Thoracoscopic Implantation of the Implantable Cardioverter Defibrillator*

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The implantable cardioverter defibrillator (ICD) has become accepted treatment for the management of certain malignant ventricular arrhythmias. Implantation of the ICD usually requires an anterolateral thoracotomy through which the patch electrodes and sensing electrodes are placed, in either an intra- or an extrapericardial position, although subcostal and subxiphoid approaches are also used. This communication describes how a video-linked thoracoscopic system can be employed to implant an ICD.

ANESTHESIA AND PATIENT POSITION

General anesthesia is administered with a double-lumen endotracheal tube. The patient is positioned on the operating table in the supine position with a roll under the left side of the chest.

TROCAB PlACEMENT AND TECHNIQUE OF ICD IMPLANTATION

Three trocars are placed in the anterior chest wall as shown in Figure 1. The left lung is collapsed, and the chest is first entered using a knife and a Kelly clamp in a manner similar to that used for thoracostomy tube placement, at a site that would subsequently be used for thoracostomy tube drainage. This approach is used to avoid the theoretical possibility of injury to the underlying lung or heart with the disposable trocars. A 12-mm trocar (U.S. Surgical, Norwalk, Conn) is then placed, and a 10-mm forward-viewing thoracoscope attached to a chip camera and external video monitor is inserted. This gives an excellent view of the pleural cavity and aids in the internal observation of the subsequent placement of two 5-mm trocars in the line of the inframammary anterolateral thoracotomy incision, as shown in Figure 1. A grasper and a pair of disposable scissors (U.S. Surgical) are placed through these working channels. Under thoracoscopic guidance the pericardium is grasped and incised with the disposable scissors in a superior-inferior direction to expose the left ventricular apex and anterolateral wall.

The lateral trocar is then removed, and the incision is enlarged to allow the passage of the epicardial electrode placement device and the patch electrodes through the intercostal space without rib retraction. The patch electrodes are placed intrapericardially, first posteriorly and then anteriorly, followed by placement of the sensing electrodes in an area of left ventricular myocardium devoid of epicardial vessels. The pericardium is then approximated with a single stitch to hold the patches in place.

The procedure is completed by placing the implantable battery pack/defibrillator unit in a subcutaneous pouch in the subcostal position and by tunneling the four leads over the ribs using a DeBakey vascular tunneled. After appropriate testing of the device, a thoracostomy tube is placed through the site previously occupied by the thoracoscope, the lung is expanded, and the incision is closed in two layers.

PATIENT DATA

A 23-year-old man with no past medical history was referred to the University of Virginia after suffering an episode of near sudden death while hunting. He was successfully resuscitated with cardio-pulmonary resuscitation and cardioversion. Cardiac catheterization revealed normal coronary anatomy without inducible vasospasm; an electrophysiologic study was normal, and programmed stimula-

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Figure 1. Position of trocar placement. A = 12-mm trocar for thoracoscope and subsequent thoracostomy tube. B = 5-mm trocar for placement of grasper. C = 5-mm trocar for placement of scissors and site of incision for placement of ICD patches and sensing electrodes.
tion failed to produce ventricular tachycardia. Because of the significant risk of recurrence of a malignant arrhythmia, the patient was referred for ICD implantation, which was performed using the described technique. The patient's recovery was rapid, uneventful, and with minimal postoperative pain.

**Comment**

Thoracoscopy is not a new modality, but it is finding new applications to problems in thoracic surgery. The use of this approach for ICD implantation gives excellent exposure and magnification of the operative field for viewing by the surgeon, assistant, scrub nurse, and cardiologists. Bleeding can be controlled by electrocautery. Rescue defibrillation can be accomplished with direct placement of pediatric defibrillator paddles through the ICD insertion site should the ICD patches or external R2 patches fail to provide defibrillation during testing of the device. If the thoroscopic approach should turn out to be unsatisfactory, the standard anterolateral thoracotomy can be performed, encompassing the two trocar incisions along the inframammary line.

The thoroscopic approach for ICD placement produced minimal postoperative pain, and the patient had an early return to normal activity. The avoidance of a painful thoracotomy incision should have a positive effect on the morbidity of this procedure, particularly in patients with borderline pulmonary function. However, further clinical experience will be required to accurately evaluate the short-term and long-term benefits and limitations of the thoracoscopic implantation of the ICD.

**References**