during device implantation. The algorithms for continuous atrial pacing and the lead technology to permanently pace specific atrial sites are available.

No Difference in LV Function Between RV Apex or Septum Pacing

Written by Mary Beth Nierengarten

Patients with high-grade atrioventricular (AV) block and preserved baseline left ventricular (LV) function who need a high percentage of right ventricular (RV) pacing show small but significant reductions in LV ejection fraction (LVEF) over a 2-year period from pacing with either RV apex (RVA) or RV high septum (RVHS), with no difference between RVA and RVHS.

Gerry Kaye, MD, Department of Cardiology, University of Queensland, Princess Alexandra Hospital, Brisbane, Australia, presented results of the Protection of Left Ventricular Function During Right Ventricular Pacing [PROTECT-PACE; NCT00461734], a randomized, prospective, international, multicenter, single-blinded trial to compare the effect of pacing the RVA versus the RVHS on LV systolic function in patients with high-grade AV block. Full results of the study will be published in the *European Heart Journal*.

Sponsored by Medtronic UK, the study was undertaken to test the hypothesis that RVHS pacing is superior to RVA pacing in preventing LV dysfunction in patients with preserved LVEFs who need ventricular pacing. The need to examine pacing other than with the RVA is highlighted by accumulating evidence that RVA pacing has multiple deleterious effects, including the potential to result in long-term LV dysfunction.

The study included 240 patients with high-grade AV block and sinus rhythm or permanent atrial fibrillation (AF) who were randomly assigned to RVA pacing (n=120) or RVHS pacing (n=120). Patients with selected cardiac diseases were excluded, along with those with indications for implantable cardioverter-defibrillators or cardiac resynchronization therapy and those with intermittent AV block or reversible causes for AV block, those with known paroxysmal AF prior to enrollment, and those who needed amiodarone therapy within 6 months

Table 1. Patient Demographics[a]

Characteristic	RVA Pacing (n=120)	RVHS Pacing (n=120)	Total Patients Randomly Assigned (N=240)	p Value
Age, mean ± SD, years	73.7 ± 11.1	74.7 ± 10.0	74.2 ± 10.5	NS
Men	73 (60.8%)	89 (74.2%)	162 (67.5%)	0.0274
Systemic hypertension	76 (63.3%)	67 (55.8%)	143 (59.6%)	NS
Diabetes	29 (24.2%)	27 (22.5%)	56 (23.3%)	NS
Hypercholesterolemia	39 (32.5%)	46 (38.3%)	85 (35.4%)	NS
No diagnosed CV disease	22 (18.3%)	26 (21.7%)	48 (20.0%)	NS
Coronary artery disease	27 (22.5%)	31 (25.8%)	58 (24.2%)	NS
Primary/idiopathic electrical disease	24 (20.0%)	21 (17.5%)	45 (18.8%)	NS
Previous stroke	4 (3.3%)	5 (4.2%)	9 (3.8%)	NS
Transient ischemic attack	3 (2.5%)	3 (2.5%)	6 (2.5%)	NS
Previous CABG	8 (6.7%)	8 (6.7%)	16 (6.7%)	NS
Previous valvular surgery	5 (4.2%)	4 (3.3%)	9 (3.8%)	NS

CABG=coronary artery bypass grafting; CV=cardiovascular; RVA=right ventricular apex; RVHS=right ventricular high septum.

[a]Data are expressed as number (percentage) except as indicated.

Table 2. Primary End Point Outcomes[a]

LVEF, Mean ± SD, %				
Arm[b]	**Baseline**	**24 Months**	**Change**	**p Value**
RVA (n=85)	57.5 ± 9	55.2 ± 9	−2.3 ± 10	0.0470
RVHS (n=83)	57.2 ± 10	53.7 ± 10	−3.4 ± 8	0.0003

LVEF=left ventricular ejection fraction; RVA=right ventricular apex; RVHS=right ventricular high septum.
[a]The primary endpoint (intention to treat) was change in LVEF.
[b]The p value between arms was 0.4347.

Table 3. Secondary End Points Outcomes[a]

Outcome	RVA Pacing	RVHS Pacing	p Value
2-y percentage ventricular pacing	98 ± 11%	93 ± 20%	0.0781
AF/AT burden (minutes)	56.5 ± 22.6	24.1 ± 15.0	0.2257
6-min walk distance (m)	389 ± 106.8 to 391.0 ± 127.1	400.0 ± 117.0 to 395.0 ± 114.1	0.9719
Change in BNP levels (pmol/L)	−541 ± 770	−295 ± 578	0.0525
Lead implantation duration (minutes)	56 ± 24	70 ± 25	<0.0001
Fluoroscopy time (minutes)	5 ± 4	11 ± 6	<0.0001
Lead dislodgement	2.7%	4.5%	0.4987

AF=atrial fibrillation; AT=atrial tachyarrhythmia; BNP=brain-type natriuretic peptide; RVA=right ventricular apex; RVHS=right ventricular high septum.
[a]Data are expressed as mean ± SD.

prior to study enrollment. Table 1 shows demographics of all patients enrolled in the study.

The primary end point of the study was change in LVEF measured by transthoracic echocardiography from baseline to 24 months. Secondary end points included AF and atrial tachyarrhythmia burden, change in brain-type natriuretic peptide level, change in 6-minute walk distance, lead implantation duration and fluoroscopy time, and death and heart failure hospitalization.

At 2-year follow-up, 85 patients in the RVA group and 83 patients in the RVHS group were available for assessment. Both groups showed small but significant changes in LVEF at 2 years from baseline, with no difference in the primary outcome between the 2 treatments (Table 2).

Table 3 shows the results of secondary outcomes. No differences were seen between the 2 treatment groups except for lead implantation duration and fluoroscopy time, both of which were significantly longer for RVHS pacing.

On the basis of these results, the trial suggests that RVHS pacing is not protective of LV function compared with RVA pacing in patients with preserved baseline LV systolic function, according to Dr. Kaye. Left unanswered is whether RV pacing itself is the problem, whether there is some specific site within the RV where pacing may be protective of LV function, or whether preventing LV

dysfunction with RV pacing is patient specific and therapy needs to be individualized.

Implanted Pacemakers With DDD60 Pacing Superior to DDI30 Pacing for BFB

Written by Mary Beth Nierengarten

For patients with the conduction disturbance bifascicular block (BFB) and syncope of unexplained origin, an implanted pacemaker programmed at DDD60 pacing is superior to DDI30 pacing in reducing syncopal episodes and other symptomatic events regardless of their cause.

Massimo Santini, MD, S. Filippo Neri Hospital, Rome, Italy, presented the results of the prospective multicenter Prevention of Syncope by Cardiac Pacing in Patients With Bifascicular Block trial [PRESS; Santini M et al. *Circ Arrhythm Electrophysiol* 2013]. This randomized clinical trial evaluated the efficacy of antibradycardic pacing on symptoms in patients with BFB and syncope of unexplained origin.

The study included 101 patients with BFB and ≥1 episode of syncope within the 6 months before study enrollment. Patients with a dual-chamber permanent pacemaker were randomly assigned to treatment (DDD pacing mode with a lower rate limit of 60 ppm [DDD60]; n=52) or control (backup DDI pacing mode with a lower rate limit of 30 ppm [DDI30]; n=49).

All patients in the study had an ejection fraction ≥40% and a mean nocturnal heart rate ≥35 bpm. Preenrollment screening excluded patients with brady-tachy syndrome, vasovagal syncope, carotid sinus syndrome, atrial fibrillation, and inducible atrioventricular (AV) block. Patients were followed for 2 years, with follow-up at 1 month and then ambulatory follow-up every 3 months to collect clinical and device data.

The primary end point was the first occurrence of the composite of syncope of any origin, presyncopal episode with documented cardioinhibitory origin, or AV block of any degree associated with patient symptoms.

A primary endpoint occurred in 23 patients (22.8%) of the total population at 2 years. In the DDD60 group, 7 (13.5%) patients had a primary end point event compared with 16 (32.6%) in the DDI30 group (HR, 0.32; 95% CI, 0.10 to 0.96; p=0.042). Evaluation of the individual components of the endpoint was notable for significant reductions in presyncope and symptomatic AV block but not in syncope (Table 1). According to Prof. Santini, the lack of a significant difference in episodes of syncope could be due to the vasodepressor syncope, hypotension from a noncardiac etiology (eg, excessive medications, postural orthostasis), or a neurologic issue not detected at preenrollment testing. He said that it is reasonable to hypothesize that patients with cardioinhibitory episodes experience most of the presyncope symptoms.

Table 1. Incidence of the Primary End Points Components With DDD60 and DDI30 Pacing, n (%)

	Total	DDI30	DDD60	p Value
Syncope	14 (13.9)	7 (14.3)	7 (13.5)	0.89
Presyncope	22 (21.8)	16 (32.6)	6 (11.5)	<0.001
Symptomatic AV block	10 (9.9)	8 (16.3)	2 (3.8)	<0.001

AV=atrioventricular.

The secondary end points were first occurrence of a symptomatic episode of syncope or presyncope of any origin, symptoms associated with rhythm disease progression, and AF. At 2 years, 14.8% of the total study population had developed symptoms associated with new-onset heart rhythm disease (Table 2).

Table 2. Secondary Outcomes in the PRESS Study

	Population, n (%)					
Outcome	Total	DDD60	DDI30	HR	CI	p Value
First symptomatic syncope/ presyncope event	35 (34.6)	13 (25)	22 (44.9)	0.43	0.25-0.78	0.0053
First symptoms of rhythm disease progression	15 (14.8)	3 (5.8)	12 (24.5)	0.21	0.09-0.50	0.0004
First occurrence of atrial fibrillation	27 (26.7)	18 (34.6)	9 (18.4)	2.25	0.81-6.23	0.117

Among the limitations of the study are the inability of the implanted pacemakers to detect all events with a cardioinhibitory origin and its being single-blinded. Strengths include the inclusion of a highly selected, screened patient population and the frequent assessments throughout the study.