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NEW TECHNIQUE

Thoracoscopic epicardial pulmonary vein ablation for lone paroxysmal atrial fibrillation

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Abstract Surgical treatment of atrial fibrillation recently gained new popularity since the introduction of different energy sources for ablative therapy as an alternative to the original ''cut-and-sew'' techniques. However, most of the cases have been performed together with other cardiac surgical procedures and mainly through a standard median sternotomy approach. We report here the first European case of closed-chest thoracoscopic pulmonary vein isolation in a patient with lone paroxysmal atrial fibrillation.
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A 60-year-old male patient was admitted to our institution after recurrent bouts of atrial fibrillation. He had been on several pharmacological regimens (sotalol, propafenone) since 1996 without efficacy. In May 2003, after electrophysiological mapping, the patient underwent a percutaneous procedure for tricuspid isthmus ablation. However, the patient failed to gain relief from his recurrent episodes of paroxysmal atrial fibrillation. Since September 2003 the patient began taking amiodarone (200 mg once daily); in November 2003 a blood analysis showed a low level of T_3 and T_4 with elevation of Thyroid Stimulating Hormone (TSH) levels, implying hypothyroidism. The patient was, therefore, referred to us for surgical treatment of atrial fibrillation by means of closed-chest epicardial pulmonary vein isolation.

The patient had no relevant past medical history; he was admitted with normal sinus rhythm and the pre-operative echocardiogram showed

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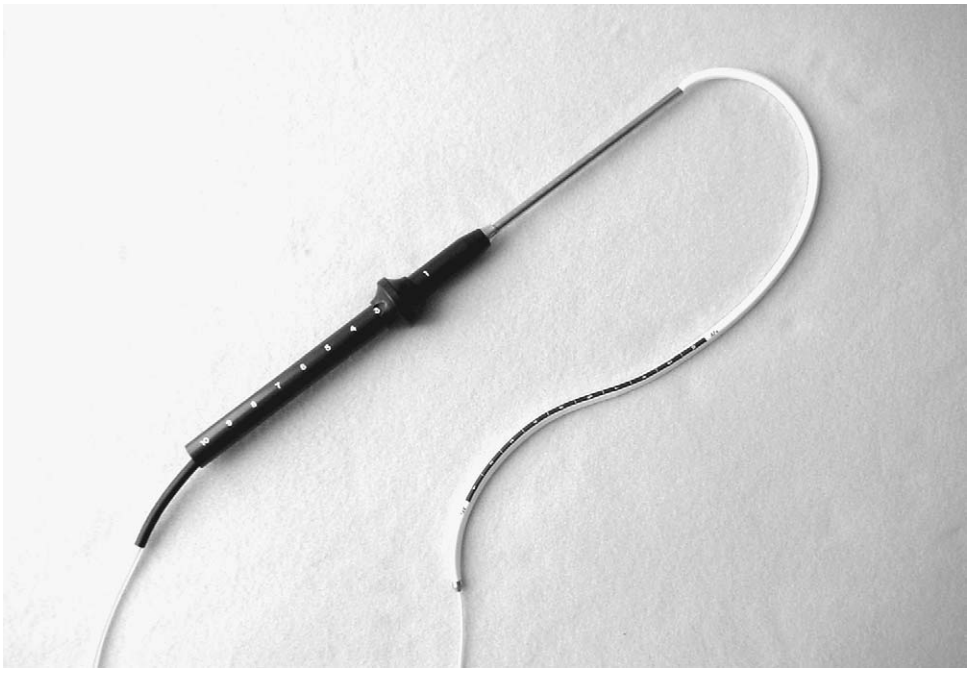

Figure 1 An overview of the microwave ablation probe Flex 10: the probe has a unidirectional energy delivery, on the side opposite to the black markers.

normal parameters, in particular the left atrial dimension was around 38 mm.

After anaesthesia sedation was obtained by means of intravenous propofol (200 mg), fentanyl (100 μg) and cysatracurium (10 mg), the patient was then intubated with a double-lumen endotracheal tube for selective lung ventilation.

A square pad was placed behind the back at the scapular level and the patient was then draped in standard fashion as for conventional thoracotomy.

Three ports were placed on the right side (4th, 5th, 6th intercostal spaces) and after right lung deflation the pericardium was longitudinally opened just above the phrenic nerve. First, a careful dissection between the superior vena cava and right superior pulmonary vein was carried out; then the pericardial reflection between the inferior vena cava and the right inferior pulmonary vein was dissected. Two Robnel catheters (Rusch Inc., Duluth, Georgia, USA) were then introduced, respectively, into the transverse sinus and the oblique sinus.

At this point the right lung was inflated and the left was deflated; three ports were placed in the left side of the chest symmetrical with those on the right. The tips of the rubber catheters were brought out of the chest from the left inferior port, tied together and finally pulled back into the chest from the right side.

The tip of the ablation probe (Flex 10 — AFx, Fresno, CA, USA) (Fig. 1) was connected to the tail of the rubber placed through the transverse sinus and the probe in the oblique sinus was pulled out from the chest, thus allowing the positioning of the ablative device around all the four pulmonary veins. A careful inspection of the correct positioning of the Flex 10 is mandatory, especially with respect to the left atrial appendage (i.e. the probe should lie

Figure 2 The Flex 10 in its final position around all four pulmonary veins is shown: all the black markers have to be visualized in order to avoid damage to the surrounding structures.

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Figure 3 The ablation set used is depicted: complete epicardial encircling is carried out around all four pulmonary veins (box lesion set).

behind the left atrial appendage in order to avoid any damage to the circumflex artery) (Fig. 2).

The ablation was carried out using the above mentioned microwave device Flex 10, setting the power at 65 W and performing segmental ablation of 90 s each, as previously reported [4] (Fig. 3).

At the end of the procedure, the patient was extubated in the operating room and went back to the ward, without any post-operative stay in the intensive care unit.

The post-operative course was uneventful: the patient was mobilized the day after the procedure and the chest drains were removed on the second post-operative day. On the same day, the patient experienced a transient period of atrial fibrillation, with spontaneous recovery of sinus rhythm. During the post-procedural hospital stay the patient received oral amiodarone and warfarin. The patient was then discharged on the third post-operative day on oral amiodarone and warfarin.

At 15, 30, 60 and 90 days follow-up the patient was in sinus rhythm , without any palpitation or electrocardiographic evidence of recurrent atrial fibrillation. As previously planned with our electrophysiologists, we, therefore, withdrew any arrhythmic medical treatment 90 days after the procedure. The patient will be maintained on oral anticoagulant therapy for 45 days: contingent on the absence of atrial fibrillation recurrence, the oral warfarin intake will be withdrawn at that time.

Complete wound healing was evident at 15 days post-operatively, as shown in Fig. 4.

Figure 4 The patient is shown at 15 days follow-up. Arrows depict the three small holes in the left chest.

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Discussion

Despite the excellent efficacy of the Cox's ''Maze'' procedure [1], its widespread use has been hampered by the technical complexity and the surgical invasiveness, making this operation unlikely to be accepted by many patients and supported by cardiologists.

The introduction of various energy sources as alternatives to the original ''cut-and-sew'' technique significantly expanded the application of the modified Maze operation (which began to be limited only to left-sided lesions) in association with other cardiac procedures (mitral surgery in particular). However, most of the Maze procedures were performed on-pump and endocardially, therefore necessarily requiring the opening of the left atrium.

A major technical advance occurred with the introduction of the epicardial approach [5] that was further improved with the development of minimally invasive techniques [2,3]. These fundamental surgical improvements have allowed the expansion of surgical treatment of atrial fibrillation to a wider group of patients, e.g. people with lone atrial fibrillation.

These procedures have the potential of the highest rate of success, since the category of patients who may benefit most from this procedure are those with normal atrial dimensions and without any structural heart disease. We, therefore, developed, together with our electrophysiologists, a collaborative arrhythmia programme in order to combine both surgical and interventional approaches.

In addition to the epicardial ablative procedure per se, it should also be stressed that opening the pericardial reflections may play an additional role in sinus rhythm restoration, since pericardial fat is removed especially from the dome of the left atrium, where a variable numbers of nerves (usually from three to five) of the dorsal plexus of the heart run. Therefore, a patient treated by means of a thoracoscopic epicardial approach could be considered as having a particularly denervated heart, at least with respect to the dorsal plexus.

In conclusion, the thoracoscopic epicardial pulmonary vein isolation is a feasible procedure but wider experience is required for its validation. This technique represents a significant advance in surgical treatment of atrial fibrillation since it potentially allows definitive cure of paroxysmal atrial fibrillation in patients with lone atrial fibrillation by means of a minimally invasive surgical approach.

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