Excimer laser assisted implantable cardioverter defibrillator lead extraction: An alternative treatment to the surgery?

Lazer yardımıyla yerleştirilebilen kardiyoversiyon defibrilatör lead çıkarılması: Cerrahi tedaviye bir seçenek olabilir mi?

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Pacemakers and implantable cardioverter defibrillators (ICDs) are used as life-saving devices over the past 20 years. Ever since these devices implanted, there has been a need to extract leads in some cases. Most common indications of extraction are infection, lead-lead interaction, vascular access issues, lead fracture, and lead recall from manufacturer (1). North American Society of Pacing and Electrophysiology defined class 1 indications of lead extraction as sepsis, endocarditis, life-threatening arrhythmias, and thromboembolic events secondary to retained lead, lead interference, and obliteration or occlusion of veins, with the need to implant a new pacing system (1).

Different methods have been used for the lead extraction. Open chest surgery, manual traction, extend weight assisted traction, forceps assisted traction and mechanical extraction systems with locking stylet have been used (2). Manual traction is often effective to remove leads implanted no more than a few months. However, chronically implanted leads require more advanced extraction systems (1, 3).

Successful, economical, safe and predictable methods would also justify the removal of redundant leads presently abandoned. To address this problem an excimer laser sheaths was developed by the Spectranetics Corporation (Colorado Springs, Colorado) to be incorporated into the system of traction-counter traction for removal of chronically implanted leads (4).

In this article, we retrospectively reviewed and analysed our experience for the excimer laser assisted lead extraction in patients with ICD. Local anesthesia associated with sedation was used in all patients. İnterventions were performed in the catheterization laboratory. Surgeons were in stand-by for any complication in the operating room of cardiovascular surgery. Any simple traction tried and the procedures were primarily planned for laser extraction. Implantation durations were very long. For this reason we used excimer laser assisted lead extraction system. After opening the ICD pocket, the pulse generator was removed and subcutaneous tissue surrounding the lead is dissected. A locking stylet is inserted into the inner coil and locked with leading end. The laser sheath was passed over the locking stylet and the lead. A tightly fitting polypropylene sheath was mounted on the outside of the laser sheath to disrupt fibrotic bands. The laser sheath was then advanced along the lead to venous entry. Lasing was started and two sheaths (laser and non-laser) advanced with fluoroscopic guiding. The non-laser outer sheath was advanced with laser sheaths for mechanical ablation when necessary. Laser lights were applied for 5 seconds intermittently. Freeing adherences of the lead to the venous and cardiac structures until the distal portion of lead was reached by the laser sheath. At this time laser light was interrupted, laser sheath was used for supporting the myocardium and applying traction to the lead. The tip of the lead was carefully extracted from myocardium.

Four consecutive patients underwent ICD lead extraction. The mean age was 44±7 years, 3 were male and the mean duration of implantation was 42±15 months. Underlying heart diseases were ischemic cardiomyopathy in 2 patients, arrhythmogenic right ventricular dysplasia in 1 patient, and sudden cardiac death in 1 patient. All types of arrhythmia were ventricular tachycardia and all devices were ICD. Indications for extraction were pocket infection in 2 patients, lead fracture in 1 patient, and lead dysfunction in 1 patient. Mean total extraction time was 39±3 minutes. All of leads were extracted successfully and we did not experience any major or minor complication (Table 1, Fig. 1).

Infection is always the major indication for the lead extraction. In many patients, the lead infection can not be treated with antibiotics and the extraction of infected leads is always required. After implantation, ICD and pacemaker leads undergo a fibrotic encapsulating process by activation of humoral and cellular mechanisms. Once lead has been in place for many months, fibrous adhesions tend to increase at the contact points between lead and venous or cardiac walls. By the time these adhesions become dense and may extend along the length of the lead (1).

The use of excimer laser assisted lead extraction system was first reported in 1996 and success rate of this system was between 81%-100% (5,6). In 1997 Wilkoff et al. (7) compared excimer laser assisted lead extraction system with teflon telescoping sheaths in the "Pacing Lead Extraction with the Excimer Sheath" (PLEXES) trial with 301 patient. Complete lead removal rate was 94% in the excimer laser group and 64% in the other group (p=0.001). Partial extraction was 2.5% and failure was

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Table 1. Patient's demographics, extraction indications and results

Case number	Age, years	Gender	Type of arrhythmia	Underlying heart disease	Size of locking stylet	Size of laser, sheath	Implantation duration, months	Indication for extraction	Complete removal	Total extraction time, minutes	Complication
1	39	M	VT	ARVD	LLD #2	14 F	51	Pocket infection	Yes	43	No
2	37	F	VT	Sudden cardiac death	LLD #2	14 F	58	Lead dysfunction	Yes	38	No
3	49	M	VT	Ischemic CMP	LLD #1	12 F	25	Lead fracture	Yes	42	No
4	52	M	VT	Ischemic CMP	LLD #2	14 F	34	Pocket infection	Yes	36	No

ARVD- arrhythmogenic right ventricular dysplasia, CMP- cardiomyopathy, F- female, LLD- lead locking device, M- male, VT- ventricular tachycardia

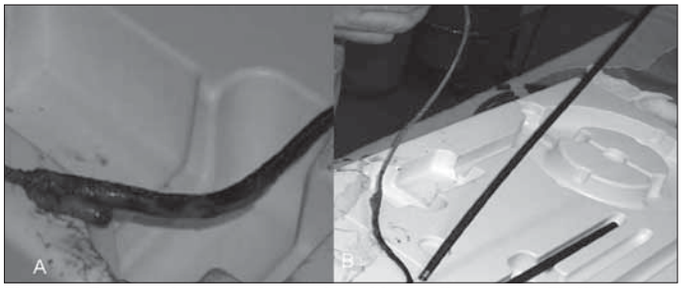

Figure 1. Extracted ventricular implantable cardioverter defibrillator lead with adherent fibrocollagenous mass (A) and excimer laser system (B)

3.3% in the laser group. The use of excimer laser reduced the duration of the intervention compared to non-laser group. After PLEXES trial, the US Laser Sheath Registry reported their experience in 863 patients with 1285 leads at 52 centers. The clinical success rate was 92% with excimer laser system (8).

Kennergen et al. (9) reported the results of European Multicenter study in 149 patients. Complete extraction rate was 89.5% and partial extraction rate was 6%. Roux et al. (10) also reported their series with 175 patients in 2007. Between September 2000 and August 2005, a total of 270 leads were extracted with excimer laser sheath system. 241 leads (89 %) were completely, 7 leads (3%) partially extracted. These findings supports that the excimer laser assisted lead extraction system is highly effective.

Major complications of excimer laser assisted lead extraction system are cardiac tamponade, tricuspid laceration, pneumothorax, subclavian vein laceration with massive hemothorax, and transient blood pressure drop prompting surgical exploration (7,8). Minor complications are local bleeding, small hematoma, small pericardial effusion, pulmonary edema and transient low output state (9, 10). In PLEXES trial, complication rate was 2.6%. One death and three major complications were observed (7). Complication rate was 2.1% in the US registry, 2.7% in European Multicenter Study and 3.4% in Roux 's report (8-10).

The most important limitation of this system is the presence of dense adherences containing calcium. On fluoroscopy it is not always possible to identify the presence of calcium (3). Upsizing of the sheath to go over the calcified area allowed laser to continue (8).

We have demonstrated that excimer laser assisted lead extraction system is efficient without any complication. The excimer laser assisted system allowed successfully extraction of the all ICD leads. This technique can be used for the vast majority of lead extraction as an alternative treatment to the surgery, but it should be left for experienced centers with cardiac surgery in stand-by and open chest surgery is still required for special cases and for complications. This technique is not a procedure to be performed in any small hospital implanting pacemakers.

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