

fixation system when this occurs could be compromised. Thus, particular care should be taken when dressing the wound and in ensuring that the system is stably fixed in the cervical region of the patient. On the other hand, the fact that it can be connected to a permanent pacemaker generator allows for programming of more physiologic pacing modes that help to maintain the patient in a stable clinical condition and allow the patient to walk about without clinical deterioration. Such advantages are particularly desirable in patients who are totally dependent on pacing and who require very prolonged temporary pacing. The small size of the generator is conducive to portability, and this in turn helps ensure that the patient can walk around and has greater mobility in general.

As a precaution, the resterilized pacemaker generators that are used for this purpose, although only ever in contact with the skin of the patient, should come from patients without evidence of infection at the time of switching to minimize the possibility of infection. The greater cost of the active fixation electrode used compared to the usual temporary pacing electrodes is compensated by the fact that the patient does not require admission to hospital in a unit with facilities for close patient monitoring.

This technique should be considered in patients who will require prolonged temporary pacing for any reason,³ particularly those who are pacing-dependent.

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REFERENCES

1. Coma Samartín R, Sancho-Tello de Carranza MJ, Ruiz Mateas F, Leal del Ojo González J, Fidalgo Andrés ML. Registro Español de Marcapasos. VII Informe Oficial de la Sección de Estimulación Cardíaca de la Sociedad Española de Cardiología (2009). *Rev Esp Cardiol.* 2010;63:1452-67.
2. Alzueta J, Linde A, Barrera A, Peña J, Peinado R. Registro Español de Desfibrilador Automático Implantable. VI Informe Oficial del Grupo de Trabajo de Desfibrilador Automático Implantable de la Sociedad Española de Cardiología (2009). *Rev Esp Cardiol.* 2010;63:1468-81.
3. Wilkoff BL, Love CJ, Byrd CL, Bongioni MG, Carrillo RG, Crossley GH, et al. Transvenous lead extraction: heart rhythm society expert consensus on facilities, training, indications, and patient management. *Heart Rhythm.* 2009; 6:1085-104.

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Value of Intraprocedural Radiologic Rotational Angiography in Atrial Fibrillation Ablation. Comparison With Other Imaging Techniques

Valor de la angiografía rotacional radiológica intraprocedimiento en la ablación de fibrilación auricular. Comparación con otras técnicas de imagen

To the Editor,

Given the complex anatomy of the left atrium (LA) and pulmonary veins (PVs), physicians should obtain individualized information on patient anatomy prior to atrial fibrillation (AF) ablation. Magnetic resonance imaging (MRI) is an excellent tool in anatomic reconstruction. Furthermore, three-dimensional (3D) navigation systems (NS) are widely used.^{1,2}

Radiologic rotational angiography (RRA) creates a 3D reconstruction of the cardiac chambers during the ablation procedure. It has previously been compared with imaging tests³⁻⁵ but not with 3D NS.

We propose to evaluate the precision of RRA in LA and PVs reconstruction and compare it with that offered by using MRI and 3D NS.

We enrolled consecutive patients indicated for AF ablation. Exclusion criteria were bronchial asthma, obesity preventing free radiologic arm rotation, difficulty in transseptal puncture, kidney failure, and iodine allergy. Ablation was performed under general anesthesia and with Ensite-NavX[®] 3D NS (St. Jude Medical)³; cardiac MRI (Philips Achieva[®] 3T) had been performed previously. We programmed 240° C-arm rotation (Philips Allura equipment). High-dose adenosine was injected (18 mg-24 mg) to provoke a transient pause due to atrioventricular block. Once the block had started, iodine contrast was injected into the LA and the programmed rotation was conducted. Postprocessing of the images rendered a 3D LA reconstruction. One researcher (CH) analyzed the reconstruction blind and compared MRI (number of PV and diameter of PV ostia) with the 3D NS (number of PVs).

Continuous variables are described as median [interquartile range] and compared with the Wilcoxon signed-rank test. Correlation was calculated with Spearman's coefficient.

Initially, we enrolled 22 patients; 5 were excluded (2 for obesity, 1 for difficulty in transseptal puncture, 1 for asthma, and 1 for kidney failure). RRA was performed with no complications in 17 patients; 2 in the pilot phase, leaving 15 who constituted our study group (Table 1).

In 3 patients, RRA images could not be analyzed. In these patients, pause duration was too short for analysis, 2.1 [1.2-4.8] vs 12.3 s [7.8-16.2] ($P=.034$). The RRA enabled us to observe 4 PVs with independent ostia in 8 of 12 patients with images suitable for analysis, and common antra in 4. When compared with 3D NS, RRA identified the same number of PVs and common antra in 10 of 12 patients (Fig. 1). In the remaining patients, 3D NS showed 1 left common antrum and 1 intermediate right PV missing in RRA and MRI.

MRI and measurements were available for 10 patients and identification of PVs and common antra proved the same as in RRA in 9 of them (Fig. 1). In the one remaining patient, MRI identified 1

Table 1
Baseline Characteristics

Patients	15
Age, years	52±10
Men	14 (93)
LVEF, %	63±9
<i>Indication for ablation</i>	
Paroxysmic AF	13 (86.7)
Persistent AF	2 (13.3)
<i>Rhythm at RRA</i>	
Sinus rhythm	10 (67)
AF	5 (33)

AF, atrial fibrillation; LVEF, left ventricular ejection fraction; RRA, radiologic rotational angiography.

Data are expressed as no. (%) or mean±standar deviation.

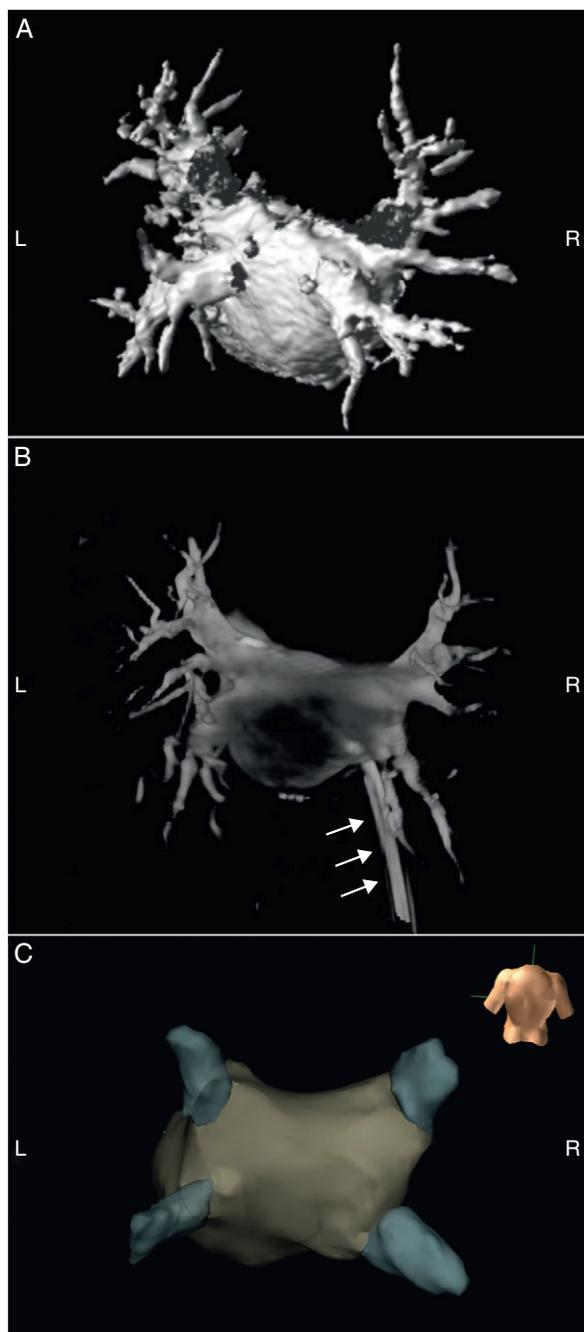


Figure 1. Magnetic resonance imaging reconstruction of left atrium (A), rotational radiologic angiography (B) and Ensite-NavX[®] (C). Posterior view. Note in B the catheters and sheaths penetrating into the left atrium (arrows). L, left; R, right.

left intermediate PV that RRA did not. PVs diameter was 14 mm (14-17.3) in MRI and 14.8 mm (14.1-17.7) in ARR, and we obtained a statistically significant positive correlation ($r_s=0.722$; $P<.001$).

RRA offers precise identification of LA anatomic structures provided the postadenosine pause is significant. In a minority of patients, this cannot be achieved.

Our study is consistent with other publications in that the pause duration was decisive for RRA images to be suitable for analysis.³⁻⁵ This is probably because the relaxation following ventricular

contraction drains contrast towards the ventricle and reduces the intensity of atrial opacification. We were able to identify PVs and measure PV diameter accurately. We coincide with other authors⁵ in finding that RRA slightly overestimates diameters, perhaps because of distension caused by the contrast injection or atrial cycle phase changes.

We also compared RRA with 3D NS. A recently published study randomized patients to 3D NS or RRA during PV ablation.⁶ However, we have found no publication that compares methods in the same patient. In our study, identification of PVs and common antra using both methods was identical in all except 2 cases. In these patients, RRA was concordant with MRI, suggesting it is more accurate than 3D NS.

The use of high-dose adenosine suggests general anesthesia is needed. Although neither our study nor others have found complications with this method, its safety in patients with structural heart disease has not been determined. RRA could not be used in 5 patients, but in 4 of them this limitation could have been identified earlier, thus permitting the use of a different imaging method.

In conclusion, intraoperative RRA of the LA provides anatomic information crucial to AF ablation provided there is always a significant pause secondary to adenosine.

CONFLICTS OF INTEREST

Dr Almendral has received lecture fees from St. Jude Medical and his institution has received payment from St. Jude Medical for educational presentations.

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REFERENCES

- Novak PG, Guerra PG, Thibault B, Macle L. Utility of a nonfluoroscopic navigation system for pulmonary vein isolation. *J Cardiovasc Electrophysiol.* 2004;15:967.
- Estner HL, Deisenhofer I, Luik A, Ndrepepa G, Von Bary C, Zrenner B, et al. Electrical isolation of pulmonary veins in patients with atrial fibrillation: reduction of fluoroscopy exposure and procedure duration by the use of a non-fluoroscopic navigation system (NavX). *Europace.* 2006;8:583-7.
- Nölker G, Gutleben KJ, Marschang H, Ritscher G, Asbach S, Marrouche N, et al. Three-dimensional left atrial and esophagus reconstruction using cardiac C-arm computed tomography with image integration into fluoroscopic views for ablation of atrial fibrillation: accuracy of a novel modality in comparison with multislice computed tomography. *Heart Rhythm.* 2008;5:1651-7.
- Kriatselis C, Tang M, Nedios S, Roser M, Gerds-Li H, Fleck E. Intraoperative reconstruction of the left atrium and pulmonary veins as a single navigation tool for ablation of atrial fibrillation: a feasibility, efficacy, and safety study. *Heart Rhythm.* 2009;6:733-41.
- Ector J, De Buck S, Nuyens D, Rossenbacker T, Huybrechts W, Gopal R, et al. Adenosine-induced ventricular asystole or rapid ventricular pacing to enhance three-dimensional rotational imaging during cardiac ablation procedures. *Europace.* 2009;11:751-62.
- Knecht S, Wright M, Akrivakis S, Nault I, Matsuo S, Chaudhry GM, et al. Prospective randomized comparison between the conventional electroanatomical system and three-dimensional rotational angiography during catheter ablation for atrial fibrillation. *Heart Rhythm.* 2010;7:459-65.

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