Oral Sessions

WEDNESDAY, 27 JUNE 2007, 8:30–10:00 **Guimaraes**

Effects of right ventricular pacing on left ventricular function

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Direct His-Bundle Pacing: acute and mid-term follow-up results

F. Zanon[1], E. Bacchiega[1], E. Baracca[1], G. Pastore[1], S. Aggio[1], A. Badin[1], L. Roncon[1], P. Zonzin[1]
[1]*General Hospital, Division of Cardiology, Rovigo, Italy*

Right ventricular (RV) apical pacing is detrimental to left ventricular function.
Aim of the study: feasibility of direct His bundle pacing (DHBP) and follow-up using a system composed by a steerable catheter and a 4.1 Fr. screw-in lead.
Methods: The study population was composed of a series of 93 pts, 67 male (76±7 yo) affected by cardiomyopathy of any aetiology (hypertensive 62%; ischemic 23%; other 15%).
NYHA class was 1.5±0.5 and ejection fraction (EF), assessed through echocardiography, was 56±10%; in all pts with narrow QRS and standard indication to PM a DHBP has been attempted.
Results: DHBP was achieved in 83 pts (89%). Pace-Ventricular intervals were similar to the His-Ventricular intervals (49±10 ms vs. 51±9 ms, p = NS) and in all pts, but 10, the paced 12 lead ECG showed a QRS morphology and duration equal to the native one (111±20 ms vs. 112±21 ms, p = NS). The mean number of lead positioning attempts was 4±3 while the mean time for lead positioning was 17±15 min, the mean fluoroscopy time was 13±11 min and the total procedure time was 81±24 min. The acute pacing threshold was 2.4±1 V at a pulse width of 0.5 ms, sensed potentials were 2.2±1.5 mV, mean pacing lead impedance was 549±105 W. In 57 (64%) patients another RV apical lead was added. Lead displacement was observed in one pts, 24 h after implant. The mean follow-up is 6 months (range: 2–18). QRS duration and morphology recorded at implant were observed in all pts. At 6, 12 and 18 months follow-up the pacing threshold was 3.2±2.1 V, 3.4±2.4 V and 3.5±2.5 V respectively. The ventricular sensing at 6, 12 and 18 months follow-up was 2.3±1.7 mV, 2.1±1.4 mV and 1.9±1.3 mV respectively. The sensing configuration was changed from bipolar to unipolar in five pts. No major complications were observed.
Conclusions: DHBP in pts with narrow QRS and standard PM indications is feasible using a system composed by a steerable catheter and a screw-in lead. The electrical parameters are stable in mid-term follow-up demonstrating the reliability of this technique.

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Clinical and biological effects of right ventricular outflow tract pacing versus right apical pacing: short-term results of a randomized trial

J. Osca Asensi[1], O. Cano Perez[1], M.T. Izquierdo De Francisco[1], M.J. Sancho-Tello De Carranza[1], J. Olague De Ros[1], J. Aguero Ramon-Llin[1], J.E. Castro Pareja[1], A. Salvador Sanz[1] on behalf of The Right Ventricular Outflow Tract Pacing Evaluation Trial
[1]*La Fe University Hospital, Cardiology, Valencia, Spain*

Background: Over the last decade new evidence has emerged about the adverse hemodynamic and clinical effects of right ventricular apical pacing. However, there is a lack of randomized trials comparing traditional apical pacing with alternative pacing sites.
Aim: To prospectively compare clinical and biological parameters of patients paced either in the right ventricular apex or in the right ventricular outflow tract (RVOT).
Methods: We designed a randomized, double-blind study including 61 patients (38 m, mean age 73 years) with pacemaker indication for AV block (n = 35) or sick sinus syndrome (n = 26) in which a screw-in lead was positioned in the right ventricular apex (n = 30) or in the right ventricular outflow tract (n = 31). Functional status (NYHA class), quality of life assessed by EuroQol EQ-5D instrument, 6-minute walk distance and NT-proBNP as well as its temporal changes (ΔBNP) were investigated in the first week after implant and at 3 months follow-up.
Results: Cumulative percent ventricular paced (Cum%VP) was 61±38% in RVOT pacing group versus 53±42% in RVAP group, p = 0.6. 50% of patients had Cum%VP over 80%. NT-proBNP values were non-significantly higher in RVOT pacing group at implant (833±912 pg/ml vs 805±1129 pg/ml, p = 0.6) with a reduction in both groups at 3 months follow-up, more evident in RVOT pacing patients (ΔBNP −21±429 pg/ml in RVOT vs +93±970 pg/ml in RVAP, p = 0.5). No significant differences were assessed in NYHA class, EuroQol EQ-5D punctuation and 6-minute walk distance. Table 1 summarise the principal findings at 3 months follow-up.
Conclusion: In our series, right ventricular outflow tract pacing showed a non-significantly reduction of NT-proBNP levels at 3 months compared with RVAP. No other clinical short term benefits were assessed.

Table 1. 3 months follow-up results.

	RVOTP (n = 31)	RVAP (n = 30)	p value
Cum% VP	61±38	53±42	0.6
NYHA class	1.1±0.3	1.3±0.5	0.3
EuroQol EQ-5D	0.84±0.15	0.80±0.22	0.6
6-minute walk distance (m)	405±60	405±117	0.9
NT-proBNP (pg/ml)	679±458	666±1570	0.8

Cum%VP: cumulative percent ventricular paced. RVOTP: right ventricular outflow tract pacing. RVAP: right ventricular apical pacing.

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DDD(R)-pacing, but not AAI(R)-pacing induces left ventricular desynchronization in patients with sick sinus syndrome. TDI and 3D echocardiographic evaluation in a randomized comparison

A.E. Albertsen[1], J.C. Nielsen[1], S.H. Poulsen[1], H. Egeblad[1], P.S. Hansen[1], H.K. Jensen[1], A.K. Pedersen[1], P.T. Mortensen[1]
[1]*Aarhus University Hospital (Skejby), Dept. of Cardiology, Aarhus, Denmark*

Background: Increasing evidence from randomized trials and experimental studies indicate that right ventricular pacing may be harmful increasing the risk of congestive heart failure. We aimed to compare left ventricular (LV) dyssynchrony and LV performance during chronic atrial pacing (AAI(R)) and dual chamber right ventricular pacing (DDD(R)) in patients with sick sinus syndrome.
Methods and Results: Fifty consecutive patients were randomized to AAI(R)-pacing or DDD(R)-pacing. Tissue-Doppler imaging was used to quantify LV dyssynchrony in terms of number of segments with delayed longitudinal contraction (DLC). Left ventricular ejection fraction (LVEF) was measured using 3D-echocardiography. Functional status was evaluated by the six minute walk test. Dyssynchrony increased significantly in the DDD(R)-group from baseline to the twelve months follow-up (1.1±1 to 2.2±1 segments displaying DLC in mean, p = 0.02). No change was observed in the AAI(R)-group (1.6±2 to 1.3±2 segments displaying DLC in mean), NS. At the one year follow-up, dysssynchrony was more pronounced in the DDD(R)-group than in the AAI(R)-group, p = 0.01. LVEF

decreased significantly in the DDD(R)-group from baseline (63.1±8%) to the one year follow-up (59.3±8%, p = 0.047), and remained unchanged in the AAI(R)-group (61.5±11% at baseline and 62.3±7% at the one year follow-up, NS). NT-proBNP did not change in the DDD(R)-group (78±85 pmol/l to 86±125 pmol/l, NS), whereas a significantly decrease was observed in the AAI(R)-group (120±178 pmol/l to 57±79 pmol/l, baseline and the one year follow-up respectively, p = 0.04). Walking distance was similar in the two groups at baseline (415±76 m vs. 444±105 m, DDD(R)- and AAI(R)-group respectively, NS). In contrast, a statistically significant difference was found between groups at the one year follow-up (446±96 m vs. 500±89 m, DDD(R)- and AAI(R)-group respectively, p = 0.04).

Conclusion: In patients with sick sinus syndrome, DDD(R)-pacing but not AAI(R)-pacing induces significant LV desynchronization and reduction of LVEF. The heart failure marker NT-proBNP decreases during atrial pacing but not during DDD(R)-pacing.

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Safety and feasibility of right ventricular outflow tract pacing versus right apical pacing: short-term results of a randomized trial

O. Cano Perez[1], J. Osca Asensi[1], M.J. Sancho-Tello De Carranza[1], J. Olague De Ros[1], M.T. Izquierdo De Francisco[1], V. Ortiz Martinez[1], J.E. Castro Pareja[1], A. Salvador Sanz[1] on behalf of The Right Ventricular Outflow Tract Pacing Evaluation Trial.
[1]*La Fe University Hospital, Cardiology, Valencia, Spain*

Background: Prior studies suggest that right ventricular apical pacing (RVAP) has deleterious effects. The right ventricular outflow tract (RVOT) may represent an effective alternative pacing site.

Aim: To prospectively compare the safety and feasibility of RVOT pacing versus RVAP in patients with permanent cardiac pacing indication for complete AV block or sick sinus syndrome.

Methods: 60 pts (38 m; mean age 73 years) with complete AV block (35 pts) or sick sinus syndrome (25 pts) were randomly assigned to receive a screw-in lead positioned either in the RVOT (n = 31) or in the right ventricular apex (n = 29). Implant procedure time, number of attempts to achieve the pacing site, pacing threshold, R-wave sensing, lead impedance and paced QRS duration were evaluated at implant and at 3 months follow-up.

Results: The overall success rate in the RVOT pacing group was 92% vs 94% in RVAP group (p = 0.7). There were no significant differences in the implant procedure time, number of attempts to achieve the pacing site, pacing threshold, R-wave sensing and lead impedance between the two groups (Table 1). Paced QRS duration was shorter during RVOT pacing at implant (139±14 ms vs 159±15 ms, p < 0.0001) and at 3 months follow-up (138±13 ms vs 165±21 ms, p < 0.0001). Dislodgement from the RVOT occurred in one patient.

Conclusions: RVOT pacing is a feasible and an effective alternative pacing site providing a more physiologic stimulation expressed by shorter paced QRS with no differences in the pacing, sensing and lead impedance parameters.

Table 1.

	Time	No. of	Implant			3 Months		
	(min)	attempts	R-wave (mV)	Pacing threshold (V)	Lead impedance (Ω)	R-wave (mV)	Pacing threshold (V)	Lead impedance (Ω)
RVAP (n = 29)	54±21	1.43±1.1	13.3±6.7	0.62±0.2	861±206	13.9±4.4	0.77±0.32	544±135
RVOT (n = 31)	54±17	1.81±1.9	12.8±6.4	0.75±0.4	910±323	13.5±7.3	0.73±0.33	542±138
p value	0.9	0.3	0.7	0.1	0.4	0.8	0.7	0.9

RVAP: right ventricular apical pacing; RVOT: right ventricular outflow tract pacing.

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Biventricular pacing preserves left ventricular performance and prevents desynchronization as compared to DDD(R)-pacing in 50 patients with AV-block

A.E. Albertsen[1], J.C. Nielsen[1], S.H. Poulsen[1], H. Egeblad[1], P.S. Hansen[1], H.K. Jensen[1], A.K. Pedersen[1], P.T. Mortensen[1]
[1]*Aarhus University Hospital (Skejby), Dept. of Cardiology, Aarhus, Denmark*

Background: Experimental studies and clinical trials indicate that single site right ventricular pacing causes left ventricular (LV) dyssynchrony and –dysfunction increasing the risk of congestive heart failure. We investigate if biventricular (BIV) pacing can minimize LV dyssynchrony and preserve LV ejection fraction (LVEF) as compared with standard dual chamber DDD(R)-pacing.

Methods: Fifty consecutive patients with high-grade AV-block were randomized to permanent DDD(R) (n = 25) or BIV pacing (n = 25). All patients had bipolar active fixation leads implanted in the right atrium and in the right ventricular septum connected to a BIV pacemaker. In the BIV-group, a dedicated LV-lead was implanted in a lateral coronary sinus tributary. Endpoints were: LVEF measured by 3-D echocardiography, intra LV ventricular dyssynchrony measured by tissue-Doppler-imaging in terms of number of segments with delayed longitudinal contraction (DLC), p-NTpro-BNP and 6 minutes walk test, all estimated the day after pacemaker implantation (baseline) and after one year of follow-up. Median (first & third quartile) or mean±SD are reported.

Results: Mean age was 75 (range 25–90) years. At one year of follow-up, LVEF decreased in the DDD(R)-group from 59.7 (57.4–61.4)% at baseline to 57.2 (52.1–60.6)% (p = 0.03) and remained unchanged in the BIV-group 58.9 (47.1–61.7)% and 60.1 (55.2–63.3)%, respectively (p = 0.15). Dyssynchrony was more prominent in the DDD(R)-group than in the BIV-group at baseline (2.2±2 vs. 1.4±1 segments with DLC per patient, p = 0.10); and at the one year follow-up (1.8±2 vs. 0.8±1 segments with DLC per patient, p = 0.02). p-NTpro-BNP was unchanged in the DDD(R)-group during follow-up (122±178 pmol/l vs. 91±166 pmol/l, NS) but decreased significantly in the BIV-group (from 198±505 pmol/l to 86±95 pmol/l after one year, p = 0.02). Both groups increased significantly walking distance during follow-up with no difference between groups.

Conclusions: In patients with high-grade AV-block, DDD(R)-pacing, but not BIV-pacing causes impairment of LVEF and increases LV dyssynchrony. p-NTpro-BNP decreases and walking distance increases during BIV-pacing. These results indicate that BIV-pacing may prevent pacing induced heart failure in patients with AV-block who need ventricular pacing.

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The degree of mitral regurgitation in PM patients depends on LV dyssynchrony and is avoided by Hisian Pacing

F. Zanon[1], S. Aggio[1], G. Pastore[1], E. Baracca[1], E. Bacchela[1], P. Zonzin[1]
[1]*General Hospital, Cardiology Department, Rovigo, Italy*

Background: Right ventricular APICAL pacing is dangerous for left ventricular function because it promotes ventricular dyssynchrony (VD) and Mitral Regurgitation (MR). In PTS with preserved left ventricular synchrony and preserved Hisian-Purkinje conduction, a pacing system that could preserve both is desirable.

Aim of Study: To assess the relationship between MR and VD in different PM paced patient populations.

Methods: 117 Pts were implanted with a permanent pacemaker according to the current guidelines. Pts have been divided into three groups in accordance to RV pacing site: (A) 63 pts (mean age 74±8 y and EF 50±16%) with a Right Ventricle Apical (RVA) lead, (B) 24 pts (mean age 72±10 y and EF 53±17%) with a RV lead positioned in Para-his (PH) and (C) 30 pts (mean age 76±7 y and EF 61±13%) with a RV Lead for Direct His Bundle (DHB) pacing. The three groups are homogeneous for diabetes, hypertension and Ischemic Cardiomyopathy. Through echocardiography we evaluated the VD as: (1) Electromechanical Latency (ELM, time for LV activation); (2) Yu index (SD of interventricular delays); (3) Degree of MR measured as Volume; (4) Tenting Area (TA, measured in 4 chamber view in systole between Mitral Ring and closed mitral leafs).

Results: Different measurements have been done to evaluate the degree of VD and MR in the three groups A, B and C as shown in the table 1. A significant correlation between the TA and ELM – Lateral Wall has been observed (r = 0.86).

Conclusions: RVA pacing leads to Left VD and, due to the strong correlation between the ELM and MR, it leads to MR. DHB pacing, maintaining LV contraction synchrony, leads to a lower degree of MR compared to the other pacing sites.

	A	B	C	p A vs B	p A vs C	p B vs C
Yu	32±10	18±4	16±4	<0.05	<0.05	ns
ELM	133±23	106±19	92±15	<0.05	<0.001	0.05
ELM – Lateral Wall	158±41	105±23	92±20	<0.05	<0.001	<0.05
MR (ml)	20±14	17±15	9.54±7	ns	<0.05	<0.05
Tenting Area cm^2	1.48±0.79	0.87±0.44	0.72±0.47	<0.05	<0.001	0.05

WEDNESDAY, 27 JUNE 2007, 8:30–10:00 **Evora**

Long-term perspectives in arrhythmia management

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Detailed ablation cost-calculations per arrhythmia target in one academic center, with parametric possibility for extrapolation to other settings

H. Heidbuchel[1], S. Foulon[1], L. Pison[1], W. Huybrechts[1], J. Ector[1], J. Adams[1], R. Willems[1], H. Ector[1]
[1]*University of Leuven, Cardiology – Electrophysiology, Leuven, Belgium*

Background: Although radiofrequency catheter ablation is a curative procedure, hospitals and governments struggle to organise adequate reimbursement. A hurdle in such discussions is the paucity of data on real costs for these procedures.
Methods: We performed detailed cost-calculations in 1191 ablations over a 6.5 y period (6/98 till 1/05) in one academic hospital. We used micro-costing of all procedure-related costs, based on (1) the use and item price of disposables, catheters and connectors, (2) time spent by nurses & physicians, multiplied by their respective bruto-bruto labour cost, (3) annuitised variable cost per hour cath lab, and (4) annuitised fixed yearly cost for electrophysiological equipment. All costs were normalised for the catalogue price of a steerable, 4-pole, diagnostic Cordis-Webster catheter (€750 in 1998, tax incl.), expressed as units (U). Total costs were also compared to those for AVNRT as a base case.
Results: The fixed equivalent yearly cost for 1 EP lab was 52 U. The different cost components are shown in the Table. Important aspects for extrapolation of these data to other countries/hospitals are: (1) catheters were reprocessed (in-hospital; reprocessing cost was included) except open irrigated or cryo-catheters (together used in 14% of all procedures). The overall average catheter cost was 10.6% compared to the catalogue price for new catheters. (2) the number of catheters, personnel type, nursing and physician time will highly depend on the particular setting, but our data serve as a relative comparator. They allow cost estimates per hospital when detailed analysis is done for AVNRT cases.
Conclusions: Ablation costs vary more than 3-fold depending on procedure type and they are mainly determined by catheter costs, even with intense reprocessing. Reimbursement schemes should factor in these important variables.

Table

N	AVNRT 399	AVRT 245	EAT 37	Flutter 316	AF (PVI) 72	His 4	IART 58	VT 60
Personnel	0.47	0.52	0.53	0.49	0.90	0.31	0.64	0.60
Equipment	0.20	0.22	0.23	0.21	0.35	0.14	0.27	0.25
Disposables	0.30	0.52	0.48	0.49	0.75	0.32	0.49	0.48
Cath. & Conn.	0.53	0.80	0.82	1.04	1.55	0.33	1.29	1.12
Total (relative to AVNRT)	1.00	1.38	1.38	1.49	2.37	0.73	1.80	1.64

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Co-existence of atrial and ventricular tachyarrhythmias in patients with congenital heart defects

N.M.S. De Groot[1], W.K. Chan[1], M. Rahantiapur[1], N.A. Blom[1], E.E. Van Der Wall[1], M.J. Schalij[1]
[1]*Leiden University Medical Centre, Cardiology Dept., Leiden, Netherlands;* [2]*Leiden, Netherlands*

Introduction: Ventricular tachyarrhythmias (VT) are a major cause of morbidity in patients with congenital heart defects (CHD). In this study, we report on the incidence, clinical presentation and characteristics of ventricular tachyarrhythmias (VT) in a cohort of patients with congenital heart defects (CHD) referred for catheter ablation of late post-operative atrial tachyarrhythmias (AT).
Methods: The study population consisted of 50 consecutive pts (24 male, 37±14 yrs) with CHD and post-operative, drug refractory AT referred for ablation between 1999 and 2005. Mapping was guided by the electro-anatomical mapping system (CARTOTM) in all pts. Mapping revealed 29 atrial flutter (AFL (CL = 278±81 ms), 31 intra-atrial re-entrant tachycardia, (IART, CL = 303±65 ms), 12 focal atrial tachycardia (FAT, CL = 372±99 ms) and 2 focal atrial fibrillation (AF). Ablation was successful in 52% of the IART, 93% of the AFL and all FAT and focal AF.
Results: Persistent AF was present in 28%, the remaining pts were in sinus rhythm. VT developed in 9 pts (8 female, age 37±12 yrs) with tetralogy of Fallot (4), tricuspid atresia type IIB (1), atrial septal defect+aortic stenosis, atrioventricular septal defect (1), ventricular septal defect+pulmonary stenosis (1) and coarctatio aortae+mitral valve insufficiency (1). The interval between the first surgical procedure and development of VT was 28±10 yrs. Patients presented with either palpitations (4) or collaps (5). The QRS width during sinus rhythm at the moment of presentation was 150±36 ms. In 7 pts, an EP study was performed and either VF (n = 3) or monomorphic VT (CL 250±69 ms, N = 4, LBBB: 3, RBBB: 1) was induced. An ICD was implanted in 7 patients, one pt was treated with sotalol and 1 pt died due to progressive pump failure.
Conclusion: AT and VT co-exist in patients with complex CHD. VT develop late after cardiac surgery and occur in patients with a variety of defects.

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Long-term results of atrial flutter ablation in follow-up of up to 10 years: freedom from arrhythmia in less than 1/4 of patients

L. Lickfett[1], S. Lenertz[1], A. Yang[1], J.O. Schwab[1], A. Bitzen[1], J.W. Schrickel[1], G. Nickenig[1], T. Lewalter[1]
[1]*University of Bonn, Cardiology, Bonn, Germany*

Background: Catheter ablation of the cavotricuspid isthmus (CTI) has been established as the therapy of choice for recurrent typical atrial flutter. Despite the fact that ablation of the CTI is regarded as a curative treatment with low incidence of recurrences, long-term consequences especially in respect to coexistent or developing atrial fibrillation are unknown. The goal of the current study was to follow up patients ablated for typical atrial flutter before October 1999.
Methods: Eighty-four patients ablated for typical atrial flutter with the electrophysiological endpoint of bidirectional isthmus block (also currently accepted as endpoint of CTI ablation) between November 1995 and October 1999 were included in the study. Patients with only incomplete block in the CTI after ablation were excluded. Follow-up examination included history, ECG, 24 hour Holter ECG as well as transthoracic echocardiography. Age of the patients at the time of ablation was 59±10 years. 86% were male. 49% were diagnosed with atrial fibrillation even before the ablation.
Results: Mean follow-up time was 84±20 months (maximum 129 months). Recurrent typical atrial flutter was diagnosed in 20% of patients. Atypical flutter was documented in another 6%. Atrial fibrillation was observed in 73% of patients. Atrial fibrillation was paroxysmal in 55% and persistent in 45%. At the time of follow-up, specific antiarrhythmic drugs (class Ic or III) were taken by 56%, oral anticoagulation

by 64%, platelet inhibitors by 22% and neither oral anticoagulation or platelet inhibitors by 14% of patients.
Conclusion: Only a minority of patients after catheter ablation for typical atrial flutter is arrhythmia-free at long-term follow-up of up to 10 years. $\frac{3}{4}$ of patients exhibit atrial fibrillation. Therefore continuing treatment is mandatory for the majority of patients after successful catheter ablation of atrial flutter.

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Clinical impact of catheter ablation in patients with left ventricular dysfunction and ventricular outflow tract premature ventricular complexes

L. Calo'[1], E. De Ruvo[1], F. Lamberti[1], L. Sciarra[1], A. Sette[1], P. Di Donna[1], F. Gaita[1], E. Lioy[1]
[1]Policlinico Casilino, Cardiology, Rome, Italy; [2]S.Eugenio Hospital, Cardiology, Rome, Italy; [3]Civil Hospital, Cardiology, Asti, Italy

Background: Frequent premature ventricular complexes (PVC) could determine left ventricular (LV) dysfunction. Few reports suggested that the suppression of PVC with radiofrequency catheter ablation (RFA) could increase the ventricular function in patients with dilated cardiomyopathy. Aim of this study was to evaluate if the RFA of PVC in patients dilated cardiomyopathy can reverse the LV dysfunction.
Methods: The patient population included 20 patients with reduced left ventricular function (LV Ejection Fraction 38±7), no evidence of underlying structural heart disease, and frequent PVC with ECG characteristic suggesting an origin from the right or left outflow tract. These patients were prospectively randomized to continue their usual care (control group: 10 patients, 5 female, 44±6 years) or to attempt RFA of PVC (ablation group: 10 patients, 4 female, 45±8 years). A 7F, 4 mm electrode tip, steereable catheter was used for mapping and ablation procedure. The left catheterization was performed by transaortic retrograde approach. Local earliest ventricular activation during PVC and pace mapping were used to identify the ablation site. A non-fluoroscopic mapping system was used in 5 patients.
Results: The clinical characteristics of the patients in the 2 groups were similar. At the baseline, the total number of PVC on 24 hours Holter monitoring was 24345±15247 beats/day. The ablation was successful in 9 of the 10 patients of the ablation group (RF pulses 5±3). The site of successful ablation was located in the left outflow tract in 2 patients, in the right outflow tract in 5 patients and close to the mitral annulus (posterior region). In 1 patient with frequent PVC of two morphologies the successful ablation sites were located in the right and in left outflow tract. There were no complications related to the procedure. After 8±4 months of follow-up, RFA significantly reduced the number of total PVC ($P < 0.01$) and increase the LV ejection fraction (from 39±7% to 48±6%, $P < 0.01$). In the control group, there were no significant changes of the number of PVC and of ejection fraction.
Conclusion: In a subgroup of patients with idiopathic dilated cardiomyopathy and frequent PVC the RFA of PVC focus can improve LV dysfunction.

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Incidence, diagnosis and treatment of premature ventricular complexes-induced dysphagia in patients with idiopathic ventricular arrhythmias

S. Stec[1], W. Tarnowski[1], A. Binda[1], P. Kulakowski[1]
[1]Postgraduate Medical School, Dept of Cardiology, Grochowski Hospital, Warsaw, Poland

Background: While it has been known for many years that eosophageous diseases can cause brady- and tachyarrhythmias, it has not been previously reported that frequent premature ventricular complexes (PVC) can also cause dysphagia.
Aims: Evaluation of incidence, diagnosis and management of PVC-induced dysphagia in pts with idiopathic ventricular arrhythmias.
Methods: Consecutive pts reffered for management of frequent, symptomatic PVC without organic heart disease have been prospectively evaluated. Detailed symptom-related questionnaire and medical history has been taken by electrophysiologist. In case of history of dysphagia bedside screening test (called "banana's test") was performed. It consisted of simultaneous ECG monitoring and swallowing of solid food (piece of banana) during sinus rhythm and spontaneous or induced frequent PVC. Moreover, barium swallow videography + ECG monitoring as well as manography + ECG monitoring were performed to exclude other eosophageal abnormalities and to verify motility abnormalities during sinus rhythm and frequent PVC. After exclusion of other causes of dysphagia electrophysiologist-guided therapy was conducted to achieve complete disapearance of PVC.
Results: PVC-induced dysphagia was confirmed in 6 of 110 (5%) pts with idiopathic PVC (mean PVC/24 h: 20400±14500, age: 18–78). Banana's test was positive in all cases. A barium swallow studies were initially normal but during frequent PVC intraeosophageal reflux was recorded. Manography revealed normal or nearly normal eosophageal motility during sinus rhythm and various pattern of motility abnormalities (spasm, complete atonia and abnormal motility) recorded after spontaneous or induced frequent PVC. Long-term cure of PVC-induced dysphagia was achieved after effective antiarrhythmic treatment by propafenone ($n = 2$, in PVC with typical right ventricle outflow tract (RVOT) morphology), spontaneous remission of PVC (from RVOT) or RF ablation ($n = 3$, arrhythmogenic foci were localised in parahisian region, RVOT and left aortic cusp).
Conclusions: Prevalence of PVC-induced dysphagia is about 5% in patients with idiopathic ventricular arrhythmias. Simple tests (such as banana's test, barium swallow study and manography with simultaneous ECG monitoring) are effective for diagnosis of PVC-induced dysphagia. Succesful antiarrhythmic treatment may result in complete cure of dysphagia, therefore it should be considered in all cases of dysphagia associated with frequent of PVC.

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Surgical approach determines atrial flutter circuits late after open heart surgery

A. Makai[1], R. Pap[1], G. Bencsik[1], S. Chadaide[1], P. Furge[1], J. Szolnoky[1], T. Forster[1], L. Saghy[1]
[1]2nd Dept. of Internal Medicine and Cardiology, Szeged University, Szeged, Hungary; [2]Department of Heart Surgery, Szeged, Hungary

Background: Atrial flutter (AFL) often develops after open heart surgery (HS). The aim of our study was to examine the relationship between the atriotomy applied during HS and the type of postoperative AFL.
Patients and Methods: 55 patients with AFL underwent electrophysiology study during a 2 year period. Previous HS included only right atrial (RA) incision in 35 patients (28 of whom had only cannulation through the right auricle), while 14 patients had RA and transseptal (TS) left atrial, 6 patients had right and direct left atrial (LA) atriotomy. Atrial extrastimulation was carried out to induce all possible AFLs, as well as electroanatomic and/or entrainment mapping to determine their mechanism.
Results: During the study 46 patients (84%) had spontaneous or inducible typical, cavotricuspid-isthmus dependent (CTId) AFL, 24 patients (44%) had atypical, and 15 patients had both types of AFLs. Altogether 72 AFLs were studied, 46 (64%) were CTId and 26 (36%) were atypical (12 right incisional (RI), 4 perimitral (PM), 10 other atypical) among them. The CTId AFL was significantly more frequent after HS using only RA incision ($p = 0.005$), while atypical AFL was more common after HS using LA atriotomy also. RI AFL occurred in 17% of patients with only RA incision and in 43% of patients with RA and TS atriotomy, but none of the patients with direct LA atriotomy ($p = 0.056$). The RI AFL was seen in 41% of patients with a RA atriotomy, compared to 9% of patients with only right auricle cannulation without RA atriotomy ($p = 0.005$). PM AFL occurred only after LA operations (RA plus TS or direct LA atriotomy), and never occurred after operations with only RA incision ($p = 0.007$). There was no difference between the frequency of PM AFL in patients with RA plus TS and in patients with direct LA atriotomy ($p = 0.329$). Other types of atypical AFLs were significantly more common after operations with LA compared to those with only RA incision ($p = 0.015$), with no significant difference between the TS and the

direct LA approach. Radiofrequency ablation was attempted in all cases of CTId and 21 (81%) of atypical AFLs, with a procedural success rate of 93% and 81%, respectively.
Conclusion: The type of AFL occurring after open HS is strongly associated with the type of atriotomy applied during the operation. While CTId AFL is the most common type after right atrial incisions, atypical AFL was the most frequent after LA operations. Right atrial incisional AFL is likely to occur after RA atriotomy and is infrequent when only the auricle is cannulated, while perimitral and other types of AFL occur more commonly if the LA was opened.

WEDNESDAY, 27 JUNE 2007, 8:30–10:00 **Guarda**

Secondary prevention of sudden death by implantable cardiac defibrillator

839
Electric storm occurrence and survival in post-MI patients with implanted cardioverter-defibrillator

W. Kwasniewski[1], A. Filipecki[1], D. Urbanczyk[1], W. Orszulak[1], T. Zajac[1], W. Kargul[1], M. Trusz-Gluza[1]
[1]*Silesian Medical University, I Cardilogy, Katowice, Poland*

Occurrence of electric storm (ES), an important clinical problem in patients with ICD was previously found to increase mortality.
We assessed ES occurrence influence on survival during long term follow-up.
ES was defined as at least 3 separate sustained VT or VF episodes appropriately treated during 24 hours.
From 446 patients with coronary artery disease and implanted device from 1997–2004 as secondary prevention of sudden cardiac death ES occurred in 53 patients (11.9%).
We retrospectively analyzed records of 106 ICD patients: 53 with ES and 53 without matched according to implantation date, age at implant and extent of CAD.
Results: There were no differences in gender (84% male), number and location of MI, time of MI (mostly remote at implant), index arrhythmia morphology, other comorbidities and treatment (medication and revascularization). Ejection fraction at implantation in ES pts was 36.3±9.9% vs 38.4±12% in patients without ES (p = ns). During long term follow-up (25–96 months, median 49 months) 24 deaths were recorded, equally divided between two groups. Kaplan–Meier survival curves were similar. Univariate Cox proportional hazard analysis did not reveal any significant factors influencing survival.
Conclusion: Electric storm occurrence did not increase mortality in patients with CAD and implanted ICD.

840
Role of Electrophysiologic Study in predict arrhythmic events potentially fatal in chagasic patients with Implantable Cardioverter Defibrillator

P. Reis[1], S. Dos Santos Galvao Filho[1], J. Tarcisio Vasconcelos[1], C. Monteiro Barcellos[1], E. Leobino[1], L. Claudio Behrmann[1], R. Mingireanov[1], E. Tiso[1]
[1]*Beneficiencia Portuguesa, Clinica De Ritmologia Cardiaca, Sao Paulo, Brazil*

Objective: Analyze the role of Electrophysiologic Study (EPS) in predict ventricular tachycardia potentially fatal (VTPF) in chagasic patients analyzing the data stored in the implantable device memory.
Material and Methods: data from 66 chagasic pts were analyzed, 31 (47%) female, mean age 55.5±14.8 years, with previous history of ventricular arrhythmic events, which justified the indication for Implantable Cardioverter Defibrillator (ICD) implantation. Pts were submitted to EPS before ICD implantation, which results determined two groups according to their hemodynamic response during ventricular arrhythmia: (1) Hemodynamically unstable Ventricular Tachycardia (HUVT) 41 (62%) pts and (2) Hemodynamically Stable Ventricular Tachycardia (HSVT) or not inducible 25 (38%) pts. All pts were followed-up in our service, having their stored arrhythmic events analyzed. Primary episodes occurring in the Ventricular Fibrillation (VF) zone (rate >180 bpm) requiring shock therapy were considered VTPF.
Results: in a mean follow-up of 34.6±12.1 mo., 9 pts in group 1 and 12 pts in group 2 presented with VTPF. EPS showed sensitivity of 43%, specificity of 29%, positive predictive value of 22% and negative predictive value of 52% in identifying pts subject a VTPF.
Conclusion: EPS was not capable of accurately predict the risk of VTPF in chagasic patients.

841
Anatomical obstacles to initial ICD implantation. results of pre-operative venography in 302 patients

L. Lickfett[1], T. Lewalter[1], O. Balta[1], J. Kreuz[1], K. Strach[1], T. Sommer[1], G. Nickenig[1], J.O. Schwab[1]
[1]*University of Bonn, Cardiology, Bonn, Germany*

Background: ICD implantation for secondary or primary prevention of sudden cardiac death is usually accomplished without major procedural hurdles. Congenital or aquired abnormalities of the central venous anatomy however can significantly influence the implantation process. In some cases intra-procedural change to the contralateral side after failed venous access or lead passage is necessary. Aim of the study was to examine the incidence of congenital or aquired abnormalities of the central venous anatomy as well as their risk factors prior to initial ICD placement.
Methods: 302 patients undergoing ICD implantation for primary or secondary prophylaxis of sudden cardiac death were included in the study. All patients underwent bilateral contrast venography by injecting a total of 30 to 50 ml of a non-ionic contrast medium into both cubital veins. A digital subtraction angiography system was used. Two attending radiologists analyzed the images.
Results: 21 out of 302 patients (7%) exhibited an abnormal venogram indicating potential difficulties for lead placement: Persistent left superior vena cava in 2 pt (1%), obstruction (high degree stenosis or occlusion) of one subclavian vein in 13 pt (4%), obstruction of one brachiocephalic vein in 3 pt (1%), obstruction of one axillary vein in in 3 pt (1%). Risk factors for venous obstruction were previous open heart surgery in 7 pt (37%), previous pacemaker in 4 patients (21%), recent CPR and extended intensive care unit stay in 3 patients (16%). 5 pt (26%) had no identifiable risk factor.
Conclusion: Obstruction of venous access can be found even in patients referred for initial ICD implantation and not only ICD replacement. Risk factors such as previous open heart surgery, previous pacemaker and a history of extended intensive care unit stay should prompt pre-operative venography.

842
Antitachycardia pacing (ATP) usefulness for VT treatment on substrates different from ischemic or dilated Cardiomyopathy

J. Toquero Ramos[1], I. Fernandez Lozano[1], M. Cobo[1], J.M. Escudier[1], P. Aguiar[1], V. Castro[1], A. Gomez[1], L.A. Pulpon[1]
[1]*Clinica Puerta De Hierro, Dept. Of Cardiology, Madrid, Spain;*
[2]*Clinica Puerta de Hierro, Madrid, Spain*

Background: Sustained monomorphic VTs are frequently seen on patients with ischemic or dilated cardiomyopathies, in wich antitachycardia pacing (ATP) has shown its efficacy. We tried to demonstrate ATP usefulness on substrates with greater probability of polymorphic VTs, in which ATP role is unknown or of not proven efficacy.
Methods: We retrospectively evaluated 414 ICD patients, of whom, 78 had cardiopathies with greater probability of polymorphic VT (Brugada, Hypertrophic cardiomyopathy –HCM-, Steinert, Idiopatic VF, Arrythmogenic right ventricular Cardiomyopathy –ARVC-, non-compacted myocardium and long QT syndrome). ATP as the initial therapy was used in all of them: 2 burst 88% and 2 ramps 91% coupling intervals, followed

by shocks. We analyzed only patients with VT recurrence treated with ATP as the first therapy (16 patients): HCM (n: 10); Idiopatic VF (n: 3); ARVC (n: 2) and Steinert (n: 1).
Results: 300 arrythmic events were studied. ATP terminated VT on 253 (84.3%) and was unsuccessful on 48 (16%). One patient had a total amount of 148 episodes during an electrical storm, with ATP being able to terminate 147 of them (99.3%). None of the studied episodes were associated with loss of conciousness, previously nor during ATP administration. Per patient adjusted ATP-termination efficacy was 73.2% (CI 55.4–91.1%); 78% of the studied VT were monomorphic; on two patients (ARVC and HCM) they were polymorphic (cycle length and amplitude variations greater than 10%), without that meaning therapy failure.
Conclusions: ATP is effective for VT termination on cardiomyopathies in wich, in theory, no monomorphic VTs are expected. ATP is safe, without augmenting syncopal episodes, avoiding painful shocks in many of them.

843
The high incidence of shock therapies impairs quality of life of young patients with implantable cardioverter-defibrillators

R. Costa[1], K.R. Silva[1], R. Mendonca[1], S.A.D. Nishioka[1], W.T. Tamaki[1], E.S. Crevelari[1], M. Martinelli Filho[1], N.A.G. Stolf[1]
[1]*Heart Institute, Sao Paulo, Brazil*

Background: The use of implantable cardioverter-defibrillators (ICD) in children and adolescents is rare. However, the incidence of shock therapies is known to be more frequent among this population than in adults.
Objective: To assess the incidence and causes of ICD shocks in children and adolescents and their impact on quality of life (QoL).
Patients and Methods: From March/1997 to February/2006, 29 patients (15.7±5.4 years of age) underwent ICD implantation. Resuscitated cardiac arrest (41.5%), sustained ventricular tachycardia (27.6%), and primary prophylaxis of sudden cardiac death (30.9%) were the indications for ICD implantation. The number of therapies was assessed by interview and using the ICD telemetry. The SF-36 questionnaire was used to assess QoL, which was compared to that of healthy individuals. The Kaplan–Meier method was used for the analysis of shock-free survival.
Results: After 2.6±1.8 years of follow-up, eight (27.6%) patients received 141 appropriate shocks due to polymorphic ventricular tachycardia (VT) (6) or ventricular fibrillation (VF) (2), and 11 (37.9%) received 152 inappropriate shocks due to supraventricular tachyarrhythmias (8) or oversensing (3). Appropriate shock-free survival expectancy was 74.2±9.0% and 66.7±10.7% after one and three years, respectively. There was no difference between the frequency of appropriate or inappropriate ICD shocks ($p = 0.1$). No clinical variable could be identified as predictor of appropriate or inappropriate ICD shocks. Decreased QoL was observed as regards physical functioning (61.7±28.7), vitality (64.7±19.1), mental health (65.9±22.7) and emotional aspects (66.7±38.5). All patients reported fear and concern related to the ICD.
Conclusions: Despite the great efficacy of this therapy, the high incidence of shocks interfered with QoL and adaptation to the device.

844
Trends of ICD type for primary and secondary prevention in Italy. Data from the National ICD Registry during the years 2002–2005

A. Proclemer[1], M. Ghidina[1], D. Facchin[1], L. Rebellato[1], P.M. Fioretti[1], M. Brignole[1] on behalf of Italian Association of Arrhythmology and Cardiac Pacing
[1]*Az. Ospedaliero-Universitaria, U.O Cardiologia, Udine, Italy;* [2]*Ircab Foundation, Udine, Italy;* [3]*Az. Ospedaliera, U.O Cardiologia, Lavagna (Ge), Italy*

Background: Several trials demonstrated the life saving role of implantable cardioverter-defibrillator (ICD) in high-risk groups of patients. To evaluate the effects of the main published trials in the choice of ICD type, we report the main epidemiological data of patients enrolled in the ICD Registry of the Italian Association of Arrhythmology and Cardiac Pacing in the years 2002–2005.
Methods: The Registry collects prospectively 85–95% of national ICD implantation activity on the basis of European ICD form (EURID), including the relevant clinical data of the enrolled patients and the technical characteristics of implanted ICD (single vs dual vs biventricular).
Results: The number of implanted ICDs in Italy was 3,992 in the year 2002, 5,595 in the year 2003, 7,190 in the year 2004, and 10,440 in the year 2005. In the period 2002–2005 we observed a progressive decrease of single chamber ICD utilization rate, concomitantly with a continuous increase in the CRT implantation rate either for primary and secondary prevention of cardiac death. On the contrary, the use of dual chamber ICD remained stable in the same period for both primary and secondary prevention (table 1).
Conclusion: The ICD implantation rate in Italy increased significantly in the period 2002–2005, similarly to the trend in many countries. The Registry showed an important increase of CRT ICD use for primary and secondary prevention, according to evidence based medicine. The use of dual chamber ICD remained stable, while single chamber ICD implantation rate showed a progressive decline.

Table 1. ICD implant rate and ICD type

	2002	2003	2004	2005
ICD/million inhabitants	70	98	125	180
Primary prevention				
Single chamber	168 (40.2%)	387 (37.5%)	553 (31.7%)	1016 (27.6%)
Dual Chamber	101 (24.2%)	203 (19.7%)	357 (20.5%)	889 (24.2%)
CRT	149 (35.6%)	442 (42.8%)	832 (47.8%)	1771 (48.2%)
Secondary prevention				
Single chamber	1476 (46.5%)	1615 (40.2%)	1652 (35.6%)	1928 (33.5%)
Dual Chamber	1183 (37.3%)	1425 (35.4%)	1636 (35.3%)	2116 (36.8%)
CRT	516 (16.3%)	980 (24.4%)	1352 (29.1%)	1709 (29.7%)
ICD out of analysis	399 of 3992	543 of 5595	808 of 7190	1031 of 10440

WEDNESDAY, 27 JUNE 2007, 10:30–12:00 Guimaraes

Optimizing pacing

854
Degree of dyssynchrony acutely induced by different right ventricular pacing sites: apex, his, para-his, and outflow tract

G. Pastore[1], F. Zanon[1], S. Aggio[1], E. Baracca[1], L. Roncon[1], E. Bacchiega[1], M. Carraro[1], P. Zonzin[1]
[1]*Ospedale Civile, Cardiology, Rovigo, Italy*

Purposes: Published reports about selective right ventricular (RV) pacing sites (for physiological pacing) show incomplete and contradictory results. Aim of this study was to compare the degree of dyssynchrony acutely induced by pacing from different RV sites: apex (RVA), direct His Bundle (DHB), para-His Bundle (PHB) and RV outflow tract (RVOT).
Methods: Seventy pts (51 males, 74±12 y) underwent permanent pacing at different RV sites: DHB 20, PHB 16, RVOT 14, and RVA 20 pts. All pts had hypertensive cardiomyopathy and were similar for structural characteristics: normal EF (60±4%), left V (LV) end diastolic volume (66±6 ml/m^2), LV mass (132±18 gr/m^2), no valvular disease. An echocardiogram and TDI was performed during pacing from the different RV sites to evaluate: (1) time interval "earliest to latest" basal LV wall motion (ILV); (2) std. dev. of basal segments activation time intervals (Yu index); (3) electromechanical latency (EML) = mean time interval "QRS onset to LV basal segments activation". The LV dyssynchrony indexes from different RV pacing sites were compared to a "non-paced" control group (C) with similar echocardiographic and clinical characteristics. According to fluoroscopic view and QRS morphology, pts with RVOT pacing were divided in "free wall" (RVOTf, n = 8) and "septal" pts (RVOTs, n = 6).
Results: The table shows dyssynchrony indexes, comparing paced pts (from DHB, PHB, RVOT and RVA) to non-paced control pts.
Pts paced in RVOTs had less LV dyssynchrony compared to RVOTf: QRS (ms) 140±12 vs 160±13, $p < 0.05$; ILV (ms) 30±14 vs 37±15, $p < 0.05$; Yu Index 12±6 vs 16±8, p = ns; EML (ms) 200±28 vs 237±32, $p < 0.05$.

Conclusions: Acute pacing from DHB reproduced the normal activation of LV. Pacing from PHB did not significantly increase the ILV delay; however, it produced a significant increase in EML. Pacing from RVOT and RVA produced a significant increase in LV dyssynchrony (to a slight-moderate degree). The subgroup paced from RVOTs had less LV dyssynchrony compared to pts paced from RVOTf site.

	Control (C)	DHB	PHB	RVOT	RVA
QRS (ms)	112±15	111±14 (p = ns)	138±11 (p < 0.05)	152±18 (p < 0.05)	162±18 (p < 0.05)
ILV (ms)	22±8	24±9 (p = ns)	30±7 (p = ns)	34±15 (p < 0.05)	38±15 (p < 0.05)
Yu Index	9±4	10±5 (p = ns)	12±4 (p = ns)	15±7 (p < 0.05)	16±7 (p < 0.05)
EML (ms)	167±28	178±23 (p = ns)	219±18 (p < 0.05)	221±38 (p < 0.05)	236±31 (p < 0.05)

855

Quality of life after 6-month follow-up in patients with implanted pacemakers, according to the classes of recommendation

R. Mlynarski[1], E. Pilat[1], R. Gardas[1], W. Kargul[1]
[1]*Medical University of Silesia, Electrocardiology Department, Katowice, Poland*

Rapid progress in the clinical pacing has been observed in the last few years, but research on the Health Related Quality of Life (HRQL) was sometimes ignored in patients after pacemaker implantation even if it is still one of the more important aim of pacemaker implantation. There are no research comparing HRQL between classes of recommendations for pacemaker implantation.

Purpose: to compare changes in HRQL in 3 classes of recommendation (I, IIa, IIb) at 6-months follow-up in patients after pacemaker implantation.

Methods: 180 patients with AV blocks (AVB) or Sinus Node Dysfunction (SND) (84:96) and optimal pharmacological treatment of existing heart disease were included in study (bioethical agreement no NN-6501–23/05). In both groups patients were divided into to 3 subgroups according to the class of recommendations (2002 ACC/AHA/NASPE guidelines were used due to lack of European guidelines at the time of analyses). Excluded were patients with chronotropic incompetence and/or other serious illness which could interfere with the results of HRQL. Excluded also were patients with a coexistence of AVB and SND. In each DDD(R) type pacemakers were implanted with bipolar screw-in leads. None of the special functions for the pacemaker model was activated. Full programming including AV delay was optimize 4 days after implantation. HRQL was evaluated twice: 3–5 days before implantation and 6 months later. 2 questionnaires: SF-36 and Minnesota were used.

Results: Summary results are presented as the difference between the results before and after 6 month follow-up. Preliminary analyses showed the superiority of the Minnesota questionnaire due to its higher sensitivity. Statistical improvement ($p < 0.05$) was found in the group: IIA for patients with SND (however positive tendency $p = 0.09$ for class I was observed) and in class I in patients with DAV. For class IIb patients with either SND or AVB only a positive trend were observed ($p < 0.24$ and $p < 0.09$). What is very interesting, highly symptomatic patients have no significantly higher improvement in the HRQL results compared to low-symptoms group, only a positive trend was observed ($p = 0.08$). The highest improvement of HRQL was found in women age 65–75 with group SND or AVB (women: $p = 0.008$ but overall in this age group: $p = 0.018$; men: $p = 0.034$).

Conclusions: Improvements of HRQL in class I, IIa and IIb is similar, which can suggest that proper qualification for pacemaker implantation is more important then analyses of classes of recommendation. The Minnesota questionnaire seems to be better for the analyzed group of patients than SF-36.

856

Incidence of atrioventricular block episodes on a long-term follow-up of dual-chamber pacemaker patients

S. Rossi[1], M. Bisioli[1], U. Wiegand[1], D. Gras[1], R. Thomas[1], S. Schade[1], P. Ducloux[1], J.M. Davy[1]
[1]*Osp. Civile, Saronno (Va), Italy;* [2]*Univ. Lubeck, Lubeck, Germany;* [3]*Nouvelles Cliniques Nantaises, Nantes, France;* [4]*William Arvey Hospital, Ashford, United Kingdom;* [5]*Praxis fur Innere Medizin, Berlin, Germany;* [6]*SORIN Group, Le Plessis Robinson, France;* [7]*Centre Hospitalier Universitaire, Montpellier, France*

"SafeR" is a pacing mode designed to reduce the unnecessary amount of ventricular pacing (Vp), basically operating in AAI mode and switching to DDD when unexpected atrioventricular (AV) conduction disorders occur. It is indicated in sinus node dysfunction (SND) as well as in paroxysmal AV block (p-AVB) pts. We report an analysis of the SAVE-R study, aimed to analyze the incidence of AVBs on a long-term follow-up (f-up) in the study population.

Methods: Pts were implanted with a Symphony DR 2550 or 2450 pacemaker (SORIN Group, France). All devices were programmed in SafeR pacing mode. Data were collected from pacemaker at 1-month (1M) f-up, 3M f-up and 1-year f-up. We considered 396 pts in this analysis (51% males, 73±11 y old). Pacing indications (% of pts): SND 42%, p-AVB 38%, brady-tachy syndrome (BTS) 20%. 340 diagnostic files were available at 1M f-up, 145 at 3M f-up and102 at 1-year f-up.

Results: Table 1 reports the available results at 1M, 3M, 1-year f-ups in terms of AVBs incidence (= number of "AAI to DDD switches") and distribution by type (classification of AVBs according to criteria used by Symphony pacemakers).

Episodes of AVB by pacing indication at 1M f-up: 23% of p-AVB pts had no switches at all, whereas 44% of SBT pts and 37% of SND pts had experience of switches. The numbers of switches on AVB (mean±std dev, median, min-max) at 1M f-up according to pacing indication at time of implant are: SND 169±1065, 2, 0–12359; BTS 105±343, 1, 0–2194; p-AVB 311±576, 26, 0–2689.

Conclusions: When SafeR is programmed, in the selected population, we observed that the incidence of AVB episodes is higher on a long-term f-up basis than 1M after implant. The major criterion of switches is always the II degree AVB (V pauses represent only a safety criterion). At 1M f-up, p-AVB pts had a relevant impact on the mean of "AAI to DDD switches". Anyway SafeR mode prevents unnecessary Vp in 23% of p-AVB pts and assures a back-up Vp in case of unexpected AVB episodes in 44% of SBT and 37% of SND pts.

Table 1

Switches on AVB episodes	% of pts with AVBs	III d AVB (%)	II d AVB (%)	I d AVB (%)	V pause (%)
1M f-up	66 (226/340)	15	62	21	2
3M f-up	83 (120/145)	18	62	17	2
1-year f-up	83 (85/102)	29	51	16	5

857

Reducing right ventricular pacing in patients with sick sinus syndrome and paroxysmal AV block: Long-term follow-up of the AAISafeR pacing mode

S. Schmieder[1], M. Leibig[1], H. Gross[1], H-Y Sohn[1], F. Kroetz[1], V. Klauss[1]
[1]*Medizinische Klinik & Poliklinik der LMU, Kardiologie, Munich, Germany*

Purpose: Different pacemaker algorithms for reduction of unnecessary right ventricular (RV) stimulation in patients with sinus node disease (SND) have been developed recently. Long-term results, particularly with regard to patients with coexisting paroxysmal AV block (AVB), are not available.

Methods: Data acquisition was performed in 104 patients (71±14 years, 42 women) during routine pacemaker follow-up. Diagnostic parameters concerning right atrial and ventricular pacing amount, AV conduction and

atrial fibrillation (AF) burden were analyzed. Indication for pacemaker implantation was SND in 66% and paroxysmal AV block or bi-nodal disease (AVB/BND) in 34% of patients, respectively. Mean follow-up was 12±10 months. All patients had a DDD pacemaker implanted (Symphony DR 2550, Sorin Group, France).
Results: The table shows mean pacing amount (numbers show %) during follow-up; In patients with AVB, temporary AAI to DDD mode switch occurred significantly more frequent (n = 5.3/day vs. n = 1.8/day, p = 0.038) compared to patients with SND. In 40 patients (68%) with SND, AAI to DDD mode switch due to higher degree AVB (2nd and 3rd degree) was observed. The number and duration of mode switch episodes due to atrial fibrillation tended to be higher in patients with SND (58 vs. 43 minutes and 0.35 vs. 0.05 episodes/day, respectively, p = n. s.). The amount of RV pacing did not significantly influence the AF burden.
Conclusions: The AAISafeR mode significantly reduced the RV pacing amount in patients with SND and also in patients with paroxysmal AV block during a one year follow-up. In the majority of patients with SND as the initial pacemaker indication, AAI to DDD mode switch occurred due to appearance of 2nd or 3rd degree AV block.

Amount of RV pacing (numbers show %)

Pacing mode	SND	AVB/BND	p
AAISafeR	7.0	11.8	n.s.
DDDamc	53.1	60.8	n.s.
DDD	79.8	93.4	0.008

858
Postextrasystolic stimulation with bi-ventricular pacing

B. Stegemann[1], R. Vatesescu[1], C. Foldesi[1], Z. Torok[1], L. Rudas[1], T. Szili-Torok[1]
[1]Bakken Research Center, CORB Research, Maastricht, Netherlands; [2]GOKI, Cardiology, Budapest, Hungary; [3]Bakken Research Center, FCRS, Budapest, Hungary; [4]University Szeged, Intensive Care, Szeged, Hungary

Background: Cardiac resynchronization therapy is an accepted electrical therapy for systolic heart failure. Post-extrasystolic potentiation has been suggested as another potential electrical therapy to improve ventricular systolic function. Post-extrasystolic potentiation (PESP) is a well established property of cardiac muscle whereby premature stimulation of the ventricle increases the contractility of successive cardiac beats. PESP pacing has been applied using the intrinsic or single site ventricular activation in the past. As the need for ventricular pacing in heart failure population is more frequent, we studied PESP with bi-ventricular stimulation in this study.
Methods: Fifteen patients with systolic symptomatic heart failure were studied acutely. Left ventricular and arterial pressures were recorded and analyzed offline. Pacing leads were transvenously placed in the high right atrium, right ventricular septum and the left lateral wall. Bi-ventricular pacing was delivered without (BV) and with right ventricular paced extrasystoles (BVPP). Extrasystoles were delivered within 10 ms after the end of the left ventricular refractory period. Atrial pacing was delivered to avoid the strong rate drop associated with BVPP.
Results: Changing from BV to BVPP we observed the following: heart rate decreased 19% (81.8±14.9 to 66.5±10.2 bpm ($P < 0.001$)), left ventricular maximal dp/dt increased 21% (1059.7±459 to 1282±611 mmHg/s ($P < 0.001$)) and arterial end diastolic decreased by 3.3 mmHg (56.1±10.2 mmHg to 52.8±10.2 mmHg ($P < 0.001$)). Diastolic arterial pressure varied between patients, but was positive was positive for heart rate drops of about 25%, while negative hat the upper and lower heart rate limits.
Conclusion: Adding BVPP to bi-ventricular pacing was feasible. Left ventricular contractility increased and the mechanical heart rate dropped as expected. The observed increase in contractility could however not compensate for the drop in heart rate causing a decrease in arterial end diastolic pressure. BVPP may have positive hemodynamic effects in a small heart range.

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Acute and long term comparison of the select secure system electrical performance in direct his bundle pacing vs para-hisian/inflow tract pacing: data from the south European select secure registry

D. Catanzariti[1], F. Cantu'[1], E. Occhetta[1], M. Santini[1], S. Sangiorgio[1], T. Marotta[1], C. Salgarello[1], F. Zanon[1]
[1]General Hospital, Rovereto, Italy; [2]General Hospital, Bergamo, Italy; [3]Maggiore della Carita' Hospital, Novara, Italy; [4]San Filippo Neri Hospital, Roma, Italy; [5]General Hospital, Sesto San Giovanni, Italy; [6]Medtronic, Sesto San Giovanni, Italy; [7]General Hospital, Rovigo, Italy

Background: recently many studies suggested, in patients with preserved his-purkinje system, the hisian region (para-his/inflow tract) as an alternative pacing site compared to right ventricular (RV) apex, because it preserves the ventricles synchronous contraction.
Purpose: to evaluate long-term term leads electrical performance in direct his bundle pacing (DHBP) versus pacing in the hisian region (HRP) using a system (Medtronic Select Secure®) composed by a steerable catheter and 4.1 Fr screw-in lead and specifically designed for selective site pacing.
Material and Methods: 171 patients (112M, age 73±10 years), with normal QRS duration (104±23 ms) and no left ventricular dysfunction (LVEF 51.3±11.6%), have been enrolled in 20 Italian centers. DHBP is considered achieved when the paced QRS has the same morphology and duration as the intrinsic QRS in all 12 ECG leads recordings and the Vp-V interval is equal to H-V interval. HRP is considered when the pacing lead is positioned in the His region but DHBP is not reached (i.e. para-His pacing or inflow tract pacing).
Results: in 70 patients DHBP has been achieved, while the remaining 101 patients received HRP. Twenty-five DHBP patients and thirty-one HRP patients have reached 1 year follow up. The DHBP patients have shown an acute and a 1 year follow up threshold respectively of 2.1±1.5 V at 0.5 ms and 2.6±3.0 V at 0.5 ms (p = NS). Sensing was respectively of 4.9±4.6 mV and 5.7±5.6 mV (p = NS). The HRP patients have shown an acute and a 1 year follow up threshold respectively of 1.4±1.1 V at 0.5 ms and 2.2±2.4 V at 0.5 ms ($p < 0.05$). Sensing was respectively of 6.3±5.2 mV and 4.8±3.4 mV (p = NS).
Conclusions: patients with DHBP show a higher but stable threshold respect to patients with HRP while sensing shows comparable values between the two groups evaluated. Further data are needed to evaluated the clinical impact and differences in pacing in His region.

WEDNESDAY, 27 JUNE 2007, 10:30–12:00 **Evora**

Catheter ablation of ventricular arrhythmias

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Long-term efficacy of aneurismectomy with encircling cryoablation to treat life-threatening post-ischemic arrhythmic storm after myocardial infarction

J.-L. Pasquie[1], R. Demaria[1], J.M. Davy[1], B. Albat[1], F. Leclercq[1], J.M. Frapier[1]
[1]C.H.U. De Villeneuve, Service De Cardiologie A, Montpellier Cedex 05, France; [2]CHU, Montpellier, France

Background: A late surgical approach has been proved to be effective in patients with left ventricular (LV) aneurism and stable ventricular tachycardia (VT). However, arrhythmic storm due to refractory ventricular fibrillation (VF) is a rare but potentially lethal complication of acute myocardial infarction (AMI). Recent studies suggest a role for catheter ablation of ventricular ectopies initiating VF in these patients. A rapid surgical approach has never been reported in this particular subgroup of patients. The aim of our study was to assess the efficacy of early

post-infarct aneurismectomy with encircling cryoablation in patients with ischemic VF storm refractory to medical treatment.
Methods and Results: From 1985 to 1999, 60 patients underwent post-infarct aneurismectomy with encircling cryoablation at our institution. Most of them had stable VT with LV aneurism late after MI. In 5 of these patients (4M, 63±12 yo) the surgical indication was ischemic VF storm refractory to maximal medical treatment early after AMI. MI was anterior in all pts. None had had efficient revascularization (failed thrombolysis in all with no access to rescue PTCA). Evolution was associated with the early development of LV aneurism with symptoms of congestive heart failure in all pts. All pts had occlusion of the LAD and only one had bitroncular lesions. Mean LV ejection fraction was 30±7%. Arrhythmic storm occurred 17.1±6.6 days after AMI and consisted in recurrent VF in all 5 patients. VF was initiated by short coupling ventricular ectopies in all of them. Large encircling cryoablation without mapping along with aneurysmectomy appeared as the only therapeutic alternative to save patients life. Surgery was performed 30.3±9.8 days after AMI. Postoperative EP study (RV apex and RVOT, 600 to 400 ms basic cycle length and up to 3 ES down to 200 ms) was negative in all pts. None of these patients was implanted with an ICD. Post-operative LV ejection fraction was significantly improved in all pts. On a follow-up of 7.8±5.1 year, the 5 patients are alive and no pt had recurrence of ventricular arrhythmia.
Conclusion: Post-infarct aneurismectomy with encircling cryoablation appears to be an efficient therapeutic alternative on the long-term in this subgroup of patients with ischemic VF storm early after myocardial infarction.

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Regional scar encircling ablation to treat post-infarction ventricular tachycardia

T. Deneke[1], P.H. Grewe[1], T. Lawo[1], B. Calcum[1], A. Muegge[1], B. Lemke[1]
[1]University Heart Center Bochum, BG Klinik Bergmannsheil, Med. Klinik Ii, Bochum, Germany

Ventricular tachycardia (VT) in the setting of ischemic cardiomyopathy is often electrically and hemodynamically instable impeding excessive electrophysiological mapping during the arrhythmia (unmappable VT). As documented in animal studies electroanatomic voltage mapping during sinusrhythm (SR) can characterize local myocardial damage. By differentiating scar-areas (low bipolar voltage amplitude <0.5 mV) from normal myocardium (voltages >1.5 mV) regions critical for VT ablation may be identified.
Methods: In patients with frequent episodes of non-tolerated VT (25.9±22.1 VT-episodes within 3 months) left ventricular substrate mapping (CARTO^{TM}, Cordis Webster) in SR was performed after documenting 12-lead ECG morphology of the clinical VT (cycle length 362±101 ms). Local bipolar voltages <0.5 mV were tagged as scar whereas voltages >1.5 mV identified normal myocardium. Exit regions of re-entrant VT were identified to be within the scar border zone (damaged myocardium with bipolar voltages in between 0.5 to 1.5 mV). The clinical VT exit site was approximated by pace-mapping within these areas of intermediate myocardial damage. Along the scar border zone (limited to damaged myocardium) linear ablation (regional scar-encircling) within the exit region was performed.
Results: Applying this approach 68 patients with unmappable VT were included (ejection fraction 33±12%). A mean of 2.7±1.5 different VTs were inducible. Regional scar encircling (0.8±0.3 encircling lines/targeted VT; ablation duration 882±448 seconds) produced non-inducibility of the clinical VT in 96% of patients. Targeting all inducible VTs lead to complete success (no VT inducible at the end of the procedure) in 63% (N = 43). During a mean follow-up of 12±11 months 83% of all patients remained free from any ventricular arrhythmia. 18% (N = 12) had documented episodes of new-onset VT on ICD-holter interrogation but the number of arrhythmia episodes was significantly reduced.
Conclusions: Left ventricular bipolar voltages acquired during SR in patients with remote myocardial infarction characterise local myocardial damage and help to identify scar border zones. These areas of damaged myocardium include the exit regions of re-entrant VT and may serve as target for catheter ablation. Regional linear scar encircling ablation based on sinusrhythm substrate mapping effectively eliminates clinical non-tolerated VTs with excellent long-term success.

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Catheter ablation of ventricular tachycardia after repair of congenital heart disease – electroanatomical identification of the critical right ventricular isthmus

K. Zeppenfeld[1], M.J. Schalij[1], U.B. Tedrow[1], B.A. Koplan[1], K. Soejima[1], W.G. Stevenson[1]
[1]Leiden University Medical Center, Leiden, Netherlands; [2]Leiden University Medical Center, Cardiology, Leiden, Netherlands; [3]Brigham and Women's Hospital, Boston, United States of America

Background: Catheter ablation of ventricular tachycardia (VT) late after repair of congenital heart disease (CHD) can be difficult due to non-mappable VTs and complex anatomy. This study aimed to locate anatomical isthmuses by delineating areas of unexcitable tissue using 3D substrate mapping techniques and to determine the relation between anatomic isthmuses and critical reentry circuit isthmuses.
Methods and Results: Three-dimensional sinus rhythm (SR) voltage mapping of the right ventricle (RV) (224±77 sites/patient) was performed in 10 patients (age 43.2±11.4 yrs) with sustained VT 32.5±8.7 years after repair of CHD (8/10 Tetralogy of Fallot). Areas of block or unexcitable scar from patch material, valve annulus or dense fibrosis, identified from bipolar voltage (10 mA), created four anatomic isthmus regions: (1) between the tricuspid annulus and scar in the RV outflow tract free wall, (2) between the pulmonary annulus and RV free wall scar, (3) between the pulmonary annulus/adjacent scar and the septal patch/scar, (4) between the septal patch/scar and the tricuspid annulus. Of 12 VTs induced (mean CL 286±84 ms; 66% poorly tolerated) all had reentry circuit isthmuses identified by activation, entrainment, and/or pace-mapping located in an anatomical isthmus. In 9/12 VTs the reentry circuit isthmus was in anatomic isthmus 1, between the RV outflow tract and tricuspid annulus. Transecting the anatomical isthmuses by radiofrequency lesions during SR abolished all VTs. During 28±29.5 months of follow-up 90% of patients remained free of VT.
Conclusions: Reentry circuit isthmuses in VT late after repair of congenital heart disease are located within anatomically defined isthmuses bordered by unexcitable tissue. The boundaries can be identified using 3D substrate mapping and connected by ablation lines during SR. These findings should facilitate catheter and surgical ablation of stable and unstable VTs.

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Fixed electrogram-to-QRS complex interval following entrainment from the right ventricle: a new criterion for postinfarction ventricular tachycardia ablation

M. Gonzalez Vasserot[1], J.L. Merino[1], R. Peinado[1], H. Roa[1], E. Macia[1], O. Quintero[1], J.L. Lopez-Sendon[1]
[1]Hospital Son Dureta, Unidad De Arritmias, Palma De Mallorca, Spain; [2]Hospital La Paz, Unidad de Arritmias, Madrid, Spain

Entrainment by pacing from the target site for radiofrequency application is a validated technique for mapping and ablation of postinfarction ventricular tachycardia (VT). However, the measurement of the post-pacing interval following VT entrainment is often complex due to the pacing artifact and subjective in the presence of fragmented electrograms. Middiastolic electrograms showing a constant activation time with the QRS complex despite VT cycle length oscillations are makers of the tachycardia slow conduction isthmus.
The aim of this study was to evaluate the criterion of a fixed middiastolic electrogram-to-QRS complex interval (Eg-QRS) during tachycardia and at the first postentrainment cycle by pacing from the right ventricle for postinfaction VT ablation.
Methods: 36 consecutive VT ablation procedures in 33 patients with prior myocardial infarction were prospectively included in the study. Radiofrequency application was decided according to conventional criteria

(middiastolic potentials, entrainment with concealed fusion, and postpacing interval). Prior to radiofrequency application, VT was entrained by pacing from the right ventricle and the difference between the Eg-QRS measured in the first postpacing cycle and that one measured in the second postpacing cycle (Eg-QRS-Dif) was calculated but not used to guide the ablation procedure.
Results: All successful ablation sites (n = 29) but 2 showed an Eg-QRS-Dif <15 ms and 18 failure ablation sites showed an Eg-QRS-Dif >15 ms (P = 0.008). This criterion showed 93% sensitivity and 40% specificity to predict VT termination by radiofrequency application.
Conclusions: An Eg-QRS-Dif <15 ms is a sensitive but not specific criteria for successful radiofrequency application and ablation of postinfarction VT. This criterion may be particularly useful for dead-end VT circuit bystander pathways.

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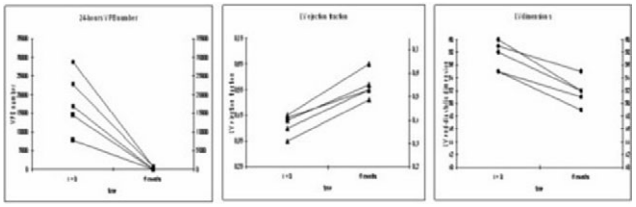
Reversal of idiopathic dilated cardiomyopathy by eliminating isolated frequent monomorphic ventricular premature beats

J. Taieb[1], P. Maury[1], C. Barnay[1], A. Duparc[1], M. Delay[1], M. Galinier[1]
[1]*cardiology, Aix En Provence, France;* [2]*cardiology, Toulouse, France*

Background: RF ablation of frequent ventricular premature contractions (VPC) has recently been shown to improve or normalize left ventricular systolic function and dimensions in a few patients but mainly in case of VPC from the right outflow tract.
Methods: RF ablation was successfully performed in 4 successive pts with frequent isolated monomorphic VPC of various locations associated with idiopathic dilated cardiomyopathy (IDC), whereas drug therapy with flecainide was administrated in another pt. Clinical status, Holter recordings, left ventricular ejection fraction (LVEF) and end-diastolic dimensions (LVEDD) were performed at baseline and at 6 months follow-up.
Results: VPC were located in the right outflow tract in 2 cases, in apico-lateral left ventricle in one, on the left septum in one and in the left Valsalva sinus in one. NYHA class was 1 in 4 pts and 2 in one. VPC had left bundle branch block pattern in 3 pts. RF ablation/drug therapy was efficient in each case. Mean VPC daily number decreased from to 18214±8055 to 268±366 (p = 0.006) while LVEF increased from 0.4±0.0 3 to 0.56±0.0 5 (p = 0.0003) and LVEDD decreased from 57±2 to 51±2 mm (p = 0.0017). Clinical status normalized with regression of palpitations and normalisation of NYHA class in all.
Conclusion: Elimination of frequent isolated monomorphic VPC in selected patients with IDC through RF ablation or efficient antiarrhythmic drug can lead to normalization of clinical status and of left ventricular systolic function and dimensions, whatever the morphology or location of VPC.



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Characterization of idiopathic left ventricular tachycardia originating from the aortomitral continuity

K. Kumagai[1], K. Fukuda[1], Y. Wakayama[1], Y. Sugai[1], Y. Hirose[1], N. Yamaguti[1], H. Shimokawa[1]
[1]*Tohoku University Graduate School of Medicine, Sendai, Japan*

Background: Ventricular tachycardia (VT) of left ventricular outflow tract (LVOT) origin has some adjacent origins, including aorto-mitral continuity (AMC), anterior site around mitral annulus (MA) and aortic sinus cusps (ASC). However, it remains to be established how to identify repetitive monomorphic ventricular tachycardia originating from those sites. In this study, we thus aimed to characterize those VTs electrophysiologically.
Methods: We examined 44 consecutive patients (mean age 57±17) of suspected LVOT-VT. Based on the site of successful ablation, we identified 3 patients with AMC-VT, 8 with anterior MA-VT, 1 with superior basal septum (His bundle areas), and the remaining 32 with ASC-VT. In those patients with those VTs, we compared the QRS morphology, intrinsicoid deflection time (IDT) and amplitude of each limb leads.
Results: The patients with AMC-VT showed monophasic R waves in almost all the precordial leads, while those with anterior MA-VT showed Rs pattern in some precordial leads except lead V6, and those with ASC-VT showed a various transitional zone in lead V1–4. The transitional zone was located in lead V1 in AMC-VT and lead V1–2 in anterior MA-VT. There was no S wave in lead V6 in any group. IDT in the patients with AMC-VT and anterior MA-VT were also significantly greater than that in those with ASC-VT (100±20 ms, 93±9 ms vs. 74±16 ms, P < 0.05). There was no significant difference in the R wave amplitude in inferior leads among the 3 groups. Successful radiofrequency catheter ablation (RFCA) was achieved at a perfect or near-perfect match site in all the 12 patients. The earliest ventricular electrogram at the successful ablation site preceded the onset of the QRS by 37±15 ms. A low-amplitude presystolic potential (prepotential) was frequently found during VT or VPCs at the successful ablation sites (37/44, 84%).
Conclusions: All LVOT-VTs were successfully treated with RFCA using pace mapping and the earliest ventricular electrogram with prepotential. Despite many morphological similarities with LVOT-VT, those electrophysiological characteristics may enable us to differentiate those VTs (AMC-VT, anterior MA-VT and ASC-VT) from LVOT-VT and to safely perform RFCA for those arrhythmias.