Video-assisted thoracic surgical implantation of an endocardial pacemaker: A challenging procedure

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Transvenous implantation of endocardial ventricular and atrial pacing leads is today the method of choice in adults. It is a well-tolerated procedure and generally performed under fluoroscopic control with local anesthesia.[1] Video-assisted thoracic surgery (VATS) is a well-established procedure with many indications in general thoracic and cardiac surgery.[1-3] Recent advances and improvements in surgical techniques, devices, and video equipment have expanded the possibilities and allowed endoscopic performance of more complex procedures. In complex cases, epicardial lead insertion via an anterolateral thoracotomy or a subxiphoid approach is often required.[1,4] VATS presents an interesting option in these patients to avoid more extensive surgical procedures.

In this report we describe our first successful experience with a VATS-guided transthoracic implantation of a double-chamber pacemaker (DDDR-mode) in a patient with bilateral subclavian venous thrombosis.

Clinical Summary

A 66-year-old man was referred to our cardiac and thoracic surgical department with a history of syncope, intermittent third-degree atrioventricular block, chronic renal insufficiency, and bilateral subclavian venous thrombosis resulting from many years of hemodialysis. Two years earlier the patient received a renal transplant and since then he received immunosuppressive therapy (cyclosporine [INN: ciclosporin] and prednisone). Clinical examination revealed enlargement of the superficial veins of the upper part of the thorax as a consequence of cavo-caval anastomosis and bilateral deltopectoral surgical scars after multiple failed attempts at pacemaker implantation. Doppler examination and magnetic resonance imaging phlebography showed bilateral subclavian venous obstruction with cavo-caval anastomosis and dye refilling of the superior vena cava at the azygos vein confluence. After obtaining written informed consent from the patient, we performed the VATS operation.

The patient was placed in the left lateral decubitus position with general anesthesia and left-sided double-lumen endotracheal intubation, which allowed selective blockage of the right lung and one-lung ventilation. A small right-sided lateral incision was performed in the seventh intercostal space at the posterior axillary line and a 10-mm rigid trocar sleeve was advanced intrathoracically. This Port-Access method (Heartport, Inc, Redwood City, Calif) was used for introduction of a 45° thoracoscope (Olympus Optical Co, Ltd, Tokyo, Japan). A second 2.5-cm incision was performed in the sixth intercostal space at the anterior axillary line, and one additional trocar was inserted under thoracoscopic vision. This larger port was used for introduction of endoscopic clamps, forceps, and a needle holder (Figure 1). The endoscopic picture was transmitted to one screen system (Olympus OTV-S6) situated at one side of the patient.

Figure 1. Postoperative image of the chest. The incision performed at the posterior axillary line was used for introduction of the thoracoscope. The anterior, larger port was used for introduction of endoscopic instruments. For subcutaneous passage of the battery, this incision was additionally enlarged at the end of the surgical procedure.

First, using the anterior, larger port, we inserted a 4-0 polypropylene purse-string suture under endoscopic control (Prolene; Ethicon, Inc, Somerville, NJ) in the superior vena cava at the azygos vein confluence. A punction needle was endoscopically guided into the chest through the anterior trocar sleeve, and the superior vena cava was punctioned at this level. By means of an endoscopic clamp, the guide wire was introduced through the punction needle and advanced in the venous system. After removal

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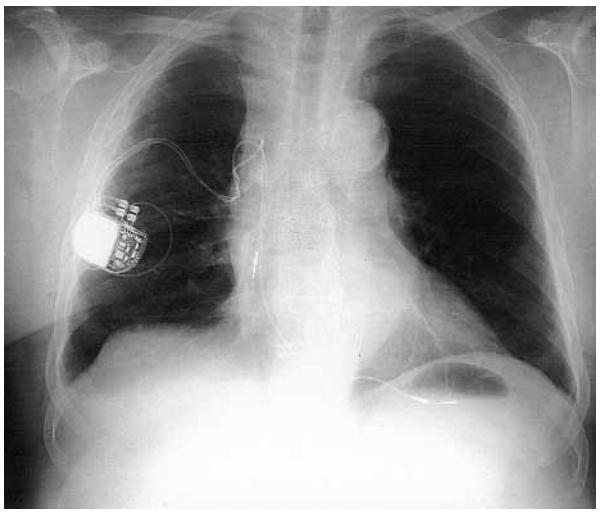

Figure 2. Postoperative chest x-ray film. Note the pacemaker lead position: entrance in the superior vena cava at the azygos vein level. The ventricular lead is positioned in the right ventricular apex and the helix of the atrial lead at the opening of the inferior vena cava in the right atrium.

of the punction needle under videoscopic control, a 7F sheath was placed over the guide wire in the superior vena cava (Seldinger technique). The ventricular endocardial, steroid-eluting, bipolar lead (Medtronic CapSure SP Novus 4092; Medtronic, Inc, Minneapolis, Minn) was thereafter guided endoscopically through the sheath in the right atrium. After the lead had been fluoroscopically positioned in the apex of the right ventricle, lead function was controlled with a pacing system analyzer (PSA 5311 B; Medtronic, Inc). The pacing lead was secured at the venous entrance level with the 4-0 polypropylene purse-string suture. For the endoscopic sutures applied on the beating heart, we used an endoscopic needle holder introduced through the anterior trocar sleeve. Knotting was performed extrathoracically. The knot was advanced through the port and fixed with the endoscopic needle holder.

The bipolar, atrial, steroid-eluting lead (Medtronic CapSure Fix 5076) was introduced 2 cm from the first lead by the same technique in the superior vena cava. After several lead repositionings, a proper place was found in the right atrial lateral wall. Under fluoroscopic control, the electrode helix was rotated into the atrial endocardium. The atrial lead was fixed, and function control was measured in an analogous fashion with the ventricular lead. Both leads were connected with a dual-chamber pacemaker (Discovery DR-1274; Guidant Corporation, Indianapolis, Ind), which was placed extrathoracically in the subcutaneous tissue at the level of the anterior port incision. For passage of the battery subcutaneously, the port incision had to be enlarged by 1.5 cm. One chest tube (20F) was introduced through the posterior trocar sleeve and connected to a suction drainage device. The port incision was closed in two layers. The operating time was 110 minutes. The patient was extubated in the operating room. No analgesic drugs were necessary during the postoperative course. The tube drainage was removed on the first postoperative day and the patient was discharged to his home in very good condition on the fifth postoperative day.

Discussion

Since its introduction in the early 1990s, VATS has been proposed to be a less invasive approach with an improved postoperative course and less pain than open procedures. Several reports have described the validity of these improvements and the advantages of VATS for the treatment of thoracic and cardiac disease.[1,2] In patients with complex disease who need pacemaker implantation, extensive surgical approaches with anterior thoracotomy, subxiphoid laparotomy, or sternotomy for pacemaker or defibrillator epicardial lead implantation have been performed.[5] It seems to be logical in such cases to try a less extensive surgical technique like VATS-guided endocardial pacemaker implantation.

A MEDLINE search of the medical literature since 1966 revealed no report associating VATS technique with endocardial pacemaker lead implantation. In the past, several attempts have been made to minimize surgical trauma by means of pericardioscopy or thoracoscopy for implanting cardioverter-defibrillator epicardial patches or to place monopolar sutureless screw-in or hook leads.[3,4] In a single report, VATS-guided epicardial lead implantation was performed in a group of 10 animals.[1]

In the present case, we noticed problems with the standard positioning of the atrial lead in the right appendage because of the 90° insertion lead angle in the superior vena cava (Figure 2). Therefore, the helix of the atrial lead was positioned near the opening of the inferior vena cava in the right atrium. Additionally, the fact that this case was our first attempt with this technique may explain the relatively long operative time.

The VATS technique of endocardial pacemaker implantation is a challenging procedure, but in experienced hands it has the potential to minimize surgical trauma and postoperative pain and to reduce the long postoperative rehabilitation associated with open dual-chamber pacemaker implantation, especially in patients with subclavian vein thrombosis.

References

1. Furrer M, Fuhrer J, Altermatt HJ, Ris HB, Mettler D, Althaus U, et al. VATS-guided epicardial pacemaker implantation hand-sutured fixation of atrioventricular leads in an experimental setting. *Surg Endosc.* 1997;11:1167-70.
2. Stammberger U, Steinacher C, Hillinger S, Schmidt RA, Kinsbergen T, Weder W. Early and long-term complaints following video-assisted thoracoscopic surgery: evaluation in 173 patients. *Eur J Cardiothorac Surg.* 2000;18:7-11.
3. Mack MJ, Acuff TE, Ryan WH. Implantable cardioverter defibrillator: the role of thoracoscopy. *Ann Thorac Surg.* 1993;56:739-40.
4. Baciewicz FA Jr. Transthoracic pacemaker lead insertion via the right atrium. *Thorac Cardiovasc Surg.* 1998;46:370-1.
5. Cuschieri A. Technique of thoracoscopic insertion of epicardial pacemaker. In: Cuschieri A, Buess G, Perrisat J, editors. Operative manual of endoscopic surgery. Springer-Verlag: Berlin; 1994. p. 121-9.