coronary intervention; CABG, coronary artery bypass grafting.

The angina pectoris pain in patient number 2 was diagnosed as Syndrome X. The patient has a normal EF and no signs of congestive heart failure.
Case reports

Five patients with ICDs were implanted with a thoracic spinal cord stimulator due to refractory angina pectoris. During the implantation, testing with the maximal tolerable level of SCS was made to exclude inference with the ICD. In all cases, the procedure was monitored by a specialist from the manufacturer of the ICD. The procedure was performed as described in our previous publication.3 The following treatment with SCS has in all cases been successful with no incidences of inappropriate defibrillator shocks. Data concerning demographic and technological information are listed in Tables 1 and 2.

Discussion

The present five case reports provide further evidence of a safe combined use of SCS and ICD with the mentioned precautions made. Owing to the combination of the increasing number of patients with refractory angina pectoris and the ongoing implementation of the guidelines for the management of ventricular arrhythmias and the prevention of SCD, we expect that an increasing number of cardiac patients will fulfill the indication to the treatment with both devices. To our knowledge, only few single case reports documenting successful combination between SCS and ICD have been published so far. However, a long-term follow-up study including a larger group of patients treated with a combined therapy of SCS and ICD is necessary for further documentation of the safety of the treatment. Further precautions to ensure the safety of the combined treatment could be to test if SCS artefacts mask ventricular arrhythmia resulting in inappropriate inhibition of the ICD. This could be done by induced ventricular arrhythmia during active SCS. So far, we have decided that the intervention would not be of sufficient benefit for the patients.

Conclusion

Spinal cord stimulation for refractory angina pectoris can be performed in patients implanted with cardioverter defibrillators without adverse events. However, individual testing is mandatory in order to assess optimal safety in each patient.

Conflict of interest: none declared.

References


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Table 2 Device data

<table>
<thead>
<tr>
<th>Patient number</th>
<th>SCS implant year</th>
<th>SCS model</th>
<th>ICD implant year</th>
<th>Indication for ICD</th>
<th>Symptom</th>
<th>ICD mode (ventricular sensitivity)</th>
<th>ICD fabricate</th>
<th>Follow-up time (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2003</td>
<td>A</td>
<td>2003/2009</td>
<td>VT</td>
<td>Syncope</td>
<td>VVI-ICD (0.3 mV)</td>
<td>Guidant/Medtronic</td>
<td>72</td>
</tr>
<tr>
<td>2</td>
<td>2004</td>
<td>A</td>
<td>2001/2007</td>
<td>VF/SSS</td>
<td>Lipothymia</td>
<td>DDD-ICD (0.3 mV)</td>
<td>Guidant/Medtronic</td>
<td>60</td>
</tr>
<tr>
<td>3</td>
<td>2004</td>
<td>A</td>
<td>2007</td>
<td>CHF</td>
<td>Nonea</td>
<td>DDD-ICD (0.3 mV)</td>
<td>Guidant</td>
<td>24</td>
</tr>
<tr>
<td>4</td>
<td>2004</td>
<td>A</td>
<td>2004</td>
<td>VT/VF</td>
<td>Chest pain</td>
<td>DDD-ICD (0.3 mV)</td>
<td>Medtronic</td>
<td>2b</td>
</tr>
<tr>
<td>5</td>
<td>2004/2007</td>
<td>A/B</td>
<td>1998</td>
<td>VT/VF</td>
<td>Syncope</td>
<td>VVI-ICD (0.3 mV)</td>
<td>Medtronic</td>
<td>60</td>
</tr>
</tbody>
</table>

SCS, spinal cord stimulation; ICD, implanted cardioverter defibrillator; VT, ventricular tachycardia; VF, ventricular fibrillation; SSS, sick sinus syndrome; CHF, congestive heart failure; VVI-ICD, single-chamber ICD; DDD-ICD, dual-chamber ICD; A, Medtronic Itrel III; B, Medtronic Synergy; Sensitivity, programmed ventricular sensitivity.

aProphylactic ICD due to chronic heart failure.

bSCS removed after 2 months due to insufficient relief of the chest pain.