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

M. YEŞİL, MD.
S. BAYATA, MD.
N. POSTACI, MD.
K. EKŞİ, MD

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 Teletronics' 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.

From: İzmir State Hospital,
Departments of
Cardiology, and of
Psychiatry, İzmir,
TÜRKİYE

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

Adress for reprints:
Serdar BAYATA, M.D.
Departments of Cardiology
İzmir State Hospital
İzmir TÜRKİYE

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 blocks and high pacing thresholds appears to be a significant complication in children, probably due to the their normally highly active immunoreactive response¹. 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 blok in 18 cases and sick sinus syndrome in 16 cases.

Patients were divided into two groups. First group of twenty patients received Telectronic's LaserDish pacing lead (033-444 nonsteroid). The other group of fourteen patients received Telectronic'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 fourth 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 I. INVESTIGATED LEADS

	LASERDISH	ENCOR DEC
Material	Platinum/iridium	Platinum/iridium
Surface Area	6 mm	6 mm
Polarity	Bipolar	Bipolar
Insulation	Polyurethane	Polyurethane
Steroid Elution	No	Yes

Table II: STIMULATION THRESHOLDS

Months	IO	1	3	6	12
LASERDISH (V)	0.65	1.41	1.38	1.40	1.33
ENCOR DEC (V)	0.56	0.81	0.75	0.66	0.65
P Value	ns	< 0.05	< 0.05	< 0.05	< 0.05
IO: Intraoperative measurement					

REFERENCES

pared to vitreous carbon tip leads, and concluded that steroid eluting electrodes exhibit a very low stimulation threshold in the acute and chronic period. And they stated that pulse generators 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 threshold measurements of two leads were comparable. 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 safely for ventricular pacing.

- 1- Ole-Jorgan Ohm. Pacing leads: New concepts and physical properties. Abstract book, 4th European Symposium on Cardiac Pacing 1989; 92-93.
- 2- Mond H, Strokes K, Helland J, Grigg L, Ketes P, Pate B, Hunt D: The porous titanium steroid eluting electrode: A double blind study assessing the stimulation threshold effect of steroid. PACE 1988; 11: 214 -219.
- 3- Güldal M: Steroid eluting electrodes and stimulation threshold. T Klin Kardiyoloji 1989; 2:262-265.
- 4- Strokes K, Bornzin G: The electrode- biointerface: stimulation In: Barold SS, ed. Modern Cardiac pacing, 1 ed. New York: Futura Publishing Company, 1985: 33-78.
- 5- Ursin C, Bieder B, Cedernaes P. Windisch E, Kühl M: Characteristics of a new designed unipolar lead utilizing a porous titanium nitride surface layer at the tip. Abstract book. 4th European Symposium on Cardiac Pacing 1989; 71.
- 6- Andreas S, Karl-Heinz K: Steroid Electrode: Suitable electrode for pacemaker with a reduced battery capacity. Abstract Book. 4th European Symposium on Cardiac Pacing 1989; 24.
- 7- Matthias A, Roland M, Norbert D, Hans-Reinhard Z, Michael W, Wolfgang H: Acute and chronic thresholds of steroid-eluting unipolar endocardial electrodes compared to vitreous carbon tip leads. Abstract Book. 4th. European Symposium on Cardiac Pacing 1989, 24.
- 8- Kruse IM: Long-term performance of endocardial leads with steroid-eluting electrodes. PACE 1986; 9: 1217-1219.