ACUTE AND CHRONIC PACING THRESHOLDS OF STEROID ELUTING VERSUS NONSTEROID VENTRICULAR ELECTRODES

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Pacing threshold is influenced by several electrode related factors such as surface area, drug elution, shape, material and surface structure. Steroid eluting electrodes may suppress the local inflammatory response and may prevent the usual threshold increase. The aim of this study was to evaluate acute and chronic ventricular pacing thresholds of two different leads which were Telelectronics’ Laserdish (033-444 nonsteroid) and Encor Dec (033-301 steroid eluting). 20 patients received Laserdish, 14 patients received Encor Dec leads. All patients (mean age 64, range 31-82) required single chamber pacing. Threshold measurements were done intraoperatively as well as 1, 3, 6 and 12 months after implantation. All testing was performed at 0.5 ms. pulse width. Mean intraoperative (IO) threshold and mean thresholds at 1, 3, 6 and 12 months were 0.65, 1.41, 1.38, 1.40 and 1.33 Volts respectively for Laserdish. Same measurements of the Encor Dec were 0.56, 0.81, 0.75, 0.66 and 0.65 Volts respectively.

Intraoperative measurements of two leads were comparable. There was a significant difference between thresholds of Laserdish and Encor Dec later. Threshold of steroid eluting lead didn't change significantly during one year, and is recommended for ventricular pacing.

Key words: Pacing thresholds, steroid elution, ventricular leads.

Pacing threshold is influenced by several electrode related factors such as surface area, drug elution, shape, material, and surface structure of pacing leads. Additionally some patient related factors may be responsible for the actual value of the stimulation threshold for each patient. For example exit bloks and high pacing thresholds appears to be a significant complication in children, probably due to the their normally highly active immunoreactive response. After the implantation of permanent pacemaker, under the influence of various factors, stimulation thresholds begin to elevate, reach the maximum level between 3 to 6 weeks and usually at the end of 2 to 3 months chronic pacing threshold stabilize at a level of between
intraoperative and maximum thresholds, 2, 3, 4. The degree of inflammation in the tissue surrounding the electrode is the major determinant of the acute and chronic threshold. Steroid eluting electrodes have been developed in order to attenuate this inflammatory reaction. Recent anatomic studies have indicated reduced fibrous connective tissue thickness and decreased population of inflammatory cells due to the anti-inflammatory properties of the steroid.1

PATIENTS AND METHODS

The patient population consisted of 34 patients, 19 female and 15 male who received an implantable, multiprogrammable VVI pacemaker, capable of real time telemetric measurement of pacing threshold.

Mean age of patients was 64, ranging from 31 to 82. All patients were candidates for permanent cardiac pacing because of syncope, presyncope or dyspnea. Indications for pacing were symptomatic bradycardia due to second or third degree AV block in 18 cases and sick sinus syndrome in 16 cases.

Patients were divided into two groups. First group of twenty patients received Telec tonic’s LaserDish pacing lead (033-444 nonsteroid). The other group of fourteen patients received Telec tonic’s Encor Dec (033-301 Steroid Eluting) pacing lead. The specifications of the electrodes used in this study are shown in Table I.

Stimulation threshold was followed over a period of 12 months. Telemetric controls were performed at the time of implant and 1, 3, 6 and 12 months after implantation. We measured the pacing thresholds at a constant pulse width of 0.5 ms. The minimum value of stimulation threshold measured at this pulse duration via telemetry.

RESULTS

Mean intraoperative (IO) threshold and thresholds on 1, 3, 6 and 12th months were 0.65, 1.41, 1.38, 1.40, and 1.33 Volt respectively for Laser Dish. Same measurements of the Encor Dec were 0.56, 0.81, 0.75, 0.66 and 0.65 Volt respectively. Stimulation thresholds of two leads are shown in table II.

DISCUSSION

Stimulation threshold of most pacemaker leads increase by two to four fold during the first 3 months postimplant.5 Lower chronic thresholds would allow to reduce energy consumption, and increase pacemaker life expectancy. Some studies indicate that steroid eluting electrodes suppress the local inflammatory response at the postimplant period, and may prevent usual threshold increase. Andreas et al. Have been compared Medtronic’s 4003 Capsure steroid eluting electrode with Biotronic’s PE 60/4-DN nonsteroid pacing electrode. According to their results steroid electrode has a significant lower stimulation threshold at the first and forth weeks of implantation than Biotronic’s nonsteroid electrode.6 Mathias et al. Have investigated acute and chronic thresholds of steroid eluting unipolar endocardial electrodes com-

<table>
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<th>Table I: INVESTIGATED LEADS</th>
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<tbody>
<tr>
<td>LASERDISH</td>
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<tr>
<td>Material</td>
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<tr>
<td>Surface Area</td>
</tr>
<tr>
<td>Polarity</td>
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<td>Insulation</td>
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<td>Steroid Elution</td>
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<th>Table II: STIMULATION THRESHOLDS</th>
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<tr>
<td>Months</td>
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<tr>
<td>LASERDISH (V)</td>
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<tr>
<td>ENCOR DEC (V)</td>
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<td>P Value</td>
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IO: Intraoperative measurement
pared to vitreous carbon tip leads, and conclud-
ed that steroid eluting electrodes exhibit a very 
low stimulation threshold in the acute and 
chronic period. And they stated that pulse gen-
erators implanted in combination with steroid 
eluting leads may be routinely programmed at 
lower outputs without loss of patient’s safety.7 
Kruse et al. followed 36 patients with 45 leads 
for 12 months, and according to their results 
steroid eluting electrodes had low stimulation 
thresholds with no significant changes after 6 
weeks postimplant.8

According to our results, intraoperative thresh-
old measurements of two leads were compara-
ble. During follow-up period stimulation 
threshold of steroid eluting lead(ENCOR DEC) 
did not change significantly, while there was a 
marked increase in the stimulation threshold of 
nonsteroid lead (LaserDish).

As a conclusion: the introduction of steroid 
elution of the electrode tissue interface has 
played a pivotal role in maintaining chronic low 
stimulation threshold. Steroid eluting leads 
could be recommended sately for ventricular 
pacing.

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