

## Scientific letters

### Transulnar Approach With Ipsilateral Radial Occlusion: Forearm Vascular Anatomical Description and Long-term Follow-up



#### Abordaje transulnar con arteria radial homolateral ocluida: descripción de la vascularización del antebrazo y seguimiento a largo plazo

#### To the Editor,

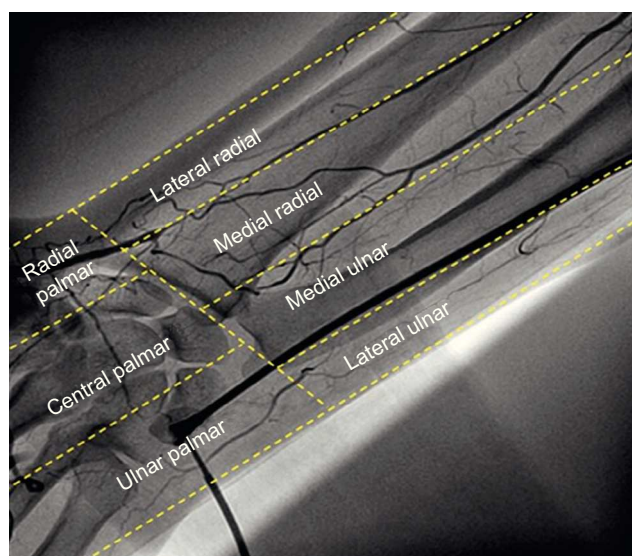
The transradial approach is the approach of choice in many centers for its advantages over the femoral approach; however, in up to 12% of procedures, the radial artery is occluded,<sup>1,2</sup> which forces using alternative routes. Traditionally, the transulnar approach has been considered contraindicated in cases with a positive Allen test and/or evidence of ipsilateral radial occlusion, because of the risk of inducing acute hand ischemia. Recently published studies indicate this strategy seems to be safe in the short term.<sup>3,4</sup> However, we do not know how the hand can be vascularized under these circumstances or its long-term outcome.

From January 2009 until February 2013, we studied hand vascularization in 14 patients, applying our transulnar approach protocol, which includes an angiography (10 mL to 3 ms/s) of the forearm, and we recorded 1 ipsilateral radial occlusion. To systematize the forearm vascularization, we divided it into 4 regions according to their relationship with the radial, ulnar, and interosseous arteries: lateral radial, medial radial, medial ulnar, and side ulnar regions. We subdivided the vascularization of the palmar arch into 3 regions separated by the second and fourth metacarpal bones: radial palmar, central palmar, and ulnar palmar regions (Figure). In addition, we conducted long-term follow-up on these patients, assessing the occurrence of hand sensory disorders, pain, or mobility problems. In a subgroup (the last 7 patients in the

series), ultrasound follow-up was performed to assess ulnar artery permeability.

Using angiography of the forearm, we were able to show that these patients had simultaneous occlusion of the ulnar and ipsilateral radial arteries (ulnar occlusion was acute due to the arterial sheath covering the entire lumen). Despite having both arteries occluded, patients suffered no symptoms or signs of acute hand ischemia during the procedure, because the palmar arch was vascularized through small collateral branches, all from the interosseous artery. In 12 patients, we observed collateral branches over a region of the forearm and/or palmar arch. More often (11 cases), they led to the radial artery (distal to the occlusion) in the medial area, with direct insertion to the palmar arch (palmar-ulnar region, 10 cases). The table shows all the collateral branch insertions in the 14 cases. After an average follow-up of 26 [interquartile range, 10 to 43] months, all patients retained ulnar pulse. There was no evidence of chronic ischemia or signs of serious effects on the ulnar nerve (motor and sensory). No claudication or pain was observed in any of the patients after they conducted a series of hand openings and closings. Ulnar artery permeability was recorded for all patients in the ultrasound follow-up subgroup.

With the above-described findings, it can be inferred that the absence of acute hand ischemia in the transulnar approach with ipsilateral radial occlusion may be due to the presence of collateral branches from the interosseous artery, which in most patients led to more than one region of their hands. Because we observed collateral branches going to the vascularized region due to the ulnar artery in 11 of 14 patients, we considered that the recruitment of these collateral branches was acute. This rapid recruitment would explain the shortage of published cases of acute hand ischemia following arterial catheterization through forearm arteries. Despite the very long-term safety demonstrated in our series, and due to the theoretical possibility of ulnar artery



**Figure.** Angiography of the right arm showing the division of the forearm and hand in 7 regions. Also shown are the collateral branches from the interosseous artery going to the distal radial artery, to the radial occlusion, and to the palmar arch in its radial and ulnar region.

#### Table

Insertion of Collateral Branches From the Interosseous Branch in the 14 Studied Patients

	Radial		Ulnar		Palmar		
	Side	Medial	Side	Medial	Radial	Ulnar	Medial
1	X		X		X		
2		X		X			
3		X		X		X	X
4		X			X	X	
5		X		X		X	
6		X				X	
7							X
8		X				X	X
9		X				X	X
10		X					X
11						X	
12		X				X	
13		X				X	
14		X				X	

occlusion after the procedure, we recommend caution in using this route in case of ipsilateral radial occlusion.

## CONFLICTS OF INTEREST

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## REFERENCES

1. Kiemeneij F, Laarman GJ, Odekerken D, Slagboom T, Van der Wieken R. A randomized comparison of percutaneous transluminal coronary angioplasty by the radial, brachial and femoral approaches: the ACCESS study. *J Am Coll Cardiol*. 1997;29:1269–75.
2. Alberto Ruano-Ravina, Guillermo Aldama-López, Belén Cid-Álvarez, Pablo Piñón-Esteban, Diego López-Otero, Ramón Calviño-Santos, et al. Acceso radial frente a femoral después de una intervención coronaria percutánea en infarto agudo de miocardio con elevación del segmento ST. Resultados de mortalidad a 30 días y a 1 año. *Rev Esp Cardiol*. 2013;66:871–8.
3. Kedev S, Zafirovska B, Dharma S, Petkoska D. Safety and feasibility of transradial catheterization when ipsilateral radial access is not available. *Catheter Cardiovasc Interv*. 2014;83:51–60.
4. Kwan TW, Ratcliffe JA, Chaudhry M, Huang Y, Wong S, Zhou X, et al. Transradial catheterization in patients with ipsilateral radial artery occlusion. *Catheter Cardiovasc Interv*. 2013;82:849–55.

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## Value of Intraoperative Electrical Parameters Obtained During Implantation of Cardiac Resynchronization Therapy Devices for the Prediction of Reverse Remodeling



### Valor predictivo de remodelado inverso de los parámetros eléctricos obtenidos durante el implante de dispositivos de resincronización cardíaca

#### To the Editor,

Cardiac resynchronization therapy improves the prognosis and symptoms of patients with advanced heart failure and intraventricular conduction disturbances.<sup>1</sup> However, 30% of the patients do not respond to this treatment. The identification of reproducible and easily obtained parameters predictive of the response during implantation could eventually increase the number of responders.

Our objective was to determine the prognostic value of reverse remodeling with regard to the different electrical parameters obtained intraoperatively.

We included 62 patients with an accepted indication for implantable cardioverter defibrillator with cardiac resynchronization therapy. Paced patients were excluded. The baseline characteristics of the enrolled patients are summarized in the Table. The device was implanted in accordance with the standard procedure, with the dual-coil pacemaker-defibrillator lead placed in the apex of the right ventricle (RV) and a bipolar pacing lead placed in a vein that drains into the coronary sinus (preferably lateral or posterior). During implantation, we recorded bipolar intracavitary electrocardiograms in the left ventricle (LV) and RV simultaneously with a surface lead (II) during spontaneous rhythm at 100 mm/s. We obtained the following measurements: electrical delay between the onset of the QRS complex and the intrinsic deflection in the bipolar LV electrogram (LV QRS), between the intrinsic deflections of the bipolar RV and LV electrograms (RV-LV), and between the onset of the QRS complex and the intrinsic deflection of the bipolar RV electrogram (RV QRS), in addition to the ratio between the LV QRS and the total QRS duration (Figure). The pacing configuration of the device was programmed on an individual basis (biventricular or LV alone) to optimize QRS narrowing. During the paced electrocardiogram, we determined the  $\Delta$ QRS (baseline QRS width - paced QRS

width). The results were obtained by averaging 3 measurements made by a single observer.

Six months after implantation, 41 patients (66%) were classified as responders as their LV end-diastolic volume had been reduced by  $\geq 15\%$  with respect to baseline.

When the baseline electrical parameters of responders were compared with those of nonresponders, we observed that a longer LV QRS (mean [SD]: 151 [30] ms vs 126 [28] ms;  $P = .003$ ), a longer

**Table**  
Baseline Clinical and Echocardiographic Characteristics

	Responders (n = 41)	Nonresponders (n = 21)	P
Age, mean (SD), y	62 (10)	61 (12)	.80
Men	28 (70)	12 (60)	.41
<b>Etiology</b>			
Ischemic	12 (30)	7 (33)	
Nonischemic	29 (70)	14 (66)	.77
<b>Baseline rhythm</b>			
Sinus rhythm	36 (87)	17 (80)	
Atrial fibrillation	5 (12)	4 (20)	.47
Left bundle branch block	39 (95)	19 (90)	.49
Lateral/posterior LV lead placement vs anterior position	39 (95)	20 (95)	.98
NYHA functional class, mean (SD)	3 (0.22)	2.9 (0.2)	.29
<b>Drug therapy</b>			
Beta blockers	38 (92)	19 (90)	.76
ACE inhibitors, mean (SD)	36 (87)	17 (80)	.47
LVEF, mean (SD), %	26 (6)	24 (8)	.43
LVEDV, mean (SD), mL	217 (94)	216 (100)	.96
LVESV, mean (SD), mL	163 (87)	160 (81)	.9

ACE, angiotensin-converting enzyme; LV, left ventricle; LVEDV, left ventricular end-diastolic volume; LVEF, left ventricular ejection fraction; LVESV, left ventricle end-systolic volume; NYHA, New York Heart Association; SD, standard deviation. Data are expressed as No. (%) or mean (standard deviation).