



Cardiac Pacing

NEW TRENDS IN CARDIAC PACING

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Introduction: New trends in implantation of pacemakers take their way to algorithms which minimize ventricle stimulation, but also sensors for optimization of AV and VV delay are being improved.

Procedure: In our workplace, we could familiarize with these new technologies which we would like to present here.

There is a sonar in the atrium electrode which consists of a micro accelerometer and electrical circuits. Micro accelerometer analyzes the heart activity and scans heart contractility. Then, signals are transferred to the pacemaker where the information is processed and the AV and VV delays are re-adjusted up to date for optimal resynchronization therapy.

Next, we will mention an algorithm which minimizes ventricle stimulation, AV delay is extended and therefore atrium stimulation is favoured.

Another algorithm this paper deals with enables measuring trans-valvular impedance (TVI). TVI is a haemodynamical regulator of heart electro-stimulation and sensitively reacts to the change of ventricle volume induced by mechanical activity of the heart. TVI can be used to change many parameters of the pacemaker, most of all haemodynamical monitoring, validation of stimulation threshold, validation of sensing threshold, and dynamic regulation of AV delay. The latest innovation is a pacemaker and electrodes suitable for MR imaging. The pacemaker is equipped with an algorithm which has to be switched on prior to the MR scan. This pacemaker has to be equipped with special electrodes. These electrodes are invested with a special spiral which leads away the induced voltage, generated during the MR scan. The spiral then ensures that the tip of the electrode will not heat up causing necrosis of surrounding tissue and increase of stimulation thresholds.

Conclusion: New algorithms which minimize ventricle stimulation allow preferring physiological stimulation. These technologies give us more information on contractility of ventricles which increases efficiency of resynchronization therapy.

DOES THE AUTOMATIC PRE-VENTRICULAR ATRIAL BLANKING (PRE-VAB) FUNCTION ALWAYS PREVENT THE OVERSENSING OF THE R-WAVE SIGNAL ON THE ATRIAL CHANNEL WHEN THE ATRIAL LEAD IS POSITIONED ON THE LOW SEPTUM?

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Background: The atrial lead placement on the low septum emphasizes the R-wave signal oversensing on the atrial channel. This could result in inappropriate automatic mode switching (AMS). Two cases can be described:

- VA cross talk: The end of the R wave is sensed on the atrial channel.
- RP far field: the ventricular event is sensed prior on the atrial channel and then on the ventricular channel.

To prevent R wave oversensing due to RP far field, a special function, PreVAB, was implemented on St Jude Medical pacemaker. If

a P wave is sensed less than 16ms prior a ventricular event, it is considered as an R wave.

Method: 73 patients eligible for permanent pacing were implanted with a St Jude Medical IDENTITY ADx DDD(R). The atrial lead was positioned on the septal wall to improve the atrial overdrive benefit on the AF burden reduction. The stored IEGM recording was set on AMS beginning trigger. IEGM were retrieved at 1, 6, 12 and 18 months FU. All of them were scrutinized to search RP far field and VA cross talk.

Results: 3 patients out of 73 were found with a RP far field. In 95.8% of cases, the automatic pre-Ventricular Atrial Blanking (16 ms) was sufficient to prevent RP Farfield occurrence. But, in 4% of patients the Pre-VAB should have been set at a higher value.

Conclusion: In most cases, the 16 ms value was sufficient to avoid inappropriate AMS, due to RP Farfield. However, this phenomenon is likely to be observed more frequently on pacemakers when the priority is currently given to the intrinsic ventricular rhythm sensing. Knowing that the consequences can be a false atrial arrhythmia diagnosis, it could be interesting to enable the programming of the PreVAB function from 16 ms to 20 ms to hide "atrial" R wave oversensing.

TRANS-VALVULAR IMPEDANCE SENSING ALLOWS EJECTION SURVEILLANCE AT EVERY BEAT

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Trans-valvular impedance (TVI) is derived between right atrium and ventricle with standard pacing electrodes. TVI recording in the time domain results in a periodic waveform correlated with the cardiac cycle, as the signal typically increases during ventricular systole and decreases in diastole. Such fluctuation can range from about 10 to 100 Ohm in different implants, depending on the chosen ventricular electrode (either the tip or the ring), the ventricular lead position, and the mechanical performance of the myocardium. In spite of individual variability, TVI excursion from diastole to systole is always detected only if ejection occurs. This principle can be applied in the hemodynamic surveillance of pacing and sensing reliability at every cardiac beat. In the absence of TVI rise in the proper time-window after ventricular pacing, capture failure is assumed and the pacemaker (PM) increases the pacing energy to restore effective stimulation. Similarly, any ventricular sensing event not followed by the expected TVI increase might represent a false-inhibition from electromagnetic interference, rather than a true cardiac signal inducing hemodynamic activation. In this instance, the PM operating mode can temporarily be switched over from ventricular-inhibited to triggered pacing. We checked the performance of TVI-driven ventricular capture surveillance in 30 patients implanted with Sophos 145 or 155 (Medico, Padova, Italy). A suitable TVI signal (at least 8 Ohm peak-peak excursion with appropriate timing is required to start the function) was present in 74% of the cases, where the sensor always proved effective in prompt recognition of capture loss during threshold analysis (100% sensitivity and specificity). The prevalence of missing-ejection alarms in dynamic conditions (walking for 10 min) was limited to 0.6±1.6 out of 1000 paced cycles. These results support the use of TVI as a tool for ejection checking, which could substantially improve the safety of electrical therapy in PM-dependent patients.

TRANS-VALVULAR IMPEDANCE ANALYSIS IN THE FOLLOW-UP OF CARDIAC PACING

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Trans-valvular impedance (TVI) recording is proposed as a tool to gain insight into the heart mechanical activity in pacemaker patients. The signal is derived with standard pacing electrodes and is modulated by ventricular preload, contractility, and contraction pattern. We have analyzed the TVI waveform in 7 patients, implanted with Sophos 145 or 151 pacemakers (Medico, Padova, Italy), undergoing careful echocardiographic evaluation. The follow-up time ranged from 2 to 18 months (mean±sd=10±6). LVEF and TAPSE showed small interpatient variability, ranging between 49 and 63% (54±5) and from 21 to 28 mm (26±3), respectively. The peak-peak amplitude of TVI fluctuation had a wider distribution, ranging from 14 to 64 Ohm when the signal was derived with the ring ventricular electrode (4 cases), and from 21 to 36 Ohm with the tip (3 cases). The different TVI amplitude was not explained by any obvious difference in RV apical motility, suggesting that the signal features in each patient largely depend on technical rather than clinical factors. However, it is noteworthy that the TVI waveform remained stable along the time, in the absence of relevant changes in patient's hemodynamics. One case only showed initial hemodynamic deterioration based on two echocardiographic checks separated by 8 months, during which the prevalence of ventricular pacing was 97%. LVEF decreased from 60 to 52%, LVEDV and LAEDD increased from 102 to 154 ml and from 42 to 46 mm, respectively, and the delay of aortic versus pulmonary flow onset increased from 20 to 40 ms. At the same time, the TVI waveform recorded after ventricular pacing was altered, showing a fast rate-of-rise and multiple peaks in the QT interval never detected previously. Our preliminary experience suggests that specific TVI waveform changes could be associated with hemodynamic worsening and provide first warning in the follow-up of pacemaker patients.

VARIATION OF COMPENSATORY HEMODYNAMIC PARAMETERS IN COMPLETE ATRIOVENTRICULAR BLOCK BEFORE AND AFTER PACEMAKER IMPLANTATION PERIOD

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Background: While complete atrioventricular (AV) block causes hemodynamic instability, the variation of hemodynamic and hormonal parameters play an essential role in stabilization of cardiovascular system. The aim of the study is to evaluate the variations of hemodynamic parameters in cardiovascular adaptation mechanism and the role of brain natriuretic peptide (BNP) before and after permanent pacemaker implantation.

Methods: We evaluated 25 patients (14 M, mean age 71±10 years) with complete AV block complaining of syncope, stable at rest without implantation of temporary pacemaker and planned to implant permanent pacemaker, with a mean heart rate of 36±4 beat/min. Before and two weeks after permanent pacemaker implantation mean arterial pressure (MAP), stroke volume (SV), cardiac output (CO), systemic vascular resistance (SVR), systemic aortic compliance (SAC) variations were analyzed with echocardiography and BNP levels were measured as hormonal parameter.

Results: In relation with a significant decrease in CO before pacemaker implantation there was compensatory increase in SVR (3237±957ml/min vs 4676±880ml/min p<0.003, 2540±970 dynes.

s-1*cm-5 vs 1800±450 dynes.s-1*cm-5 p<0.001). There were no significant differences in SV, SAC, and BNP levels before and after pacemaker implantation period p>0.05.

Conclusion: There were no differences in SV, SAC and BNP before and after pacemaker implantation. However, before pacemaker implantation decreased CO seems to be balanced by an increase in the SVR, which consequently maintain stable mean arterial pressure as a result of cardiovascular system adaptation.

INTEREST OF A NEW «MODE SWITCH» FUNCTION IN FOLLOW-UP OF ARRHYTHMIAS WITH DUAL-CHAMBER PACEMAKERS

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Dual chamber(DC) pacing beneficiaries are impaired by the occurrence of arrhythmias. Recently, DC have been enhanced by a "mode switch" function(MSF) which allows the switch from DDD(R) to DDIR pacing in the presence of atrial arrhythmias(AA) and associated diagnosis functions.

Methods: We analyzed the MSF at 6 and 12-month follow-up in 393 patients free of permanent AA (59%male, 41%female), implanted with DCKappa700® (Medtronic) for II and III AVB (65%), and SD (35%). There was no difference in electrical parameters at implant regardless of the lead and/or the indication, especially about intrinsic signals: Pwave 3+/-1.6mv, Rwave 12.4+/-5.6mv. No specific programming was imposed. MSF data was collected at each follow-up. EGM was used to confirm AA in most of them.

Results: The MSF shows an arrhythmic episodes rate of 43% (169 pts) during 6 first months follow up and 38% during last 6 months (151pts). There was no significant difference between patients implanted for AVB and those implanted for SD. 43% of patients (171 pts) had no AA during the 12 months, 25% had AA during the 12 months. 18% (71) had AA only during the first 6 months, 13% (51) only during the last 6 months.

Discussion: MS event counter may predict the existence of AA. The number of MS is significantly high in SD, whereas the observation of a high number of MS may also point to oversensitivity of the MSF. The AA burden is the revealing parameter, as it represents the average time during which the patient had been in AA since the previous follow-up.

Conclusion: This study confirms that the AA occurrence remains an important complication in pacemaker patients, regardless of the implantation indication. Simple examination of MS recordings can lead to suspicion of major arrhythmia. The gravity of this arrhythmia can be quickly determined, but only detailed examination of MS episodes can confirm the diagnosis.

ATRIO-VENTRICULAR DELAY HYSTERESIS: A SOLUTION TO SPONTANEOUS VENTRICULAR CONTRACTION IN DUAL-CHAMBER PACING

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Preservation of spontaneous atrio-ventricular (AV) conduction in dual-chamber rate-responsive pacemaker patients can reduce unnecessary ventricular stimulation and limit the incidence of atrial fibrillation (AF). A specific algorithm called "AV delay Hysteresis" (AVHyst) is used to lengthen the AV delay (110ms) in order to provoke spontaneous ventricular contractions (VS) under certain conditions.

Method: The study concerns a population of 136 randomly selected

patients (63% male, 37% female) implanted with a dual-chamber Medtronic KAPPA®700 pacemaker, average age 74.5+/-9.8. 74% were implanted for syncope, 53% AVB and 41% SD. Follow-up was at 3 and 6 months.

Results: Results show patient attribution into 3 groups:

Gr1: AVHyst was programmed on "off" throughout the study's duration. Gr2: AVHyst was programmed on "dynamic" throughout study's duration. VS<1% as from the 3-month follow-up. Gr3: Programming identical to Gr2, VS>1% as from the 3-month follow-up.

A majority of AVB were observed for Gr1 (83%) and Gr2 (78%). On the contrary, 85% of SD were observed in Gr3. The PR interval is lesser according to the group's degree. No discriminating effect is produced, principally due to a significantly large standard gap.

In Gr3, the average AVHyst % remains stable: 29.7% at 3 months, 31.6% at 6 months. At the same time, AV detected and paced delays did not change, and more than a quarter of the patients (26%) had AVHyst% >50% throughout the study's duration.

Conclusion: Recent studies show the importance of spontaneous ventricular contraction in the development of cardiac pathology, as the prognosis deteriorates starting at 40% of cumulative ventricular pacing. In our study, for the 25% of patients who benefited from this function, the prognosis can be favorable due to the fact that more than 50% of the spontaneous ventricular contraction is taken in charge by the AVHyst algorithm.

INTRINSIC RHYTHM SUPPORT ALGORITHM (IRS-PLUS) ACTUALLY IMPROVES SPONTANEOUS ATRIO-VENTRICULAR CONDUCTION IN DDD PACING. LONG TERM EVALUATION BY HOME MONITORING™ REMOTE CONTROL

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Background: Constant right ventricle apical pacing may induce negative effect on cardiac hemodynamics. Intrinsic Rhythm Support (IRS-plus) is an algorithm available in Cylos DR-T pacemaker specifically designed to favor intrinsic AV conduction by periodically extending AV delay up to 300ms. Home Monitoring (HM) technology allows daily remote control of several pacing parameters including ventricular sensing percentage (Vs%).

Aim the study: To estimate the Vs% increase induced by IRS-plus by means of remotely transmit HM data technology.

Methods: We retrospectively analysed data of 61 patients implanted with pacemaker Cylos DR-T (both first implant or replacement) by reviewing HM files to evaluate Vs% immediately before and after IRS-Plus activation. AV delay programming before IRS-Plus activation was optimised basing on individual settings and not complying with any uniform protocol. We sought to estimate the increase in Vs% ten day IRS-Plus activation with respect to an already optimized AV programming. HM data were also analyzed to observe Vs% long-term trend after IRS-Plus activation.

Results: All the included patients (mean age 73.8±8.8 years, 34 male) had a basal PR interval =260 ms. IRS-plus algorithm was activated 87±134 days after implant. HM data reported that before IRS-Plus activation the Vs% was 68.4±30.6% increasing by 18.1±23.7% after the activation, reaching 88.5±16.4% (p<0.0001). A high Vs% was maintained during long-term follow-up: 88.2±17.0% 1 month, 88.2±15.9% 3 months and 87.8±16.8% 6 months after IRS-plus activation. A small but significant difference was observed between first implant and replacement patients (88.6±4.5% vs 77.5±5.3% respectively, p=0.05). In patients in whom antiarrhythmic therapy was introduced or potentiated, a reduction in Vs% was observed.

Conclusion: The IRS-plus algorithm was able to ensure almost 90% of spontaneous AV conduction in the studied population. HM was useful to continuously monitor spontaneous beat trend in each patient.

THE ROLE OF INTRAOESOPHAGEAL ECG IN RECOGNIZING PACEMAKER DYSFUNCTION AND IN PATIENT-ADAPTED PACEMAKER PROGRAMMING

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In additional to surface and intracavitary ECG, intraoesophageal (IO) ECG and transthoracic echocardiography could be useful in some cases in the diagnosis of pacemaker (PM) dysfunction and in optimal customized programming. The two cases below support this theory. The first case involves a patient with paroxysmal atrial fibrillation (PAF). Their medical history includes dilated cardiomyopathy and congestive heart failure. Due to sick sinus syndrome, a conventional dual chamber pacemaker was implanted. After this intervention, signs of pacemaker syndrome developed. Intraoesophageal ECG showed that the evoked left atrial A-wave and ventricular activation occurred at the same time. After programming the optimal AV delay, the patient was free of symptoms. After implanting the AV sequential pacemaker, paroxysmal atrial fibrillation was not detected. In the second case, the AV sequential pacemaker was implanted with an epicardial left ventricular lead during open-heart surgery. During the recovery period, manifestation of pacemaker syndrome was observed both clinically and on the ECG recording. To monitor the atrial and ventricular electrical activity of the heart, surface and intraoesophageal ECG was recorded simultaneously. The relative timing of the left atrial A-wave and the onset of left ventricular systole were examined using different AV delay settings. The optimal AV-delay was 140 ms, as determined by the distance of the left atrial A-wave and the ventricular spike. The changes of the mitral inflow curve, and the left ventricular outflow velocity with each AV delay settings, were evaluated using echocardiography. The haemodynamically optimal AV delay was 140 ms as well. Our investigations show that intraoesophageal ECG and echocardiography are useful in customized programming of dual chamber pacemakers.

RIGHT ATRIAL AMPLITUDE DETERMINES QUICKOPT PROPOSAL FOR INDIVIDUAL AV DELAY IN BIVENTRICULAR PACING

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Individual programming of the AV delay can effectively increase hemodynamic and reduce non-responder rate in cardiac resynchronisation therapy. Therefore, accurate, automatic, and easily comprehensible algorithms are desirable.

Aims: To test, in vitro and in vivo, the influence of different right atrial amplitudes (RA) on the optimal AV delay proposal (AVD) of the QuickOpt algorithm (St. Jude, USA).

Methods: QuickOpt algorithm of an Epic HF system (St. Jude, USA) was in vitro tested by programmable ARSI-4 four-chamber heart rhythm and IEGM simulator (HKP, Germany) for constant RA amplitudes between 0.3 and 3.5 mV during both, manual atrial sensing between 0.2 and 1.0 mV and automatic atrial sensing between 0.2 and 0.8 mV. Subsequently, we analysed 60 QuickOpt procedures in patients.

Results: In vitro, 1. QuickOpt measuring accuracy was ±8 ms. 2. For simulated RA between 0.3 and 3.5 mV, duration of atrial activity differed between 23 and 86 ms and resulted in AVDs between

90 and 150 ms in VDD operation. In vivo, during sinus rhythm, 3. QuickOpt measurements demonstrated maximal variation of atrial activity duration between 23 and 102 ms (figure). Consecutively repeated procedures resulted into AVDs between 120 and 160 ms. In-vitro and in-vivo, 4. QuickOpt AVDs in DDD and VDD mode differed independent on manual or automatic RA sensing.

Conclusion: The influence of right atrial amplitudes on QuickOpt AV delay proposals must be considered during routine follow-up.

HEMODYNAMICS OPTIMIZATION IN DDD PATIENTS

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Aims: The 1st was assessment of echocardiography (Echo) usefulness for determination of AV 1 block influence on hemodynamics. The 2nd was selection the optimal AV delay in DDD patients.

Materials and methods: 40 patients (M-58%, 64±5 years) with hypertension and coronary artery disease were enrolled in the study. Indications for pacemaker implantation (DDDR) were sick sinus syndrome and transient complete AV block. Sinus rhythm with permanent AV 1 block was dominant. All patients had rigid mitral flow type and diastolic HF (mean EF=54±5%). Modes with AV delay from 80 to 200ms were programmed step-by-step with assessment of mitral inflow type and VTI.

Results: Patients were separated into 2 groups. The 1st group included 22 patients. Intrinsic AV interval was < 250ms. Optimal parameters were registered with baseline AV interval (optimal mitral flow type, VTI 17.9±0.8sm, 6-min. walk test 410±15m). AV delay shortening and RV pacing lead to worsening of hemodynamics (VTI 14.5±0.9sm, 6 min. walk test 361±13sm). The 2nd group included 18 patients. Intrinsic AV interval was > 250ms. Baseline parameters were VTI 14.1±1.1sm, 6 min. walk test 349±10sm. Long AV delay characterized mitral flow type of the 2nd group. Best Echo parameters were registered with RV pacing and optimal AV delay (VTI 17.1±0.5sm, 6 min. walk test 391±11sm).

Conclusions: AV delay selection with Echo is effective method for optimization DDD systems. Determination of mitral inflow type is indicated in all DDD patients for selection of optimal pacing mode. Optimal AV interval increases VTI and 6-minute hall walk test in patients with LV filling delay. Maximal AV delay, ADI mode and MVP are indicated in patients with intrinsic AV interval less than 250ms. DDD mode with optimal AV delay is indicated in patients with intrinsic AV interval more than 250ms. RV pacing should be avoided, if possible.

PACEMAKER LONGEVITY AND AMPLITUDE ADJUSTMENT – JUST A SHORT TERM GAIN?

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It has been established that pulse amplitude has positive effect on pacemaker longevity. Our aim was to assess initial and long-term effects of this procedure.

50 patients with implanted pacemakers were randomly selected for follow up between October 2006 and August 2008. Mean age was 64.48±12.765 years. All pacemakers were working in factory settings for average of 3 years before, with pulse amplitude of 3.5V and pulse width of 0.4ms. Threshold test was performed with average of 0.63±0.22V. New pulse amplitude was set to 2.5V and pulse width was unchanged. Immediate longevity gain was observed by

increasing the mean longevity estimate from 67.71months to 79.98 or gain of 12.27 months (p<0.0003). Battery current also decreased from 14.33µA to 11.63µA (p<0.05). Follow ups on 6 and 12 months were performed and revealed paradoxical increase of battery current to 12.01µA and than decrease to 11.48µA at 12 months. Battery voltage has decreased from 2.78V to 2.77V, while battery impedance has had a period of steadiness for 6 month and than an increase of ~200ohms from 550ohms to 735ohms and to over 1000ohms at 18month (increase of 300ohms). 43 patients have so far underwent follow up at 18 months and the results so far reveal increase of battery current of 0.18µA to 11.66µA. The biggest longevity gain is visible at 6month when the average longevity expenditure is 0.53 months per actual month while at 12 and 18months the expenditure is on average, month per actual month.

Conclusion: The initial longevity gain after pulse amplitude adjustment proves that this simple procedure should be done wherever and whenever possible and allowed by other parameters. However, the increase of battery parameters which influence longevity, such as the battery impedance, and battery current, the decrease of the battery voltage may question the long term longevity gain effect.

IMPLANTATION OF PERMANENT SINGLE CHAMBER PACEMAKER BY ECHOCARDIOGRAPHIC GUIDANCE DURING THE FIRST TRIMESTER OF PREGNANCY

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Experiences and reports of implantation of permanent pacemaker and pacemaker supported cardiac function during pregnancy are still rarity. According to our knowledge this case is the first such reported in Croatia.

We present a case of 28 year old woman in first trimester of pregnancy who was admitted to our Coronary care unit (CCU) due to the syncopal attacks and a result of the tilt-table test which pointed to cardioinhibitory vasovagal syncope. In her 18th year she was diagnosed with mild arterial hypertension, and therapy with low dose bisoprolol was started, until pregnancy. Three months and then ten days prior to admittance to CCU, she had syncopal attacks. Tilt-table test was performed. In horizontal position heart rate varied between 73-79/minute, and blood pressure was 115/80 mmHg. In the 35th minute of orthostatic position she felt dizziness, faintness and soon after had syncope.

Asystolic pause of 14 seconds was recorded, blood pressure dropped and tonic-clonic muscle spasms appeared. Since the patient was 8 week pregnant, it was crucial to admit her to CCU for further diagnostics and treatment. Transthoracic ultrasound shown a healthy heart, and neurological examination and EEG were without pathological signs. Indication for implantation of drop rate responsive permanent pacemaker was clearly established. Because of the early pregnancy the use of RTG implantation guidance was absolutely contraindicated. Ventricular electrode of single chamber pacemaker (VVI) was implanted under the guidance of transthoracic ultrasound. Procedure went without complications, and patient had no rhythm disturbances or syncopal attacks afterwards. After delivery dual chamber pacemaker was implanted by standard procedure.

Occurrence of cardioinhibitory vasovagal syncope presents a great risk for destabilization of cardiovascular adaptation during the course of pregnancy, labor and delivery. The implantation of the permanent single chamber pacemaker (VVI) by echocardiographic guidance was critical in avoiding possible maternal and fetal distress.

ACUTE-PHASE AND 1-YEAR FOLLOW-UP RESULTS OF RIGHT VENTRICULAR OUTFLOW TRACT (RVOT) VERSUS VENTRICULAR APICAL (RVA) PACING WITH AN AUTOCAPTURE (AC)PACEMAKER SYSTEM

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Aims: To determine viability of Autocapture® pacing function at RVOT compared to RVA.

Methods and results: Impedances (IMP), R wave amplitudes, Pacing thresholds (ACT), Evoked response (ER) and Polarizations (POL) were obtained. Measurements were taken at implant and 12 months after implant. Values are expressed as mean \pm standard deviation.

The study enrolled 139 patients (F39-M100) (71.9 \pm 7.7 years) with an pulse generator (St. Jude Medical). The ventricular lead was, in all patients, the Tendril SDX type (St. Jude Medical). All leads were implanted successfully in the RVA (59%) and in the RVOT (41%).

Follow-ups were completed in 99% at discharge and 89% at month 12 after implantation.

There were 10 deaths not pacemaker-dysfunction related (5 RVOT vs 5 RVA). There were 2 leads dislocations (1 RVOT vs 1 RVA). AC function could no be applied in one patient (RVOT).

There was no difference in ACT at implant (RVOT: 0.38 \pm 0.09V vs RVA: 0.42 \pm 0.12V, P=NS). At 12 months, there were significant differences (RVOT: 0.58 \pm 0.12 vs RVA: 0.76 \pm 0.33V, P<0.001).

We obtained significant differences with RE (RVOT: 9.4 \pm 6.0 vs RVA: 14.9 \pm 6.6mV, P<0.001 at implant), (RVOT: 11.5 \pm 6.4 vs RVA: 16.6 \pm 7.3mV, P<0.001 at 12 month)

Were differences in POL at implant (RVOT: 0.48 \pm 0.19 vs RVA: 0.61 \pm 0.32mV, P<0.001), but not at the follow-up (RVOT: 0.50 \pm 0.36 vs RVA: 0.59 \pm 0.45mV, P=NS).

There was difference in IMP at implant (RVOT: 401 \pm 63 vs RVA: 435 \pm 105 Ohm, P<0.05), but not at the follow-up: (RVOT: 347 \pm 35 vs RVA: 348 \pm 70 Ohm, P=NS).

There was no difference (RVOT vs RVA) in terms of R-wave sensing over a 12 months period evaluated.

Conclusions: The Autocapture® function could be activated with excellent safety and success rates in RVOT.

ADVANTAGE OF RIGHT VENTRICULAR OUTFLOW TRACT PACING COMPARE TO THE RIGHT VENTRICULAR APEX PACING IN THE CHRONIC PHASE

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Background: Right ventricular apex (RVA) pacing has been thought to be an advertised effect for the heart function in some studies. Instead, the pacing site of right ventricular outflow tract (RVOT) is known as alternative pacing site. Previous studies have been reported the differences between RVA and RVOT pacing in the early short term. Therefore the aim of this study is to reveal the advantage of RVOT pacing in the chronic phase.

Method: We compared QRS duration, threshold, sense, lead impedance, BNP, left ventricular ejection fraction(EF), left ventricular diastolic/systolic diameter, septal to posterior wall motion delay(SPWMD) and incident rate of atrial fibrillation in RVA group (20pts) and in RVOT group (20pts) for two years who are good cardiac dysfunction (EF>40%).

Result: The QRS intervals was significantly shorter in the RVOT group than RVA group (142 \pm 22 vs 176 \pm 18msec. p<0.001), but the QRS duration has not been changed in the RVA group. The threshold (0.5 \pm 0.1 vs 0.7 \pm 0.3mv/0.4msec), sense (17 \pm 8 vs 13 \pm 8) and impedance (615 \pm 123 vs 660 \pm 231) were not significantly different. The BNP (70.6 \pm 56 vs

192 \pm 189), EF and LV Dd/Ds were not significant different between both groups. SPWMD measurement was tending to be better in RVOT group (112 \pm 65Vs152 \pm 36). Incident of atrial fibrillation after the pacemaker implantation RVOT group was less than RVA(18% Vs 50%). The total duration time of the atrial fibrillation in RVOT group has not increased compared to the RVA group.

Conclusion: The RVOT avoid the risk of Disynchronization of the left ventricle, and not worsens atrial fibrillation. We considered that the RVOT pacing is more safety and less trouble management compare to the RVA pacing in the result of the chronic phase.

PACED QRS COMPLEX: HOW WIDE IS TOO WIDE?

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Introduction: Hyperkalemia (hK) may cause life-threatening arrhythmias through a reduction of the electronegativity of the resting myocardial potentials. Changes in ECG correlate roughly with the severity of hK. Very wide QRS complexes may suggest hK, however the degree of hK-related QRS prolongation is not well characterized.

Case report: A 74-y/o patient with history of DDD pacemaker insertion for sick sinus syndrome and underlying right bundle branch block presented to the Emergency Room with changes in mental status and generalized weakness. His ECG on admission is shown in the Figure. Shortly afterwards, the patient developed asystole, for which he received ACLS successfully. His K level at the time of the cardiac arrest was found to be 10.5 mmol/L.

Discussion: hK is known to cause QRS widening in patients with spontaneous AV conduction, which, in extreme cases, may result in a sinusoidal wave. A number of pacemaker abnormalities, which may include loss of atrial and ventricular sensing and/or capture, have also been described in association with hK. Our case underscores the challenge of appropriately diagnosing hK-related QRS widening in patients with implantable pacemakers. A prompt recognition of electrolyte abnormalities may avoid life-threatening complications, such as cardiac arrest secondary to loss of capture, which may occur in the setting of severe, uncorrected hK.

MULTISLICE COMPUTED TOMOGRAPHY DETECTION OF PERSISTENT LEFT SUPERIOR VENA CAVA: USEFULNESS FOR PREOPERATIVE PLANNING OF CRT. CASE REPORT

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Purpose: Cardiac resynchronization therapy (CRT) is an effective treatment of selected heart failure patients. Ideally, cardiac venous anatomy should be assessed non invasively before implantation to determine whether a transvenous approach is feasible. In this report preoperative multi-slice CT was able to show a persistent left sided superior vena cava (PLSVC) draining into the coronary sinus (CS) and to visualize the cardiac venous system in detail.

Methods: A 66-year old man underwent surgical repair of an atrial septal defect at the age of 45 and Pacemaker DDD implantation one month after surgery. The leads were inserted via right subclavian vein and PM was placed under the right shoulder. In the past few months he developed heart failure NYHA Class III and echocardiography showed marked left ventricular dilatation with an EF of 0.25 and a dilated CS. CRT system implantation was planned. To detect significant coronary artery disease a 64-slice CT was performed preoperatively.

Results: CT imaging showed the presence of PLSVC draining into a dilated CS (3 cm). No innominate vein bridging the two caval systems was present. A cardiac posterior vein (PV) with an acute angle of detachment from the main body of the CS was visible, the left marginal vein (LMV) was absent. We tried CRT system implantation via left subclavian vein but cannulation of PV failed. After patient recovering an epicardial catheter was then placed in the upper postero-lateral wall of left ventricle via left lateral mini-thoracotomy in video-assisted thoracoscopy (St. Jude Medical MyoDex TM bipolar, steroid eluting, screw-in catheter suturless) with good acute sensing and pacing parameters. CT scan showed to the surgeon the LM artery position preventing the artery to be damaged during the procedure.

Conclusions: Preoperative multi-slice CT is a useful tool for planning CRT in patients with complex venous malformations.

CRT SYSTEM IMPLANTATION IN A PATIENT WITH PERSISTENT LEFT SUPERIOR VENA CAVA AND SEVERE CORONARY SINUS STENOSIS: USEFULNESS OF PREOPERATIVE MULTISLICE CT

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Background: Non invasive evaluation of coronary sinus and its tributaries before CRT can play a key role for planning the implantation particularly if a complex congenital venous abnormality exists. In this report preoperative multi-slice CT scan was able to show a persistent left sided superior vena cava (PLSVC) draining into a severely stenotic coronary sinus (CS).

Methods: A 65-year old man with history of severe heart failure, left ventricular dysfunction and chronic atrial fibrillation with slow ventricular rate was scheduled for biventricular pacing. In order to rule out significant coronary artery disease a 64 slice CT scan was performed.

Results: Unexpectedly CT imaging showed a long and severe stenosis of the middle portion of coronary sinus and a narrow in diameter vessel (6 mm) arising from the subclavian vein and draining into the distal CS, thus appearing as a PLSVC. A lateral marginal vein was absent; the middle cardiac vein and a posterior vein were present, draining into the proximal CS. An anterolateral vein draining into the distal CS was present. CS was easily cannulated via left subclavian vein and retrograde venography confirmed the CT imaging. The lead for the left ventricle was placed in the distal portion of the PV but the pacing threshold proved to be too high (>5V/1,5 msec). A bipolar over the wire left ventricular lead (QuickSite™, St. Jude Medical) was placed in the antero-lateral vein via PLSVC successfully cannulated at its origin from the left subclavian vein. The right ventricular lead was placed at the right ventricular apex in the standard way.

Conclusions: Preoperative multi-slice CT scan is a useful tool for planning CRT in patients with complex venous malformations.

TARGETING LEFT VENTRICULAR LEAD PLACEMENT IN PATIENTS UNDERGOING CARDIAC RESYNCHRONIZATION THERAPY

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Aims: Recent studies have suggested differences in the quantity and distribution of coronary veins between patients with ischemic

(I) and non-ischemic (N) cardiomyopathy. We hypothesize that this may affect the potential for LV lead targeting in patients undergoing CRT with and without ischemic heart disease.

Methods: In 133 patients the retrograde contrast venograms were reviewed. The quantity and distribution of coronary veins and the final lead position were recorded.

Results: LV lead positions by vein were: posterior 14.04% (I) vs 15.79% (N) (p=1.00), posterolateral 21.05% (I) vs. 18.42% (N) (p=0.36), lateral 59.65% (I) vs 50.00% (N) (p=0.29), anterolateral 3.51% (I) vs 13.16% (p=0.11) and the middle cardiac in 1 patient (I). There were no major differences in the distribution of final LV lead positions between the I and N patients. The proportion of patients with 1 or more vein suitable for LV lead placement in each territory was 26.32% (posterior), 36.84% (posterolateral), 59.40% (lateral) and 24.81% (anterolateral) with no significant differences according to underlying aetiology. Excluding the middle and great cardiac veins only 58/133 patients had more than one suitable vein for LV lead placement (I – 36.8% vs N- 50.0%, p=0.16). There was a mean of 1.64+/-0.94 suitable veins per patient (I - 1.51 +/- 0.87 veins per patient vs 1.73 +/- 0.98 veins per patient p=0.18). Within the ischemic population there were no differences according to a history of previous CABG.

Conclusion: Underlying aetiology does not appear to affect the quantity and distribution of coronary veins available for LV lead placement or the final achieved lead positions. The limitations of venous anatomy restrict LV lead placement to a single vein with little scope for site selection in almost half of all patients. Given these limitations, in many patients, prospective targeting of LV lead placement may require a direct surgical approach.

DETERMINATION OF THE INTRAVENTRICULAR DYSSYNCHRONY THROUGH THE RELATIONSHIP BETWEEN LEFT VENTRICULAR CONTRACTION AND THE DURATION OF AORTIC FLOW

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Background: The optimal selection of the patient candidate to treatment of cardiac resynchronization (CRT) passes through a careful multifactorial evaluation, where the echocardiography plays a conclusive role.

The purpose of our study is to show as the intraventricular dyssynchrony (IVD) determined by the calculation of the overlap of the left ventricular contraction with the duration of the aortic-flow (AoFl)

Materials and methods: 28 patients with CMD with severe systolic dysfunction, in advanced NYHA class, has run to implant of tricameral/biventricular PM/AICD. All the patients have been submitted in basal and at 6 months follow-up (FU), to clinical examination and echocardiographic evaluation.

Close to the known echo-parameters, the IVD gotten subtracting to the time of contraction of the left ventricle, considered as the distance among Q-wave and maximum contraction of the side wall (4-chamber view, M-Mode), the duration of the Aortic-flow, considered as the distance between the Q-wave and the end of the AoFl (pw- doppler, in LVOT position), has been calculated.

Patients has been classified as responders to the reverse remodeling if the VTS was reduced than at least 15% in comparison to the basal values.

Results: After six months of FU, 20 patients resulted responders (VTS 178.40 vs131.61ml P=001). Moreover 18/20 patients responders showed a meaningful increase of the FEVS% (24.2vs32,1 P=0.025). Through univariate analysis possible predictable parameters of ventricular reverse remodeling have been valued. An elevated delay VC/AF pre-implant was correlated with a marked reduction of the VTS (r=-0.8, p<0.01) and to an important improvement of the

FEVS% ($r=-0.75$, $p=0.02$). All the patients responders introduced a delay VC/AF >40msecs.

Conclusions: From our analysis we have appraised as the intra-ventricular delay gotten through the relationship among left ventricular contraction and duration of the effective aortic flow, is a predictive parameter of ventricular reverse remodeling, therefore useful echocardiographic parameter for the selection of the patient candidate to the CRT.

CARDIAC RESYNCHRONIZATION THERAPY: COST OR INVESTMENT?

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Purpose: HF is costly for HealthCare Systems (HCS). Hospitalization costs cover 80% of total costs. CRT has been demonstrated to reduce the number of HF-related readmissions and to decrease their duration. To evaluate evidence in the practice, a single-center observational retrospective study was performed to assess the outcomes and the economic impact.

Method: 64 class 1A pts treated with CRT-P or CRT-D were considered.

Clinical (NYHA class, EF) and HF admissions (number, Length of Stay-LoS, costs) data were analyzed at pre-implantation, 1-year (43 pts) and 2-year (23 pts) FU. Implantation costs were considered.

Results: Data showed improvement in NYHA class and EF both at 1 and 2-year FU.

At 1-year, all NYHA class III pts have improved functional status. 80% of them experienced NYHA class I transition. 57% of pts in NYHA class IV has passed to class II. 81% of pts with EF ranging 21-30% has moved to 31-40%. 70% of pts with EF <20% have had EF increase.

After 2 years, all NYHA class III pts have improved functional status, 63% of them transitioning to class I. 60% of pts in NYHA class IV passed to class II. 77% of pts with pre-implantation EF value ranging 21-30% has improved to 31-40%. 80% of pts with EF <20% have EF increase (60% to 21-30%; 20% to 31-40%).

In the first year 82% decrease in HF readmissions and 30% decrease in the LoS were detected. Two years after implantation, HF hospitalizations reduction settled at 44% while LoS dropped at 30%. The hospital cost saving was approx. {130,000. The positive achievement was confirmed even if implant-related costs and tariffs were considered.

Conclusion: CRT improves clinical outcome and HF readmissions, favorably impacting on morbidity and costs. CRT has positive impact on HCS and hospital costs. Further analysis (i.e. statistical and subgroup analysis) and longer FUs are recommended.

LONG TERM FOLLOW-UP OF RIGHT VENTRICULAR BIFOCAL PACING

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It is well established that biventricular(BV) pacing therapy is effective in patients with severe congestive heart failure. However BV pacemaker implantation was not always successful. Right-ventricular

bifocal pacing (RVBF) was reported as a kind of cardiac resynchronization therapy.

In three patients (mean age: 70+/-11y/o, two men) with conventional indications for a pacemaker who had impaired LV function (mean left ventricular ejection fraction: 22+/-8%), upping treatment from pacemakers to a BV pacing system was tried, however LV leads to the coronary sinus was not possible. In these patients, another pacing lead was fixed on the septal wall of the right ventricular outflow tract. And RVBF pacing was performed. Evaluation of regional wall motion by our method using strain Doppler imaging had done. All patients improved intra-ventricular contraction delay especially longitudinal dyssynchrony without improvement of whole heart left ventricular contractility. Mean follow up period was 34+/-14 months. Patient events were defined as death or hospitalization due to heart failure. All patients improved symptom and echocardiographic data in acute phase. One patient who had been hospitalized due to heart failure 5 times before upgrade died after 17 months because of cardiac cirrhosis. His Brain natriuretic peptide (BNP) decreased acute phase, however his BNP increased chronic phase. Another patient who had been hospitalized due to heart failure 2 times before upgrade showed worsening of heart failure and hospitalized at once(16 months later) during follow-up period (43 months). His trend of BNP decreased continuously. The other patient who had been hospitalized due to heart failure 2 times before upgrade was not hospitalized during follow-up period (41 months). Her trend of BNP also decreased continuously.

RVBF pacing may be feasible alternative of cardiac resynchronization therapy especially in patients with conventional indications for a pacemaker.

ICD IMPLANTATION IN COMPLEX CONGENITAL HEART DISEASE WITH DEXTROCARDIA: A CASE REPORT

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We describe a case of successful implantation of a dual chamber ICD in a 35-year-old male with dextrocardia, situs viscerum inversus, bilateral superior vena cava, double outlet right ventricle (DORV), ventricular septal defect (VSD), atrial septal defect and pulmonary stenosis status-post Rastelli repair, and poorly tolerated ventricular tachycardia (VT). The patient underwent Rastelli operation at the age of 14; 14 years later, he required re-operation because of residual VSD with systemic right ventricular pressures and dyspnea. He had been asymptomatic until august 2007 when he experienced sustained VT associated with haemodynamic impairment and syncope. Echocardiography revealed a poor haemodynamic balance due to severe pulmonary regurgitation, right ventricle dilation, and moderate tricuspid regurgitation, therefore the patient underwent a third operation. Surgery consisted of implantation of a pulmonary conduit with biological valve, and tricuspid annuloplasty. Two weeks later, the patient was submitted to dual chamber ICD implantation with active fixation leads. The procedure was performed via right subclavian vein using a double-coil defibrillation lead, in order to involve both ventricles within the shocking circuit. Post-implantation defibrillation testing showed correct detection and treatment of ventricular fibrillation. The post-operative course was free of complications and ICD interrogation showed optimal leads and device parameters. At ten months' follow up the patient has been asymptomatic and no ICD intervention has been reported.

PROBLEMS OF IMPLANTATION OF CARDIOVERTERS-DEFIBRILLATORS IN CHILDREN

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We have an experience of 6 CD implantations in children aged from 3.5 to 18 years. Diagnoses: long Q-T syndrome (n=2), idiopathic ventricular fibrillation (n=1), congenital carditis (n=1), familial case of hypertrophic cardiomyopathy (n=1), incisional ventricular tachycardia (n=1). Life threatening ventricular tachycardia was recorded in the course of preliminary examination in 4 patients, 2 of them had history of syncope. One patient aged 7 years had multiple syncopes, has history of 13 sudden deaths of relatives -children. CD was implanted in one more patient aimed at primary prevention of sudden cardiac death. After CD implantation, all patients continue to receive antiarrhythmic therapy (α - adrenoblockers - 4, sotalex - 2). During follow-up period, a patient aged 3.5 years experienced post-traumatic dislocation of endocardial electrode which induced non-motivated operation of implanted cardioverter-defibrillator (ICD). Two patients had non-motivated operations of ICD against of sinus rhythm.

Thus, while making decision concerning implantation of CD in children, one must take into account methodical severity of the given procedure in infants and need in control of sinus rhythm rate aimed at preventing non-motivated operations of CD. One must consider the possibility of administrating α - adrenoblockers in such case.

NOONAN SYNDROME IMPLANTED ICD

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Patients of Noonan syndrome are known to have specific physical characteristics, cardiac anomaly, and cardiac hypertrophy. Their prognosis depends on the cardiac function and the thickness of their heart. Patients with cardiac muscle hypertrophy usually die suddenly with ventricular tachycardia (VT.) We were successful with such a case of Noonan syndrome through inserting an implantable cardiac defibrillator (ICD) to prevent a patient's sudden death from VT. The patient was a 30-year-old woman with Noonan syndrome. Her ASD and PS were surgically repaired at the age of 2 years old. She arrived at the hospital with heart failure. We treated her with beta blocker and ARB tablets. Her condition improved. However, she had severe cardiac hypertrophy. We noticed non-sustained VT using a Holter EKG. We discovered some scars in her left ventricular muscle with a MRI. We could induce sustained VT in the procedure. Therefore, we implanted an ICD. The ICD successfully saved her life. We conclude it is important to implant an ICD for a patient with cardiac hypertrophy of Noonan syndrome.

A CASE OF ICD MALFUNCTION CAUSED BY AN ELECTRIC BATH

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Background: Identifying potential causes of malfunctions in cardiac pacemakers (PMs) and implantable cardioverter-defibrillators (ICDs) is extremely important in terms of giving patients lifestyle

instructions. As reported here, we encountered a case in which a patient bathed in an "electric bath," common in Japan, and suffered a malfunction in her ICD.

Case: This case involved a 72-year-old female who was being treated for hypertrophic cardiomyopathy; ventricular tachycardia was noted clinically, so the patient was admitted to this hospital. Electrophysiology was performed and ventricular fibrillation (VF) was induced, so ICD implantation (VENTAK MINI IV, Guidant) was performed in December 2001. In March 2004, dizziness was noted, and the patient also had sinus bradycardia and an advanced atrioventricular block. An atrial lead was added. The ICD was also changed to a Prizm 2 DR (Guidant).

In December 2007, the patient lost consciousness while bathing at a public bath, after which DC defibrillation activated. On the following day, the patient was seen at this hospital on an outpatient basis and her ICD was checked. The ICD oversensed the slight electrical stimuli in the bath and pacing could not be achieved; the ICD was determined to have perceived the stimuli as VF and to have then activated DC defibrillation.

Conclusion: We encountered a case of an ICD that malfunctioned in an electric bath. Electric baths are common in Japan, but there are few reports of ICD malfunctions in them. Identifying such a potential cause of a malfunction is extremely important in terms of lifestyle instructions for patients.

DOES THE IMPLANTATION OF AN ICD LEAD TO A WORK INAPTITUDE IN AN ELECTRICAL COMPANY?

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An EDF worker had been implanted with a implant cardioverter defibrillator (ICD). His occupational doctor had to define his work aptitude. This person was working in hydroelectric plants, so was exposed to 50Hz magnetic field. The ICD may be perturbed by magnetic field, and the risk had to be evaluated.

From this case study, we present our approach to define the work aptitude or inaptitude.

Method: The protocol consists in measuring magnetic field in the presence of implanted worker. A pluridisciplinary team performed the study: the cardiologist was there with cardiac reanimation material; the ICD constructor questioned the ICD with the telemetry material and the engineer performed magnetic field measurements. The magnetic field measurements were realised with an EFA-3 (Wandel et Goltermann). The EDF worker was also wearing an EMDEX II (Enertech), which allows to verify afterwards that no exposure situation had been forgotten. The measurements began in the offices and continued with the places where the magnetic field intensity increased (substations, alternators, turbines, control rooms, proximity of cables). The ICD was questioned with telemetry at each new exposure situation.

Results: The ICD was Medtronic, bipolar and a 0.3mV sensitivity setting. In the different areas, 50Hz magnetic field has been measured from 0 to 650µT at the ICD location. No dysfunction of the ICD has been seen with the bipolar mode.

Conclusion: Following these measurements, this person has been declared apt to work and has worked again in hydroelectric plants. Six months after, no incident has been reported.

This example shows the interest of measuring magnetic field and questioning the implant in the same time, at the different working places, in order to evaluate risks of electro-magnetic interferences and to help the occupational doctor to define the work aptitude or inaptitude.

ICD DEFIBRILLATION WAVEFORM OPTIMIZATION IN CASE OF DEFIBRILLATION TESTING FAILURE: RESULTS OF A SINGLE-CENTER RETROSPECTIVE STUDY

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Purpose: In case of ICD testing failure the next conventional strategies consist in enhancing ICD shock output, in excluding the proximal coil (double coil catheters) and finally in positioning an additional subcutaneous lead. Another option, available only in selected devices (St. Jude Medical), is defibrillation waveform optimization. Aim of this study is to evaluate the feasibility and efficacy of ICD defibrillation waveform optimization during device testing.

Methods: One-hundred eighty pts who underwent ICD implantation (St. Jude Medical devices, Epic or Atlas model) in our institution were enrolled in the study (130 M, mean age 55±18 ys). Fifty-two pts were implanted for secondary prevention and 128 pts for primary prevention of sudden cardiac death. One-hundred five pts were affected by coronary artery disease (CAD), 60 pts by idiopathic dilated cardiomyopathy (IDCM), 9 pts by Brugada syndrome and 6 pts by arrhythmogenic right ventricular dysplasia. Mean LVEF was 38±15. Eighty-two devices were biventricular; the remaining were dual lead/ single lead ICDs. All pts underwent ICD testing at the end of the implant procedure: VF was induced by direct current and the shock output tested was 10J less than the maximum output deliverable.

Results: Failures in defibrillation testing were reported in 4 pts (2 ischemic dilated cardiomyopathy, 1 IDCM, and 1 CAD and normal LVEF); none of them was on amiodarone therapy. In these pts ICD testing was repeated after defibrillation waveform optimization by the aid of Kroll's tables, leading to successful defibrillation in all cases (after 1 attempt in 3 pts, and 2 attempts in 1 pt).

Conclusions: ICD defibrillation waveforms optimization is a simple, feasible and effective tool useful in case of defibrillation testing failure; this method might allow to avoid in some cases other invasive approaches (subcutaneous lead implant).

INCIDENCE OF SUBSEQUENT APPROPRIATE THERAPIES IN ICD PATIENTS

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ICD Shocks are painful and can result in clinical depression. Substrate-based catheter ablation reduces the incidence of ventricular arrhythmias in patients with a history of myocardial infarction (MI). It would be useful to identify patients at high risk of shock therapies to offer them ablation therapy.

Objective: To study the incidence of ventricular arrhythmias and shock therapies in ICD patients with a history of MI who had suffered a first ICD therapy for a ventricular arrhythmia.

Methods: records of 162 ICD patients with a history of MI were reviewed. 73 patients suffered at least one appropriate therapy. We include in the study those 55 patients (51 men, mean age 68.7±8.9 y) with a follow up greater than >3 months after the first ICD therapy.

Results: 11 patients (20%) received the ICD for primary prevention and 44 (80%) for secondary prevention. The first appropriate therapy occurred 25±29 moths after the ICD implant, 20 patients were successfully treated with antitachycardia pacing (ATP) and 35 with ICD shock. During a mean follow-up of 41.7±37.7 months, 38 patients (69.1%) suffered at least one more appropriate therapy (21

ATP/17 shock). The risk of suffering an ICD shock were 18% in the global population of ICD patients with a history of MI and 31% in those who had suffered one previous appropriate therapy (25.7% if this were ATP and 40% if this were an ICD shock).

Conclusion: ICD patients with a history of MI and a first appropriate therapy are at high risk of suffering appropriate ICD shocks during follow-up, especially when the first therapy was an ICD shock.

PATIENT TIME COMMITMENT AND DEPENDENCE ON OTHERS REDUCED WITH REMOTE ICD EVALUATION

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Purpose: Remote monitoring (REM) systems represent an emergent way of controlling patients (pts) implanted with implantable cardioverter defibrillator (ICD). This study was designed to evaluate the benefit of REM using the Housecall Plus (St Jude Medical) system on patient's overall time commitment as compared to traditional in-hospital visits (HOSP).

Method: 60 pts (49 male, 62±11y) were enrolled within 2 months after the implantation of an ICD and randomized to REM or HOSP group. 67% of pts were in NYHA>=2 and primarily implanted for primary prevention (53%). Enrolment visit required pts to travel 34±41km mainly by car (72%) and representing an average of 48±42 min.

Results: At the 3-month follow-up, HOSP group (n=31) traveled 28±32 km for an average of 46±35 min typically by car (57%). Half of the pts (61±11y;NYHA 2.2±0.7) were accompanied and 20% of the companions took time off from work. Overall time commitment was greater when pts were accompanied (191±251 vs 113±157 min) and interactions with clinicians represented 19±9 min. For 78% of REM pts, follow-up was conducted without assistance and average call duration with clinicians was 17±37 min. No safety issues occurred with this method and 4 pts were asked to come to the hospital for an additional evaluation mainly for ICD programming.

Conclusions: REM evaluations provide an efficient way for reducing pts time commitment and dependence on others for ICD evaluation while maintaining a similar level of interaction with clinicians with as compared to traditional in-hospital control. Further investigations are warranted to determine the impact on socioeconomic and health care related costs.

REMOTE ICD FOLLOW-UP OFFERS PATIENTS MORE OPPORTUNITY TO INDEPENDENTLY MANAGE THEIR HEALTH CARE

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Purpose: Remote monitoring (REM) systems represent an emergent way of controlling patients (pts) implanted with implantable cardioverter defibrillator (ICD). This study was designed to evaluate the patient's dependence on others for REM using the Housecall Plus (St Jude Medical) system compared to traditional in-hospital visits (HOSP) for ICD evaluations.

Methods: 60 pts (49 male, 62±11y, NYHA 2.0±0.7) were enrolled within 2 months after the implantation of an ICD and randomized to REM or HOSP group. 67% of pts were in NYHA>=2 and primarily implanted for primary prevention (53%). Enrolment visit 53% of pts were accompanied. Overall time commitment was slightly more when the patient was accompanied (240±153 vs 260±124 min). 18% of pts and 23% of companions took time-off (255±157 and 347±348 min) from work for the follow-up. Pts need for a companion appeared to increase with higher NYHA (34% NYHA I, 50% NYHA II, 80% NYHA III)

Results: At the 3-month follow-up, the HOSP group (n=31) 50% of pts, younger (60±11y) and with a lower NYHA (2.15±0.7), were accompanied. Overall time commitment was again slightly more when the patient was accompanied (113±157 vs 191±251 min). 13% of pts and 20% of companions took time-off (255±157 and 410±267 min) from work for the follow-up. Similar to enrollment, pts need for a companion appeared to increase with higher NYHA (33% NYHA I, 50% NYHA II, 50% NYHA III).

For the REM group (n=29) 78% of pts, older and with a higher NYHA (64±11y, NYHA 2.5±1.0), were able to perform the remote follow-up independently. Overall time commitment was doubled when the pt was assisted (15±38 vs 25±34 min).

Conclusion: Remote ICD follow-up offers pts older and/or with a higher NYHA and opportunity to manage their health care independently as compared to traditional in-hospital visits. Further investigations are needed to confirm these findings.

RESOURCE CONSUMPTION REDUCED WITH REMOTE ICD EVALUATION

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Purpose: Remote monitoring (REM) systems represent an emergent way of controlling patients (pts) implanted with implantable cardioverter defibrillator (ICD). This study was designed to evaluate the resource consumption for REM using the Housecall Plus (St Jude Medical) system compared to traditional in-hospital visits (HOSP) for ICD evaluations.

Methods: 60 pts (49 male, 62±11y, NYHA 2.0±0.7) were enrolled within 2 months after the implantation of an ICD and randomized to REM or HOSP group. 67% of pts were in NYHA>=2 and primarily implanted for primary prevention (53%). At the enrolment visit pts traveled a total distance of 2030 km by car (72%), bus (12%), ambulance (10%), taxi or train (3% each). The total travel time was 2886 mins with a total cost of 760.50 Euro. Only 12% of patient transportation costs were reimbursed. 18% of pts and 23% of companions accompanying pts took time-off (255±157 and 347±348 min) from work.

Results: At the 3-month follow-up, HOSP group (n=31) traveled a total distance of 897km by car (57%). By bus or ambulance (14% each), train (10%), or walking (4%). Total travel time and costs were

1473 min and 355.60 Euro, respectively. Only 14% of patient costs were reimbursed. 13% of pts and 20% of companions took time-off (255±157 and 410±267 min) from work. For the REM group 22% of pts needed assistance which doubled the overall time commitment (15±38 vs 25±34 min) for the follow-up. Pts traveled only when contacted by the physician for an additional follow-up (4 times for ICD programming). Total travel time and costs were 305mins and 75.20 Euro respectively. Clinician time was equivalent (Dr 14.5±8.7 vs 14.7±8.0; Nurse 13.4±10.2 vs 11.5±8.2 min)

Conclusions: Remote ICD follow-up reduces resource consumption as compared to traditional in-hospital visits. Further investigations are needed to confirm the impact on health care and socioeconomic costs.

NOT INVASIVE HEMODYNAMIC EVALUATION OF CARDIORESPIRATORY CAPACITY BY DYNAMIC ATRIOVENTRICULAR DELAYS IN PATIENTS WITH AV-CONDUCTION DISTURBANCE AND DUAL CHAMBER ICD

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Background: In patients (pts.) with heart failure (HF) and atrioventricular (av) conduction disturbance, pacemakers are particularly programmed with fixed av-delay. Some of the pts. showed a deficiency in shortening systolic delay with growing heart rate during exercise. This leads to reduced exercise performance and faster exhaustion. The aim of this prospective study was to evaluate whether programming of dynamic av-delay can improve physical performance by means of spiroergometric performance testing.

Methods and results: The study group consisted of 5 pts. with dual chamber ICD (Belos DR, Biotronic) (5 male, 65±6 years, 4 CAD/1 DCM, EF: 39±6%, NYHA II) who underwent exercise on a treadmill with breath-by-breath gas exchange analyses. During the exercise noninvasive measurement of the hemodynamic was done with InnocorTM-System (Innovision, Denmark). None of the patients was paced neither atrially nor ventricularly before and none of them was programmed with dynamic av-delay. Exercise testing under intrinsic av-delay was followed by testing after programming into dynamic av-delay of 100 ms at any heart rate (HR) beyond 70/min. The mean intrinsic av-delay was 178±48 ms, mean HR was 64±7/min at rest, mean HR during exercise was 96±13/min. The VO2max (ml/min/kg) (intrinsic(i) vs. dynamic av-delay(d); 15.6±4 vs. 17.6±6 p=0.04) and VO2max (ml/min) (i: 1428±660 vs. d:1606±521, p=0.04) showed an increase with dynamic av-delay. The minute-ventilation (VE) to expired carbon dioxide (VC02) slope was not significantly (p=ns). The non-invasive measurement of cardiac output (4.7±2 vs. 4.6±2 l/min/m2) and stroke volumen (81±34 vs. 80±42 ml) showed no significant different by dynamic av-delays.

Conclusion: Patients with atrioventricular conduction disturbance suffer from chronotropic inefficacy due to extended atrioventricular duration. It is known, that permanent pacing of right ventricle is worsening heart failure. However spiroergometric parameters argue for ventricular pacing with dynamic av-delay during exercise.

FOLLOW-UP OF PATIENTS WITH BRUGADA SYNDROME TREATED WITH AN IMPLANTABLE CARDIOVERTER DEFIBRILLATOR

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Background: The Brugada syndrome is a primary cardiac electrical disorder and is associated with an increased risk of sudden cardiac death (SCD) caused by life threatening ventricular tachyarrhythmia.

The diagnosis is based on the typical ECG pattern, combined with clinical symptoms, and a family history of SCD. The currently suggested therapy consists of implantation of an internal cardioverter defibrillator (ICD) in pts. with risk for SCD. The aim of this retrospective study was to report about the follow-up of patients with Brugada syndrome treated with an ICD.

Methods and results: The study group consisted of 12 pts. with Brugada syndrome with typ 1 ECG pattern (9m/3f, mean age: 45 ± 14 years, EF: $60 \pm 4\%$). The indication for ICD in 2 pts. (16%) was ventricular fibrillation, sustained ventricular tachycardia (VT) in 4 pts. (33%), and syncope in 6 pts. (50%). In one patient the ICD was implanted because of positive family history and inducible sustained VT in the electrophysiological study (EPS). 4 pts (33%) had a positive family history, 11 pts. (92%) underwent EPS. In 2 pts. (18%) VT was documented during a mean follow-up of 50 ± 20 month, no pat. died, 2 pts. had appropriate, and 3 pts. had inappropriate device therapy. The complication rate was 25 %, predominantly through oversensing caused by lead failure, which implicated a lead revision.

Conclusion: During a mean follow-up of 54 months the arrhythmic event rate of our patient population was 16%, inappropriate therapy and the complication rate were 25%. The rate of complication was higher than as the adequate ICD therapy in our patient population.

ATRIAL ACTIVITY DETECTION THROUGH A VDD SINGLE LEAD MAY IMPROVE DISCRIMINATION BETWEEN SUPRAVENTRICULAR AND VENTRICULAR TACHYCARDIAS IN IMPLANTABLE DEFIBRILLATORS

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Background: The number of implanted single chamber ICDs remains high mainly due to the increasing number of primary prevention indication. The major disadvantage of a single chamber ICD is the lack to discriminate supraventricular from ventricular arrhythmia. Implementation of atrial sensing capability in a single chamber ICDs may improve arrhythmia detection specificity.

Aim the study: To evaluate atrial activity detection through a single-lead ICD system at implant, at 7 days and at 1 month follow-up.

Methods: In nine patients (mean age 66 ± 17 years, 6 male) we implanted a single-lead ICD system composed by the single-lead implemented with atrial bipole able to atrial signal detection and by a VDD-ICD provided with an additional filtering/amplification stage to improve sensing performance. Atrial sensing signal was collected at implant by conventional PSA. Sensing test was performed using the programmer at implant and at 7 days and 1 month follow-ups when also different conditions were tested (left side, right side, stand position and during deep breath).

Results: At implant the mean P wave detected by PSA was 1.91 ± 0.82 mV while the mean P wave detected during sensing test by programmer was 3.6 ± 0.5 mV corresponding to an amplification of about 2 times (min amplification 1.5-max amplification 3.). The mean value of P wave detected at 7 days and 1 month follow-up during eight different conditions are summarized in table below.

No statistically differences were detected between atrial sensing at 7 days and 1 month follow-up. The ANOVA test for multiple comparisons showed a statistically significant difference between right side normal and deep breath vs left side deep breath (both $P < 0.05$) at 7 days follow-up. One patient experienced sporadic atrial undersensing at follow-up during sensing tests. In the same patient a self-limited ventricular tachycardia was correctly detected by device. No supraventricular episodes were detected in the study population at studied follow-up.

Conclusion: The single-lead ICD system is able to detect and amplify atrial signal of about twice in about 90% of studied patients. Reliable atrial activity detection is maintained at follow-up also in different body and breathing conditions. The single-lead ICD system capability to detect atrial activity and to amplify atrial signal may improve the discrimination between supraventricular and ventricular arrhythmia comparing to single chamber ICD.

HOME MONITORING™ REMOTE CONTROL IN PACEMAKER AND ICD PATIENTS. TEMPORAL PATTERNS AND VARIABILITY OF CLINICAL AND TECHNICAL ALERTS

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Background: Remote monitoring of implantable device by Home Monitoring™ (HM) technology is an important challenge for the management of patients implanted with pacemakers (PM) and Implantable Cardioverter Defibrillator (ICD). Although several studies have already proven the reliability and feasibility of that technology, more data regarding the impact on clinical practice are necessary to implement devices remote monitoring as a standard method for patient management.

Aim the study: To evaluate temporal trend of clinical and technical interventions requested from HM data evaluation in patients implanted with PM, ICD and ICD-CRT.

Methods: One hundred sixty-six patients (mean age 73 ± 10 years, 112 Male) were implanted with HM devices (121 PM, 22 ICD and 23 ICD-CRT). Data sent daily by the HM function were analysed by a dedicated nurse who submitted to the physician all critical cases. After HM data analysis physician formulated a diagnosis and requested, if necessary, an intervention that consists in a phone call or in outpatient follow-up.

Results: During a mean follow of 488 ± 203 days the physician requested an intervention for 61 patients. In 44 patients interventions were asked for clinical purpose (i.e. atrial or ventricular arrhythmia and heart failure) while in 25 patients interventions were requested for technical reason (i.e. inappropriate atrial/ventricular sensing, high atrial/ventricular threshold, etc). The median time from implant to the first request of intervention was 88 days (interquartile 31-169). When temporal pattern of intervention was analysed separately for clinical and technical reasons, the median of time to the first request of intervention was respectively 88 days (interquartile 33-172) and 141 days (interquartile 34-258).

The cumulative percentage of intervention request at 2 years follow-up was 56% (C.I. 46-66%) for all intervention, 68% (C.I. 60-76%) for

	Supine normal breath (mV)	Supine deep breath (mV)	Right side normal breath (mV)	Right side deep breath (mV)	Left side normal breath (mV)	Left side deep breath (mV)	Stand normal breath (mV)	Stand deep breath (mV)
7 days FU	3.0 ± 1.12	3.6 ± 0.56	3.9 ± 1.5	2.5 ± 0.7	3.1 ± 0.7	3.7 ± 0.4	3.3 ± 0.7	3.4 ± 0.0
1 month FU	3.2 ± 0.79	3.6 ± 0.76	3.3 ± 0.7	2.1 ± 1.2	3.9 ± 0.0	3.6 ± 0.6	3.4 ± 0.4	3.0 ± 0.9

clinical intervention and 81% (C.I. 73-89%) for technical interventions. **Discussion:** The majority of intervention from HM data analysis was requested during the first 6 months of follow-up. However, few clinical and technical events that need an intervention to optimize device and pharmacological therapy happened also later.

Conclusion: The major of intervention from HM data analysis was requested during the first 6 months after PM and ICD implantation. On the other hand, the presence of later events and the intervention probability more than 50% at two years follow-up suggests that daily remote monitoring through HM technology is useful during all device life.

FAST VENTRICULAR TACHYCARDIA INDUCED BY HIGH ENERGY SHOCK

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We reported a case of a 74 year-old woman that was referred for recurrent episodes of Tdp due to iatrogenic long QT. In 2001 she was admitted for heart failure and diagnosis of ipocinetic dilated cardiomyopathy with reduced EF (36%). ECG showed a LBBB. In 2004 a therapy with amiodaron for persistent AF was started. On admission, echocardiogram showed an EF of 28%. The coronarography emphasized a single vessel coronary disease. An biventricular ICD system was implanted, without execution of DFT. The device was programmed with 2 antitachy zone: VT zone(>160 bpm), with 3 ATP and 5 shocks at high energy (31J); VF zone(>200 bpm) only shock at 31J. The patient was discharged without amiodaron therapy. After 1 month she was sheltered for episodes of monomorphic VT (360 ms), recognized in VT zone correctly and treated with ineffective ATP and repeated shock to the greatest energy that accelerated and bred the arrhythmia in VF zone, treated with shock to 31J. The patient was hospitalized and the DFT was performed, induced ventricular fibrillation treated with shock to 21J (inverted polarity). The device was reprogrammed, excluding the therapy ATP with addition of betablocker therapy. After 2 months new hospitalization for syncopal episode. At the ICD interrogation, presence of monomorphic VT episode treated ineffectively with 6 shocks at 31 J and degeneration in VF resolved to the first attempt with shock to the greatest energy. It has decided to carry out induction test of clinical VT with ventricular stimulation programmed, interrupted with shock to low energy (5J). The device was reprogrammed with two zone: VT(>140 bpm) without ATP and the first shock with low energy (5J); VF(>210) only shocks at 31J. After 6 months, an episode of monomorphic VT(360 ms) occurred that treated effectively with a single shock to 5 J.

VENTRICULAR TACHYCARDIA AFTER PACEMAKER IMPLANTATION FOR COMPLETE HEART BLOCK: UNEXPECTED LATE CARDIAC INVOLVEMENT IN SARCIDOSIS

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Case report: a 51 year-old men was admitted because of transient second AV block symptomatic for dyspnoea. ECG showed sinus rhythm, first AV block, RBBB and Q wave in inferior leads. 10 years

ago he suffered from sarcoidosis with pulmonary and skin involvement symptomatic for dyspnoea. After corticosteroids therapy patient became asymptomatic and subsequent gallio scan was negative. Current echocardiogram showed atrial enlargement, normal LVD and EF, inferior akinesia, left ventricular hypertrophy (15 mm) with increased septal echogenicity. Because of Q wave in inferior leads he underwent coronary angiography that revealed normal coronary artery. Patient underwent DDD PM implantation and was discharged. The day after he was readmitted because of sustained palpitations from 4 hours. ECG showed sustained VT (cycle length 330 ms) with negative QRS in precordial leads and positive in inferior leads, interrupted by 150J external DC-shock. Active sarcoidosis with cardiac involvement was suspected and patient underwent EMB that confirmed typical infiltrative non caseating granulomas with multinucleate giant cells. A bipolar voltage map with CARTO system (Biosense Webster) showed multiple scars in RV and intraventricular septum. EPS induced multiple fast VT symptomatic for syncope. Patient underwent ICD implantation and started corticosteroids. At 6 months of follow-up patient was asymptomatic and no events were recorded by ICD store.

Conclusion: sarcoidosis is a systemic disorder with infrequent symptomatic cardiac involvement. Extensive cardiac infiltration of granulomas and residual fibrosis can cause infiltrative/hypertrophic cardiomyopathy, pseudoinfarction with Q waves at ECG. Conduction disorders and ventricular arrhythmias with sudden death are frequent. In patients with cardiac sarcoidosis corticosteroids therapy appears reasonable because of risk of lethal cardiomyopathy while ICD implantation may be considered when extensive cardiac involvement is present with ventricular scars because of high risk of sudden death.

PRIMARY PREVENTION OF SUDDEN DEATH IN X-LINKED EMERY DREIFUSS MUSCULAR DYSTROPHY

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We present a case of 14-year-old patient with X-Linked Emery-Dreifuss muscular dystrophy (XL-EDMD) who developed sick sinus syndrome. DNA analysis revealed a novel nonsense mutation, changing lysine in a stop codon. On February 2008, at the age of 13 years and 5 months, the patient experienced three episodes of lipotimia during walking and one syncopal episode at rest. Holter monitoring showed long periods of junctional escape rhythm with an HR of 42 bpm, and no evidence of atrial electrical activity. The usual sudden death risk factors, such as low left ventricular ejection fraction (LVEF), spontaneous or EP inducible ventricular tachycardia or ventricular fibrillation, drug therapy or electrolyte imbalance, were investigated and did not show any anomalies. An ICD pacemaker was implanted for both the treatment of sick sinus syndrome and the primary prevention of sudden death. One month later (March 2008), home monitoring interrogation of device revealed one proper and effective discharge, occurred during an episode of ventricular fibrillation.

At our knowledge, the case here described is the first report of an ICD implantation for primary prevention of sudden death in an X-Linked EDMD young male patient. The findings here reported probably lessen the role of electrophysiological study in identifying EDMD patients at high risk of sudden death. In our experience, LMNA A/C mutated patients need to be implanted more frequently compared with STA mutated patients. In these cases ICD implantation has been demonstrated to be more effective in treating potential fatal

tachy-arrhythmias when compared with pace-maker implantation. Therefore, a careful monitoring of EDMD patients with mutations in the emerin gene is of pivotal importance because an early implantation of ICD in these patients, even in cases without evidence of risk factors usually related to the onset of malignant ventricular arrhythmias, is able to prevent sudden cardiac death.

QUANTIFICATION OF SUBJECTIVE EASE TO USE DATA FROM OVER 4,000 CARDIAC PACING LEADS

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The functional efficiency of a cardiac lead in a cardiac pacemaker system depends on objective physical characteristics (shape, insulation, polarity, fixation...) and on the individual practitioner's perception of ease of use.

Method: This study concerns 4,028 Medtronic leads, representing a mix of 68% ventricular and 32% atrial. The leads were used among 988 VVI, 1536 DDD and 28 VDD pacemakers. The investigators measured the electric parameters: pacing threshold, sensing and impedance. Subjective ease of use perception data were quantified on a codified scale from 1 to 9 (poor to excellent) for a certain number of parameters such as introduction into the vein, passage through the venous network, glide, maneuverability inside the chambers, flexibility, localization in the final site and passage through the tricuspid valve (for the ventricular leads).

Other quantifiable data were collected, including radioscopia duration, number of stylets used and total time for the lead localization procedure.

Results: The total duration of lead implant procedures was shown to be less than 15 minutes in each cavity in approximately 88% of cases. Ventricular thresholds were stable (0.46 ± 0.28 Volt) as were atrial thresholds. Both atrial and ventricular sensing were stable at (3.7 ± 2.2 mV) and (12.6 ± 5.0 mV) respectively. Impedance stability was identical in both standard leads and high impedance leads within +400 ohms in high impedance leads.

Discussion: Statistically speaking, there is an inverse correlation ($P < 0.05$) between the radioscopia time and the ease of use score for atrial and ventricular leads. This study concerns data gathered on over 4,000 leads, which is a significant high number. Since 1998 and the appearance of the polarity switch function, the tendency is to use bipolar leads as primary approach (atrial 96%, ventricular 81%, in this study) without compromising patients safety and security.

NEW OPTIM INTRA-CARDIAC LEADS: THE ONE YEAR FOLLOW-UP

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Purpose: The electrical characteristics of St Jude Medical Optim leads were assessed after 1 year of follow-up (FU). Optim is a new co-polymer cardiac lead insulation (silicone-polyurethane), specifically designed for better durability (abrasion resistance and biostability) and improved handling (lubricity and flexibility).

Methods: A total of 44 leads (34 Tendril ST Optim 6Fr pacing leads and 10 Riata ST Optim 7Fr ICD leads) were followed up 1 year after implant in 4 French centres. The choice to use an Optim lead and its positioning was left to the implanter. Electrical measurements were performed at time of implant with a Pacing System Analyzer and during FU with the dedicated programmer.

Results: Thirty leads were implanted in the atrium (appendage 66%,

free wall 34%), 14 in the ventricle (apex 79%, septum 21%) and followed during 1 year.

Atrial leads Implant One year FU

P wave amplitude (mV)	3.6±1.9	3.5±2.1
Pacing threshold (V)	1.1±0.7	0.7±0.3
Impedance (Ohms)	455±109	377±112

Ventricular leads Implant One year FU

R wave amplitude (mV)	12.5±7.2	11.0±8.0
Pacing threshold (V)	0.7±0.2	0.8±0.2
Impedance (Ohms)	629±101	440±84

No lead dysfunction was reported.

Conclusions: After one year, electrical characteristics of both atrial and ventricular leads were comparable in terms of pacing, sensing and impedance to other St Jude Medical silicone leads of the former generation. The major benefit of the Optim leads appeared to be the improved handling during implantation, as demonstrated in the acute study. Durability will be evaluated with longer-term FUs.

SENSING AND PACING PROPERTIES OF A NEW ATRIAL LEAD WITH 1.1 MM TIP-TO-RING SPACING

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Introduction: Far-field-R-wave-sensing (FFS) is the most common cause for inappropriate mode switching in dual chamber pacemakers and may be avoided by using bipolar atrial leads with a very short tip-to-ring spacing. The aim of the prospective randomised AVOID-FFS study is to investigate the influence of the lead selection on the occurrence of inappropriate mode switching due to FFS. This analysis evaluates the pacing and sensing properties of the two different lead types at discharge (PHD), one and three months post-implant.

Methods: 204 patients (121 men; 74 +/- 8 years) with indication for a dual chamber pacemaker (40% sick sinus syndrome; 41% AV-block; 17% binodal disease; 2% other) were enrolled in the study and randomly assigned to either receive a bipolar atrial lead with a very short tip-to-ring spacing of 1.1 mm (Optisense, St. Jude Medical; study group; n=103) or a lead with conventional tip-to-ring spacing of 10 mm (Tendril 1388, 1688 or 1788, St. Jude Medical; control group; n=101).

Results: Patient characteristics, procedure and fluoroscopy time were similar in both groups.

	PHD			1 Month			3 Months		
	Study (n=98)	Control (n=98)	p	Study (n=99)	Control (n=96)	p	Study (n=94)	Control (n=93)	p
p-wave min.(mV)	2.1 ±1.2	2.5 ±1.3	0.019	2.1 ±1.4	2.7 ±1.3	<0.01	2.1 ±1.2	2.5 ±1.3	0.017
p-wave max.(mV)	2.8 ±1.4	3.2 ±1.4	0.049	2.7 ±1.3	3.3 ±1.4	<0.01	2.7 ±1.4	3.1 ±1.4	0.031
Pacing thresh.(V)	0.57 ±0.25	0.64 ±0.26	0.056	0.60 ±0.23	0.72 ±0.27	<0.01	0.59 ±0.18	0.71 ±0.21	<0.01
Impedance (ohm)	408 ±112	343 ±74	<0.01	363 ±67	336 ±67	<0.01	355 ±60	337 ±62	0.036

3 lead dislodgements were observed in the Control group.

Conclusions: The tested atrial lead with a 1.1 mm spacing has similar pacing and sensing properties as conventional leads with 10 mm spacing. Signal amplitudes are lower, yet in an acceptable clinical range, whereas the pacing thresholds are slightly better. The potential of the Optisense lead to avoid FFS can be evaluated after the analysis of the complete dataset.

CHARACTERISTICS OF PATIENTS WITH DIFFERENT INDICATIONS FOR PERCUTANEOUS LEADS EXTRACION

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The growing problem with pacing system infections and leads excess made the percutaneous lead removal technology widespread. The most frequent indications for the percutaneous pacing leads removal are endocarditis and localized pocket infection.

The aim of the study was to analyze patients characteristics that had percutaneous leads extracted due to endocarditis, localized pocket infection and other indications.

Methods: It was extracted 236 leads in 120 patients within the period of 2,5 years. All patients referred to university centre for lead removal underwent percutaneous procedure, none required cardiosurgery, there were no death related to procedure. The leads were removed by means of the Lead Extraction System using the rotational cutting force only. The mean age was 65.7 years (18 to 87). Parametric or nonparametric ANOVA were used for statistics.

Results: Indications for the leads removal: local infection (LI) - 47%, endocarditis (EN) - 27% and other (mainly lead excess) (LE) - 26%. Patients with EN had higher number of leads than pts with LI 2.45 vs 2.09 (p<0.05). LI patients had higher number of preceding pacemaker operations (2.59) than LE (2.0) (p<0.05). The time since last operation was the shortest in the local infection group (13.4 months) than in endocarditis group (25.1 months) and other (32.0 months) (p<0.05). The number of extracted leads were 2.33 (EN), 2.02 (LI), 1.55 (LE). The number of leads with abrasions was higher in the EN group (51.5%) than LI (8.9%) and LE (9.7%).

Conclusions: Patient with endocarditis have higher number of leads implanted than other and patients with local infection have higher number of previous pacemaker operations as well as shorter time since previous operation. In most cases with endocarditis we found abrasions on the leads.



Cardiac Electrophysiology

ANALYSIS OF CIRCADIAN RHYTHM AND HEART RATE VARIABILITY IN CHILDREN WITH SINUS NODE DYSFUNCTION

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The aim of our study was assessment of circadian rhythm and heart rate variability in children with sinus node dysfunction.

Study group: 33 pts aged 4.6 to 25 years (mean 14.5 year): 24 boys and 9 girls with SND - Group I and 21 patient without heart disease, age and sex matched - Group II

Group I consisted of: 8 pts without cardiac disease, 2 - with rheumatic fever, 12 - after Senning TGA correction, 4 - after TOF correction; 2 - with heterotaxy syndrome, 2 after ASD sinus venosus type correction with PAPVR, 2 - after VSD closure and 1 - after Fontan procedure (HLHS).

Holter monitoring with assessment of pauses longer than 1900ms; maximal, minimal and mean heart frequency; time domain HRV parameters: SDNN, pNN50 i rMSSD was performed in all patients.

Results: In Group I - 15 children (45.4%) had sinus rhythm and in 18 pts (54.6%) escaped rhythms, whereas in Group II all pts had sinus rhythm. In Group I significant decrease of minimal (HRmin-37.4 vs 47.8/min, p=0.001) as well as mean heart rate (HRs - 64.9 vs 85.0/min, p=0.0001) was noticed in comparison to Group II whereas there was no difference in maximal heart rhythm (HRmax - 162.2 vs 164.0/min). Time domain HRV parameters were significant higher in group with SND (SDNN-235.6 vs 160.5 ms; rmsSD- 24.9 vs 63.1 ms; pNN50-38.3 vs 21.8 %). Maximal pauses was logically longer in group I than in group II (maxRR 2204 ms SD 887.9 vs 1455 ms SD 125.3).

Conclusions: In patients with sinus node dysfunction essential lower minimal and mean heart rates were obvious noticed. Substantially higher time domain heart rate variability parameters in children with sinus node dysfunction could indicate autonomic dysfunction in this group of patients.

HEART RATE TURBULENCE PREDICTS NEW ONSET ATRIAL FIBRILLATION AFTER MYOCARDIAL INFARCTION; A CARISMA SUBSTUDY

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Purpose: Identification of non-invasive risk stratification parameters for prediction of new onset atrial fibrillation (AF) in a population with recent myocardial infarction (MI) and left ventricular systolic dysfunction.

Materials and methods: The study included 271 patients from the CARISMA study without atrial fibrillation at enrollment. All patients had acute myocardial infarction and a left ventricular ejection fraction <40. Within 21 days after the AMI, an insertable loop recorder was implanted and used for diagnosis of AF. Within 7 days after MI

and at week 6 after the MI the following non-invasive tests were performed: 24-hour Holter-recording including analysis of heart rate variability and turbulence indices, 2D echocardiogram and exercise testing with testing for presence of T-wave alternans. Patients were followed every 3 months for 2 years.

Results: 102 patients (37%) developed AF during the study, 30 of these before week 6 after MI. Among the test parameters, only heart rate turbulence <2.5 ms/RR interval, measured within 7 days after MI (HR=1.6, p=0.039) or at week 6 after MI (HR=1.9, p=0.015) independently predicted new onset AF. Other significant parameters included in the model were age > 70 years (HR=1.9, p=0.004) and moderate to severe mitral valve insufficiency (HR=2.0, p=0.005).

Conclusion: Heart rate turbulence independently predicts new onset AF after MI in a population with left ventricular systolic dysfunction after adjustment for age and echocardiographic risk factors. Heart rate turbulence measured at week 6 appears to be a more sensitive risk stratifier than if measured just after the MI, but almost 30% of the patients that developed new onset AF were diagnosed before week 6.

RECURRENT ATRIAL FIBRILLATION AFTER SUCCESSFUL ELECTRICAL CARDIOVERSION IN HYPERTENSIVE PATIENTS

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Background: Atrial fibrillation (AF) is the common form of arrhythmia associated with hypertension. Direct current cardioversion (ECV) is the most effective treatment for the restoration of sinus rhythm (SR). After successful ECV the current arrhythmias may occur from weeks and months.

Aim of study was to evaluate the factors that might influence this phenomena.

Methods: 142 patients (pts) (94 men, mean age 68 years) with persistent AF, after electrical conversion in SR, were included in this study. 58 pts were treated with angiotensin converting enzyme (ACE)-inhibitors and 63 with angiotensin-receptor blockers (ARBs). All pts underwent the echocardiographic (ECHO) study and electrocardiographic (ECG) evaluation. The following ECHO parameters were determined: ventricular end-systolic (LVES) and end-diastolic (LVED) diameters, septal (SIV) and posterior wall (PW) thickness, ejection fraction (EF), and left atrial diameter (LAD). On ECG were evaluated the presence and the type of biphasic P-wave in V1 and inferior leads and duration of P-wave.

Results: 39 of 142 pts (27.5%) had recurrence of AF. This occur in 18%, 26% and 51%, respectively in pts with EF <40%, EF between 40-50% and EF >50%. All pts had increased LAD. The SIV and PW thickness were increased in the pts with recurrence more than without. There were no statistically significant difference between the two groups regarding electrocardiographic parameters and the use of ACE-I or ARBs.

Conclusion: Recurrent arrhythmias after successful ECV in hypertensive pts is more highly correlated to diastolic than systolic dysfunction. Furthermore the treatment with ACE-I or ARBs does not prevent AF recurrences.

OBSTRUCTIVE APNOEA SYNDROME AND BRADY ARRHYTHMIAS. CASE REPORT

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Obstructive sleep apnoea syndrome (OSAS) can be associated with brady and tachy arrhythmias. Particularly the abnormal vagal activity during apnoea can bring to bradyarrhythmias and the indication to a pace maker implant.

This is the case of a woman 58 years old admitted to our ICU for pulmonary embolism after surgery operation. In anamnesis hypertension and obesity.

During Ecg monitoring we observed a lot of sinus arrest episodes with the longest pause of 13 seconds associated to apnoea periods. It is possible that the presence of pulmonary embolism represents an important factor in the pathogenesis of bradyarrhythmias both for hypoxia and parasympathetic stimulation due to the lungs receptors stimulation.

The subsequent Polisonnography was significant for high grade OSAS (AHI 39.3) especially obstructive, with clear desaturation (the slightest 79%) and evidence of sinus arrests (the longest 6253 msec) during apnoea.

The patient was treated with Bi-BAP ST with the following parameters: IPAP 18 cm H₂O, EPAP 7 cm H₂O, respiratory rate 12/min.

A second Polisonnography during Bi-BAP didn't show the presence of apnoea episodes nor sinus arrest.

In the follow up subsequent Ecg Holter didn't show any bradyarrhythmias.

The present case is emblematic to underline as a correct diagnosis and treatment of a patient with OSAS could avoided the implant of a pacemaker.

A NOVEL INDICATION FOR IVABRADINE: SUCCESSFUL TREATMENT OF INAPPROPRIATE SINUS TACHYCARDIA

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Introduction: Inappropriate sinus tachycardia (IST) is a relatively rare disease defined as increased heart rate at rest and/or inadequate response to physical or emotional stress. The disease affects predominantly young women without structural heart disease and results in sometimes severe symptomatology like palpitations, shortness of breath, chest pain, vertigo or presyncopal spells. Mechanisms include primary sinus node disease with increased automaticity, primary autonomic disorder with increased sympathetic activity and increased beta-adrenergic sensitivity of sinus node.

Therapy of IST is empirical. Betablockers, sotalol, verapamil or digoxin are frequently used usually with very poor response. In pharmacologically resistant cases, radiofrequency catheter modification or ablation of sinus node with pacemaker implantation is indicated.

Case report: Our case report describes a novel use of If channel inhibitors (bradines) in the management of IST. The 35-year-old women was successfully treated with Procoralan after failure of all conventional medication and both normal heart rate at rest and adequate heart rate increase during stress test was documented on the treatment by Procoralan 5 mg b.i.d.

Conclusion: Since ivabradine is usually very well tolerated, it might be considered as an alternative to invasive procedures with their inherent risks in cases where all commonly used medication fails. The main purpose of our report is to promote this novel indication of ivabradine in IST management as current indication include only angina in patients with coronary artery disease.

MAINTENANCE OF SINUS RHYTHM WITH IVABRADINE AFTER REVERSION OF PAROXYSMAL ATRIAL FIBRILLATION

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After cardioversion of paroxysmal atrial fibrillation (PAF) a new episode of AF occurs within the first 3 months after AF if prophylactic antiarrhythmic drugs are not prescribed. Ivabradine is a new medication that has HR-lowering properties acting specifically on the sino-atrial node by inhibiting the If current of cardiac pacemaker cells.

Aim of the study: To study the efficacy of Ivabradine (I) in order to maintain the sinus rhythm in patients (pts) with PAF after cardioversion.

Methods: Twenty six (26) pts (19 male, mean age 56 years) with PAF were included in the study. Hypertension was diagnosed in 57.6% of pts (n=15), ischemic heart disease in 11.5% (n=3), and 34.6% (n=9) had idiopathic AF. After reversion to sinus rhythm (SR) all patients received Ivabradine 5 to 7.5 mg daily in 2 divided doses according the HR at rest.

Results: Treatment effectiveness was evaluated once monthly during the observational period until 3 and 6 months. At 3 months after reversion all but 1 pts were in SR (96.1%). At 6 months 4 patients (15.3%) had at least 1 episode of PAF requiring cardioversion. No side effects were registered. Sinus bradycardia was noted in 23% (6/26) pts. No treatment discontinuation was needed.

Conclusion: After an episode of paroxysmal AF, treatment with Ivabradine is an effective, safe and promising therapy for the maintenance of sinus rhythm.

EARLY TREATMENT OF ATRIAL FIBRILLATION RECURRENCES AFTER ELECTRICAL CARDIOVERSION

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Atrial Fibrillation (AF) recurrences after electrical cardioversion (ECV) are high at one year follow up and relapses are often common in first two weeks (subacute recurrences). There is a time dependent electrical and structural atrial remodelling that evolves over days and weeks of sustained AF: atrial cycle length and waveform similarity index are expression of these processes.

We performed a retrospective study of 57 patients with persistent AF referred to our Day Hospital for ECV.

Mean age was 63.5 years (+10), 56% had coronary heart disease, 54% hypertension, 23% left ventricular hypertrophy, 9% dilated cardiomyopathy. Pre ECV treatment with amiodarone, angiotensin converting enzyme inhibitors or Angiotensin receptors blockers, aldosterone antagonist, beta blockers, statins and oral anticoagulant was done.

Biphasic shocks were delivered beginning with 70 joules, passing to 100, 150, 200 joules in a right anterior - left posterior patch position.

Measuring cycle length on a beat to beat basis and relative number of similar wave pairs (waveform similarity index) we observed that more AF is organized the easiest it is to convert to sinus rhythm (SR): 2 spontaneous SR conversions occurred before ECV: at the atrial cycle analysis they had the better degree of AF organization.

7 patients had AF relapses in the first two weeks after ECV: they had a pre-cardioversion pattern with greater AF disorganization as reflected by a decreased similarity index and shorter cycle length. These parameters observed early after AF recurrences significantly changed to a different pattern of more organized atrial cycles; 5 patients accepted a new ECV and all maintained SR conversion.

In conclusion: the higher degree of electrical organization early in

AF recurrences after ECV may offer a propitious intervention window for repeated CV with early SR conversion and prevention of remodelling induced AF perpetuation.

TRANS-THORACIC ELECTRICAL CARDIOVERSION OF ATRIAL FIBRILLATION: ROLE OF NURSE CARE IN MANAGING ASPECTS OF PATIENTS IN A DEDICATED DAY HOSPITAL LABORATORY

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Electrical Cardio-Version (ECV) is widely applied in atrial fibrillation (AF) patients and it consists in R-wave synchronized defibrillation-cardioversion (DC) shocks to restore sinus rhythm through a complete depolarization of cardiac muscle. The aim of this paper is to evaluate the role of a trained nurse in a dedicated Day Hospital Laboratory. Guide-Lines for AF recommend a period of anticoagulant therapy from 3 to 4 weeks before and of at least 4 weeks after an ECV, with stable aPT-INR target values comprised between 2,5 and 3,0. A preliminary evaluation of each AF patient will need the collection of several parameters: (1) a complete anamnesis; (2) a complete physical examination; (3) a basal electrocardiogram, in order to confirm the effective presence or absence of AF; (4) a blood sample to evaluate renal parameters, thyroid function and aPT-INR; (5) an Echocardiogram, when not already available, to evaluate left ventricle wall motion and left atrial diameters and area. Also patients' preparation to ECV need collaboration between Physician and Nurse, and it consists in: (a) enlightening the patients of the need of an empty stomach and evaluate the adhesion of the patients to this warning; (b) shaving patient's thorax and back; (c) removing movable prosthesis and necklaces; (d) a peripheral venous way, in order to administer the different drugs used in the ECV procedure; (e) monitoring electrocardiographic and arterial parameters and oxygen saturation.

After that, 2 paddles will be put on patient's anterior thoracic wall and on back thoracic one. Then the subject will be sedated and the ECV will be performed. Our observation period is of 4 hours, monitoring cardiovascular parameters. On these basis, it is quite obvious the opportuneness of having a good trained Nurse in order to make all works easier, particularly regarding points 3 and 4 and from (a) to (e).

PREDICTORS OF ATRIAL FIBRILLATION DURING REHABILITATION AFTER CARDIAC SURGERY

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Background: Atrial fibrillation (AF) developing during rehabilitation after cardiac surgery represents an underestimated but relevant phenomenon, occurring in 13-17% patients. Although this arrhythmic event has a significant impact on hospital resources, few data are available on involved risk factors. Moreover, the pathophysiological mechanisms have never been evaluated. The aim of the present study was to investigate potential risk factors for AF occurring during rehabilitation after coronary surgery.

Methods: We conducted a two-year retrospective study of 246 patients (mean age 67±10 years, range 32-84; 81% males) operated on for isolated coronary artery bypass grafting (CABG, n=195, 79%) or combined with valvular procedures (n=51, 21%). All patients underwent a cardiac rehabilitation program, starting 9±5 days after surgery, that included supervised breathing exercises, callisthenics and bicycle training sessions. The first AF episode that occurred during the rehabilitation period (21±7 days) was the study end-point.

Results: The overall AF incidence was 13%, ranging from 8% for CABG to 33% for combined procedures. Sixty-eight percent episodes occurred in patients who have already experienced AF in the surgery ward, whereas 32% represented new arrhythmic events. The independent risk factors for AF during rehabilitation were older age (OR 1.07, 95% CI 1.01-1.14), left atrial enlargement (OR 1.15, 95% CI 1.03-1.29), and mild-to-moderate pericardial effusion (OR 3.29, 95% CI 1.36-7.98). Focusing on cardiovascular therapy, only ACE-inhibitors therapy was identified as an independent risk factor for AF (OR 2.90, 95% CI 1.09-7.73), whereas beta-blockers withdrawn, pre-operative statins, N-3 polyunsaturated fatty acids and amiodarone therapy did not.

Conclusions: AF during rehabilitation after cardiac surgery is a quite frequent phenomenon. Risk factors for this arrhythmia are partly different from those usually identified for post-operative AF, suggesting a possible different pathophysiological genesis of this particular arrhythmia.

N-3 POLYUNSATURATED FATTY ACIDS THERAPY DECREASES THE INCIDENCE OF POSTOPERATIVE ATRIAL FIBRILLATION IN PATIENTS UNDERGOING CARDIAC SURGERY

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Background: Atrial fibrillation (AF) after cardiac surgery is associated with an increased morbidity and mortality. Preliminary data indicate that n-3 polyunsaturated fatty acids (PUFA) administered at time of surgery reduce the incidence of AF after coronary revascularization. We investigated whether preoperative PUFA therapy is associated with reduced postoperative AF occurrence after coronary surgery.

Methods: We conducted a two-year retrospective study of 246 patients (mean age 67±10 years, range 32-84; 81% males) operated for isolated coronary artery bypass grafting (CABG; n=195, 79%) or combined with valvular procedures (n=51, 21%). Postoperative AF was assessed by continuous telemetry until discharge.

Results: The overall incidence of AF was 41%, ranging from 39% for CABG to 45% for combined procedures. Forty-two patients (17%) received pre-operative PUFA therapy for a median of 4.5 days. Postoperative AF occurred in 24% of the patients with preoperative PUFA therapy compared with 44% of those patients without it (p=0.016). At multivariate analysis, PUFA therapy was associated with a 62% reduction in risk of AF development (OR 0.38, 95% CI 0.17-0.84). Older age was the other only independent risk factor for AF development (OR 1.09, 95% CI 1.06-1.13).

Conclusions: Preoperative PUFA therapy is associated with decreased incidence of postoperative AF. Patients undergoing coronary revascularization may benefit from a preventive PUFA approach.

INCIDENCE OF ATRIAL FIBRILLATION FOLLOWING CORONARY ARTERY BYPASS GRAFTING SURGERY

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Aim: To identify risk factors of atrial fibrillation development in short-term period after CABG.

Methods: 107 patients (M - 87) with coronary artery disease were underwent CABG and were enrolled in the study. 98 patients had I-II Heart Failure NYHA class. Before operation all patients were examined with ECG, Echocardiography, ECG monitoring.

Results: Patients were separated into 2 groups. The 1st group included 29 patients with paroxysmal AF. The 2nd group included 78 patients without AF onset. Rate of AF onset during the first 7 days after CABG was 27% (on-pump CABG - 48%, off-pump CABG - 20%). There was a significant increase in AF onset on the 2nd day postoperatively (31% of episodes). Older age was the most consistent risk factor of postoperative AF ($p=0.03$). Our results showed that 43% of patients older than 60 years had AF after operation. On the other hand, patients younger than 60 years had significantly less AF rate, only 17%. Statistically significant risk factors for AF development after CABG were preoperative AF ($p<0.0001$), left atrial enlargement ($p<0.005$), LV hypertrophy ($p=0.001$), diastolic dysfunction ($p<0.005$), absence of b-blockers treatment ($p<0.01$) and on-pump CABG ($p=0.003$). There were no differences in gender, history of myocardial infarction, NYHA class of HF, LVEF, number of grafted vessels, postoperative prolonged ventilation and potassium concentration in patients with and without AF. Patients who developed AF after CABG were discharged on the 19th day postoperatively, patients without AF were discharged more early, on the 15th day ($p=0.02$).

Conclusions: Patients after CABG have high rate of AF episodes within next 7 days. Treatment with b-blockers prevents AF following CABG. Risk of AF development depends on older age, previous history of AF, LA enlargement, LV hypertrophy, diastolic dysfunction, absence of b-blockers treatment and on-pump CABG. AF after CABG is associated with longer hospital stay.

PERCUTANEOUS LEFT ATRIAL APPENDAGE OCCLUSION IN PREVENTION OF THROMBOEMBOLIC EVENTS IN PATIENTS WITH ATRIAL FIBRILLATION

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Background: Thromboembolic stroke is one of the major complication of atrial fibrillation (AF). The most common place of thrombus formation (>90%) is the left atrial appendage (LAA). The efficacy of oral anticoagulation and surgical removal of LAA for stroke prevention in patients with AF has been established. Transcatheter LAA occlusion is a new method which has been examined for it.

Methods and results: Recently, two devices specifically designed for percutaneous transcatheter LAA occlusion have been introduced: the Percutaneous LAA Transcatheter Occlusion (PLAATO; Appriva Medical Inc) and WATCHMAN LAA system (Atritech, Inc). In our institution we have experiences with both systems.

Overall we introduced 54 LAA occlusion devices (26x PLAATO, 28x WATCHMAN) since 2004 until June of 2008. 22 patients of 28 with WATCHMAN device were enrolled in multicenter, randomized PROTECT AF trial. During the follow-up we observed:

- 2 cardiac tamponades (one of them was lethal) during the implant procedure (PLAATO)
- 2 cases of device dislodgement into aorta (1x PLAATO, 1x WATCHMAN)

- 5 TIA/strokes (ischemic) (3x PLAATO, 2x WATCHMAN)
- 1 thrombus formation on the occlusion device (WATCHMAN).

Conclusions: Our experiences suggest LAA transcatheter closure to be feasible and relatively safe (periprocedural complications were depend on learning curve). We conclude, that at present, percutaneous LAA occlusion may be an acceptable option in selected high-risk patients with AF (who are not candidates for oral anticoagulation).

MAGNETIC REMOTE ABLATION FOR LEFT ACCESSORY PATHWAYS

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Purpose: to access feasibility of retrograde aortic approach for radiofrequency catheter ablation (RFA) of left accessory pathways (APs) using NIOBE magnetic navigation system.

Methods and results: Study was conducted on 22 consecutive patients (8 women, 34.3 ± 12.5 years of age) with the apparent (17 pts) and concealed left-sided APs which were verified during electrophysiology study (left lateral APs in 18 cases, left anterior-lateral in 4 cases). Magnetic 4-mm tip, catheter Helios was passed through aortic valve and advanced to the target positions (atrial (18 cases) and ventricular (4 cases) insertion sites of AP) guided by using the X-ray examination and magnetic NIOBE system.

Three step maneuver used for catheter advancement through aortic valve. First step - catheter was advanced to aortic valve into aortic root using motor drive. Second step - tip of catheter was positioned near right coronary artery ostium using uniform magnetic field. Third step - catheter was passed through aortic valve guided by catheter advancer system (Cardiodrive) while curved by itself. These maneuvers were successful in all cases (22 pts). RFA was performed (50°C , maximum 50 W, mean duration 20 ± 7 s) in all cases. There were no complication associated with catheter advancement through aortic valve and RFA.

Conclusion: Retrograde aortic approach using NIOBE magnetic navigation system is safe and feasible technique for advancement of mapping catheter towards either left atrium or left ventricle.

3D LEFT ATRIUM ANATOMY RECONSTRUCTION BY AN ABLATION CATHETER VS A CIRCULAR MAPPING CATHETER DURING NAVX GUIDED ATRIAL FIBRILLATION ABLATION: A RANDOMIZED COMPARISON

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Purpose: The aim of our study was to compare an approach based on the geometric 3D reconstruction of the left atrium (LA) anatomy obtained by the use of the mapping/ablation catheter (AC) versus the use of a circular mapping catheter (CC) in patients undergoing atrial fibrillation (AF) catheter ablation (CA) guided by EnSite NavX system.

Methods: Eighty-six consecutive patients (pts., age 58 ± 12 years, 55 men) with symptomatic AF (paroxysmal 45; persistent 41) were randomized to an AC (42) or a CC (44) ablation approach. In the AC approach a cooled-tip mapping/ablation catheter (Biosense Webster Celsius Thermocool) was used to obtain LA anatomy 3D reconstruction while in the CC approach the anatomic reconstruction was performed by a circular deflectable twenty pole mapping catheter (Irvine Biomedical Optima).

Results: In CC group, compared with AC group, a significant reduction in fluoroscopy time (33.6 ± 10.7 vs 51.8 ± 11.2 min, $p=0.03$), in total

procedural time (150.6 ± 25.7 vs 190.3 ± 27.2 min, $p=0.04$) and in time needed for the anatomic geometric reconstruction (13.5 ± 4.8 vs 35.8 ± 8.2 min, $p=0.03$), was reported. Two non-fatal pericardial tamponade and two non-tamponading pericardial effusion were reported in AC group; no complications occurred in CC group.

Conclusions: LA anatomy reconstruction performed by the use of a circular mapping catheter is safer and significantly reduces fluoroscopy, geometric reconstruction time and total procedural time during NavX-guided AF ablation compared with the anatomic reconstruction obtained by the aid of a mapping/ablation catheter. These results are probably explained by a better spatial resolution and a faster LA anatomy reconstruction associated to the rapid high density mapping allowed by the circular multielectrode catheter; moreover the atraumatic and flexible properties of the circular catheter may lead to less incidence of myocardial damage during catheter movement.

INTRACARDIAC ECHOCARDIOGRAPHY: AN IMPORTANT TOOL TO AVOID COMPLICATIONS DURING PULMONARY VEIN ABLATION FOR ATRIAL FIBRILLATION IN CASES OF ANOMALOUS VENOUS RETURN

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Introduction: Pulmonary vein ablation (PVA) in atrial fibrillation has recently become a standard procedure. However, the procedure constitutes indispensable risks. Intracardiac echocardiography (ICE) is frequently used during transseptal (TS) puncture and navigation in the left atrium to minimize complications. We describe a case of anomalous venous return of inferior vena cava (IVC) that was detected because of routine use of ICE.

Case report: As a standard in every PVA procedure in our center, coronary sinus and ICE catheters were smoothly positioned in the right atrium (RA) from the left femoral vein and long 0,035" guiding wire for TS sheath was positioned from the right femoral vein. Everything seemed to be correct on anteroposterior X-ray view in so far that the long TS sheath was positioned over the wire and classical maneuvers were used to rotate the sheath against interatrial (IA) septum. As we never managed to see the sheath tenting against IA septum on ICE despite of repeated maneuvers, we made angiogram of IVC revealing that the vein split into two veins at the level of L1-vertebra. The first arm entered the RA from beneath and the second arm entered the RA from above through the SVC, running posterior to the RA mimicking the correct position of the guiding wire on the X-ray. The CS and ICE catheters entered by chance the first arm of IVC (true IVC) while the guiding wire entered the second arm (v. azygos). We describe the case in details based on embryogenesis of the IVC. The case is also documented by detailed angiograms and CT scans.

Conclusion: ICE is a useful tool for correct navigation during TS puncture. When navigated only by X-ray, one could be misled in cases of anomalous venous return with possible disastrous complications. We advocate for routine use of ICE in all PVA procedures.

EFFECT OF INTRAVENTRICULAR ASYNCHRONY ON SYSTOLIC FUNCTION, VENTRICULAR REMODELLING AND FUNCTIONAL STATUS AFTER ABLATE AND PACE STRATEGY FOR ATRIAL FIBRILLATION

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Background: Ablation of atrioventricular junction (AVJ) is proven strategy for patients with uncontrolled atrial fibrillation (AF). However, chronic right ventricular (RV) pacing can promote development of left ventricular (LV) asynchrony and congestive heart failure.

Aim: To determine the effect of intraventricular asynchrony on left ventricular (LV) systolic function improvement, LV remodeling and functional status of patients with AF after long-term ablate and pace strategy.

Methods and results: 29 patients (54 ± 11 years, 8 women) with drug-resistant AF underwent conventional echocardiography before AVJ ablation and echocardiography coupled with tissue Doppler imaging (TDI) after long-term RV pacing (68 ± 54 months). A septal-to-lateral delay < 65 ms was used as a cut-off value for LV asynchrony assessed by TDI. LV asynchrony was documented in 11 patients (group 1) and the remaining 18 patients without LV asynchrony consisted group 2. LV ejection fraction before ablation was similar in both groups ($43 \pm 12\%$ in group 1 and $44 \pm 12\%$ in group 2, $p=ns$) and after long term follow-up improvement in systolic LV function was better for patients without LV asynchrony (EF was $53 \pm 12\%$ in group 1 and $58 \pm 14\%$ in group 2, $p<0.05$). Reverse LV remodelling (reduction in LVEDD) was noted only in patients without LV asynchrony: LVEDD was 56 ± 7 and 58 ± 7 mm in group 1 and 59 ± 8 and 55 ± 9 mm in group 2, before and after ablation, respectively ($p<0.05$). However, there was no difference in functional status improvement in patients with and without LV asynchrony: NYHA class improved from 3.2 ± 0.6 to 1.4 ± 0.7 in group 1 and from 3.0 ± 0.7 to 1.4 ± 0.6 in group 2, before and after ablation, respectively ($p>0.05$).

Conclusions: Prevalence of significant LV asynchrony after AVJ ablation and chronic RV pacing is 37%. Patients without LV asynchrony, compared to patients with LV asynchrony, have better recovery in LV systolic function and reverse LV remodelling, but similar functional clinical improvement.

NEW ARRHYTHMIAS DURING FOLLOW UP AFTER SUCCESSFUL RADIOFREQUENCY CATHETER ABLATION OF OVERT ACCESSORY PATHWAY: UNRELATED DISEASE OR SIDE EFFECT OF CURATIVE TREATMENT?

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Background: New arrhythmias were recorded in 9-14% of the patients after successful radiofrequency (RF) ablation of accessory pathway (AP). There is concern that some of these arrhythmias could be related to initially curative RF lesion.

Aims: To evaluate prevalence, type and origin of new arrhythmias during follow-up after successful RF ablation of AP.

Methods and results: Study included 117 patients (83 men, 42 ± 13 years, structural heart disease in 15%) after successful RF ablation of a single overt AP. Patients were divided into the 'left-sided-pathway group' (70 patients) and 'right-sided-pathway group' (47 patients), based on the used ablation approach (retrograde aortic vs. right atrial approach). During a follow-up of 5.0 ± 3.3 years 6 patients died.

Twenty two cases of new arrhythmias were recorded in 20 patients (17%) and in 85% of the patients drug therapy was reinstituted on the symptomatic basis. The prevalence of new arrhythmias was higher in right-sided, then in left-sided pathway group (25% vs. 11%, $p=0.047$). New arrhythmias were distributed as follows: atrial fibrillation 20%, typical atrial flutter (AFL) 5%, atrial premature beats 10%, inappropriate sinus tachycardia 30% and ventricular premature beats (VPB) 45%. Lifethreatening ventricular tachyarrhythmias were not recorded. One patient underwent pacemaker implantation due to late progression to high-degree AV block, 6 years after ablation of right-septal AP. According to published ECG-based algorithms, presumed origin site of new arrhythmias were in proximity to previous RF lesion in 3 patients (2 VPB, 1 AFL) and far away from ablation target in 9 patients, while in 10 patients it remained unknown.

Conclusion: New arrhythmias or delayed AV-block complicated long-term course in 17% of the patients after successful RF ablation, especially after ablation of right-septal pathways. Most of these patients necessitate additional treatment. It seems that at least some of these arrhythmias could be related to previous RF lesion.

CATHETER ABLATION OF ATRIAL FIBRILLATION IN PATIENTS WITH DIABETES MELLITUS TYPE 2

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Introduction: Atrial fibrillation (AF) and diabetes mellitus type 2 (DM2) often coexist however a small number of patients with DM2 undergoing catheter ablation of AF have been included in previous studies. Aim of the study was to evaluate safety and efficacy of ablation therapy in DM2 patients with drug refractory AF.

Methods and results: From January 2005 to September 2006, 70 patients with diagnosis of DM2 and paroxysmal ($n=29$) or persistent ($n=41$) AF were randomized to receive either pulmonary vein isolation or a new antiarrhythmic drug treatment (ADT) with a 1-year follow-up. The primary end point was the time to first AF recurrence. By Kaplan-Meier analysis, at the end of follow-up 42.9% of patients in the ADT group and 80% of patients who received a single ablation procedure and were without medications, were free of AF ($p=0.001$). In the ablation group, a significant improvement in quality of life scores as compared to ADT group was observed. Six patients in ADT group (17.1%) developed significant adverse drug effects. Hospitalization rate during follow-up was higher in ADT group ($p=0.01$). The only complication attributable to ablation was 1 significant access-site haematoma.

Conclusion: In patients with DM2, catheter ablation of AF provides significant clinical benefits over the ADT and appears to be a reasonable approach regarding feasibility, effectiveness and low procedural risk.

RADIOFREQUENCY ABLATION OF ACCESSORY PATHWAY USING STEREOTAXIS REMOTE NAVIGATION SYSTEM

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Introduction: Catheter ablation of accessory pathway has become highly efficacious therapy for patient with AVRT and historically one of first indication for radiofrequency ablation. It's incidence 1-2:1000. The success of first procedure is about 95%. Conventional approach in some cases is not enough efficient. The remote magnetic navigation

Stereotaxis Niobe is a new technology that has allows ablate safely complicated cases with a high success rate.

Methods: We report a group of 107 patients undergoing conventional procedure with 96% success of first procedure, without any severe complication. 3% patients had a second procedure and one patient undergo third procedure. In our presentation we report the first experience with ablation of accessory pathway using remotely controlled ablation. We present a case report of radiofrequency ablation of accessory pathway in patient with complicated venous anatomy, performed by Stereotaxis-Niobe.

Conclusions: Remote-controlled navigation is useful tool to ablate difficult cases of supraventricular arrhythmias whose non pharmacological treatment cannot be solid conventionally. This approach promise a large expansion in the future.

SUCCESSFUL CATHETER ABLATION OF FOCAL ATRIAL TACHYCARDIA FROM THE NON-CORONARY AORTIC CUSP NAVIGATED BY INTRACARDIAC ECHOCARDIOGRAPHY AND 3D MAPPING SYSTEM

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Introduction: Peri-AV nodal atrial tachycardias (AT) can be challenging to eliminate safely by catheter ablation from the non-coronary cusp of the aortic valve. Intracardiac echocardiography (ICE) together with 3D mapping system (CARTO, Biosense-Webster, USA) offers the advantage of precise guiding within the aortic root.

Case reports: We describe two successful cases of radiofrequency (RF) ablation of focal AT originating from the anterosseptal region near the aortic root guided by ICE and CARTO. Two women (53 and 23 years old) were scheduled for catheter ablation of drug-resistant AT. Electrophysiology study demonstrated focal character of both arrhythmias with heart rate of 160bpm and 180bpm, respectively. The point of earliest right atrial activation as documented by CARTO was postero-superior to the His bundle, left atrial septum was activated significantly later. Detailed retrograde mapping of the aortic root, using navigation by ICE and CARTO, demonstrated that the local activation preceded activation in the right atrium. RF delivery (ThermoCool catheter, maximum power 20 W, low irrigation flow) in this region terminated the arrhythmia, which was no longer inducible in both cases. ICE proved useful in assessment of catheter contact and positioning within the aortic cusp in relation to catheter in the His bundle region. CARTO enabled tagging the site of earliest activation and re-navigation back. The distance of ablation site from His bundle recording site as measured by CARTO was 5 and 8 mm, respectively. No complications were observed.

Conclusions: Catheter ablation from the lower portion of the non-coronary aortic cusp guided on-line by ICE and CARTO system appears to be safe and efficacious means to eliminate focal peri-AV nodal AT.

EFFECTS OF SLOW PATHWAY ABLATION ON FAST PATHWAY FUNCTION IN PATIENTS WITH ATRIOVENTRICULAR NODAL REFRANT TACHYCARDIA: CRYO - VS. RADIOFREQUENCY ABLATION

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Introduction: Effective refractory period (ERP) of the fast pathway (FP) changes after radiofrequency (RF) ablation of the slow pathway

(SP) in patients with slow/fast atrioventricular nodal reentrant tachycardia (AVNRT). The change of autonomic activity, electrotone influence and thermal effect by the heat were suggested as the mechanism. The present study was designed to evaluate the effects of slow pathway cryoablation on fast pathway function in patients with AVNRT compared with RF ablation.

Methods: We prospectively analyzed electrophysiologic properties before and after successful SP ablation. Total 100 slow/fast AVNRT patients were enrolled and were randomly assigned to group A (Cryo-ablation group: N= 50, age 43±15) and group B (RF ablation group: N= 50, age 46±13). The SP/FP ERP, and RR/AH interval (as markers of autonomic activity) during sinus rhythm were measured before and after ablation.

Results: SP ablation was performed in 58 patients and modification in 42 patients. In group A, FP ERP were shortened significantly after cryoablation compared with preablation (375±74 ms vs 281±39 ms, p<0.01) without significant changes in AH interval (83±22 ms vs 85±21 ms, p=NS) and sinus RR interval (874±164 ms vs 860±177 ms, p=NS). In group B, FP ERP were shortened significantly (358±106 ms vs 289±84 ms, p<0.01) also after RF ablation without changes in AH (69±12 ms vs 69±10 ms, p=NS)/ RR (804±106 ms vs 780±107 ms, p=NS) interval.

Conclusions: FP ERP shortening were observed both after cryo- and RF ablation, without significant changes in autonomic activity. These results suggest that the electrotone influence is the main mechanism for the changes of electrophysiologic properties of the fast pathway after cryoablation.

EPISO-D STUDY: CHALLENGES IN CONDUCTING A RANDOMIZED TRIAL OF ABLATION TREATMENT VERSUS DRUG TREATMENT

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Purpose: EPISO-D was a multi-center, prospective, randomized trial to evaluate efficacy of pulmonary vein encircling in comparison to optimal anti-arrhythmic drug (AAD) therapy for prevention of atrial fibrillation (AF) in patients (pts) with drug refractory paroxysmal AF, but was stopped due to slow enrolment.

Methods: Thirty-seven (out of 128 planned) pts were randomized to ablation (ABL; n=19) or optimized AAD therapy (AAD; n=18) in 2004 and 2005. Primary endpoint was chronic success defined as sinus rhythm at 12mos, no AF recurrences after 3mos, no redo ablation and off AADs; AAD failed if crossover to ABL or change in AAD therapy was required.

Results: Thirteen out of 19 ABL pts underwent a complete ablation procedure. Chronic success was achieved in 46% of ABL and 6% of AAD pts. Six procedure- and/or device-related serious adverse events (SAEs) were seen in ABL: 1 tamponade, 1 pericardial effusion, 1 phrenic nerve paresis, 1 anaphylactic shock (before ablation), 1 PV stenosis, and 1 left atrial flutter. Two SAE in AAD pts who crossed over to ABL: 1 pericardial effusion and 1 ST segment elevation. The encountered difficulties were introduction of new AF ablation techniques and tools, crossover design causing bias towards chronic success in AAD, defining appropriate endpoints and obtaining strict protocol compliance.

Conclusions: Although low enrolment precluded significant efficacy conclusions, the study provided valuable understanding regarding challenges in conducting randomized trials that compare ablation to drug treatment in the context of learning curve and rapidly evolving technology.

PROSPECTIVE 1-YEAR COMPARISON OF QUALITY OF LIFE IN PATIENTS WITH AF UNDERGOING CATHETER ABLATION VERSUS TREATED CONVENTIONALLY

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Aims: Quality of life (QoL) was compared between AF patients, who underwent catheter ablation or were treated conventionally.

Methods: QoL was assessed using EQ-5D in 46 patients (pts) (10 F, 60±10 years) who had ablation (group 1), and 70 pts (22 F, 70±8 years) who were treated conventionally.

Results: In groups 1 and 2, AF was paroxysmal, persistent, and chronic in 26 (57%), 7 (15%), and 13 (28%) pts vs 24 (34%), 11 (16%), and 35 (50%) pts (all P=NS). Hypertension was present in 24 (52%) vs 38 (54%), diabetes mellitus in 8 (17%) vs 19 (27%), and history of stroke in 5 (11%) vs 6 (9%) pts (all P=NS). Coronary angiography had 16 (35%) pts (81% negative) vs 52 (74%) pts (50% negative) (P=0.04). Subsequent coronary revascularization was performed in 2 (4%) vs 17 (24%) pts (P=0.03). LVEF (%) was 60±9 vs 46±14 (P=0.0001), left atrial transverse diameter (mm) was 45±6 vs 48±6 (P=0.026). In groups 1 and 2, baseline, 6, and 12 month subjective QoL (%) was 65±17 vs 55±19; 72±16 vs 57±18; and 71±16 vs 56±18; and objective QoL (%) was 71±12 vs 64±18; 73±15 vs 66±15; and 76±14 vs 65±19. The difference was significant at baseline (P<0.01 for subjective and P=0.08 for objective QoL), and increased at 12 months (P<0.001 for subjective and P=0.001 for objective QoL). Intra-group 1 comparison showed trend to significant subjective (P=0.11) and objective (P=0.06) QoL improvement, while it was insignificant in group 2 (P= 0.07, resp. 0.63).

Conclusion: AF pts treated conventionally are older, more diseased and have worse baseline QoL. Despite more revascularizations their QoL stagnated over the next year, while QoL showed trend to significant improvement in patients after catheter ablation.

CARDIAC PERFORMANCE MEASUREMENTS BY ENSITE NAVX SYSTEM

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Introduction: Up to 30% of cardiac resynchronization therapy (CRT) patients do not realize benefit from CRT. Thus, any tool that improves CRT patient outcomes would be of significant value. We present here a case report that utilized EnSite NavX based motion mapping as a tool for real-time and operator-independent assessment of myocardial wall motion and cardiac performance during CRT implants.

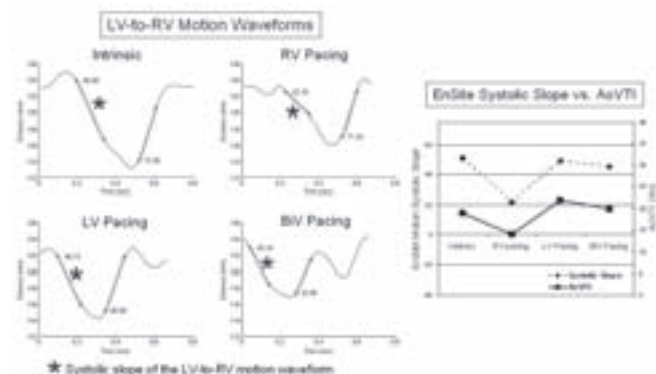
Case: A 76-year-old male patient with nonischemic cardiomyopathy, severe systolic dysfunction (ejection fraction: 19%), wide QRS duration (200ms) with left bundle branch block, and congestive heart failure (NYHA III) underwent CRT-P device implantation.

Methods: The 3-D motions of all the electrodes on the leads were tracked during intrinsic rhythm, RV pacing, LV pacing, and biventricular (BiV) pacing, using the EnSite NavX system (St. Jude Medical, St. Paul, MN, USA). Echocardiography was performed at 1-day post-implant for the same intrinsic and pacing interventions. Based on the recorded 3-D motions of the electrodes at each intervention, LV-to-RV motion waveform (see Figure 1) was computed from the relative displacements between LV and RV electrodes during a cardiac cycle. Systolic portion (asterisk in Figure 1) was identified in the motion waveform and the rate of displacement (systolic

slope) was calculated at each intervention. The systolic slopes were compared to the aortic velocity time integral (AoVTI) determined by the echocardiography.

Results: See Figure 1. The trend of AoVTI (solid line) across the different interventions resembles that of the NavX derived systolic slope (dotted line). Both echocardiography and EnSite NavX measurements indicated systolic function improvement by LV and BiV pacings.

Conclusions: EnSite NavX system has the potentials to characterize real time cardiac performance and facilitate optimization of CRT during implant.



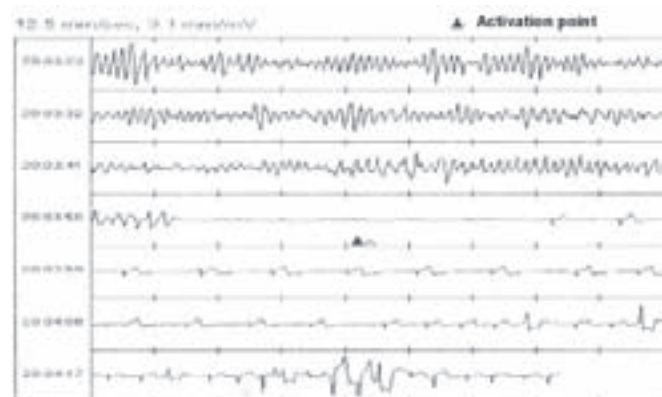
DETECTION OF FATAL ARRHYTHMIAS: RELEVANCE OF CONTINUOUS LONG-TERM MONITORING

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Syncope and palpitations are common symptoms in children. Non-invasive methods of trying to record an ECG during symptoms, including Holter monitoring, external cardiac event recorders and tilt testing have a low diagnostic yield. The use of ILR is recommended and previous reports showed that a diagnosis can be made within 1 year in similar patients.

The patient. We reported the case of a 5 year old child, male, with recurrent syncopal episodes, without structural heart disease, with congenital long QT, who referred to our institution for the implantation of a Reveal Plus ILR in 2000. The ILR was positioned in the parasternal region. A satisfactory ECG was confirmed over the site of implant by the use of surface electrodes prior to implantation. The monitor was secured to the underlying muscle using two nonabsorbable stay sutures thread through two suture holes in the



header of the device. The device was replaced with a new Reveal Plus in 2002 due to end of life and no arrhythmic episodes were recorded in the meanwhile.

In 2003 the device automatically stored a torsade de pointes shown in the figure below. The patient was then implanted with a dual-chamber ICD to prevent sudden death.

Conclusion: In patients at risk of fatal arrhythmias the monitoring strategy should never be stopped even if arrhythmic episodes are not detected for long time. The occurrence of fatal arrhythmias is unpredictable and an outcome may be achieved after a long monitoring period.

HEAD INJURY IN PATIENTS WITH TRANSIENT LOSS OF CONSCIOUSNESS IS A DIAGNOSTIC PREDICTOR OF CARDIAC ARRHYTHMIAS

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Background: Head injury due to a transient loss of consciousness (TLOC), which may be regarded as severe complication, sometimes occurs in the clinical setting. However, there are few reports on the diagnostic significance of head injury in patients with TLOC.

Methods: A retrospective analysis of 206 patients who have been referred to our cardiovascular section was performed. We evaluated the causes of TLOC and clinical characteristics. The Tilt-table test, ultrasound cardiogram, Holter monitoring and electrophysiologic study were performed depending on the patients status.

Results: The causes of TLOC were diagnosed as neurally-mediated syncope in 94 (45%), cardiac arrhythmias in 43 (21%), structural heart diseases in 14 (7%) and cerebrovascular diseases in 10 (5%) and the cause was not diagnosed in 45 (22%) patients. We classified the TLOC patients into cardiac arrhythmia (CA) group (n=43) and non-cardiac arrhythmia (n-CA) group (n=163) and data were compared between two groups. Clinical backgrounds of those patients were not significantly different as follows; 1) Gender was not different between two groups (male in 63% in CA, 61% in n-CA), 2) age was not different (61±18 y/o vs 57±19 y/o), 3) the left ventricular ejection fraction was not different (64±14% vs 67±10%). However, the prevalence of head injury was 30% (13 patients) in CA group, which was significantly higher than that in n-CA group (10%, 15 patients), p=0.003. The head injury was a predictor of cardiac arrhythmias in TLOC patients [Odds ratio (95% CI) 4.8, 1.8-9.9, p=0.03]. The cardiac arrhythmias included 19 bradyarrhythmias (atrioventricular block in 12, sinus node dysfunction in 7 patients) and 24 tachyarrhythmias (13 supraventricular tachyarrhythmias, 11 ventricular tachyarrhythmias).

Conclusions: In TLOC patients, head injury was the diagnostic predictor of cardiac arrhythmias in the present, which may indicate TLOC patients with head injury need specific studies on cardiac arrhythmias.

RELEVANCE OF AUTOMATIC DETECTION OF CARDIAC PAUSES WITH THE NEW GENERATION ILRS. A CASE REPORT

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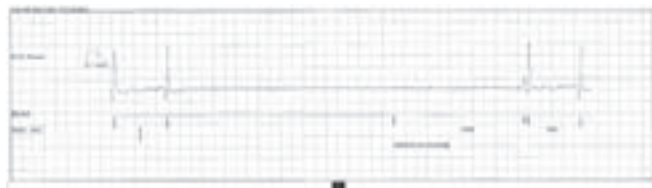
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Pre-syncope or near-syncope refers to a condition in which patients feel as though syncope is imminent. Symptoms associated with pre-syncope may be relatively non-specific (e.g., 'dizziness'), and tend

to overlap with those associated with the premonitory phase of true syncope. In some forms of syncope there may be a premonitory period in which various symptoms (e.g., light-headedness, nausea, sweating, weakness, and visual disturbances) offer warning of an impending syncopal event. Nevertheless symptoms are highly subjective and sometimes potentially misleading for diagnosis if associated only with pre-syncope, as reported by the patient.

The patient. A 79 year old man, with artificial aortic valve, documented episodes of paroxysmal atrial fibrillation and 5 pre-syncope episodes in the last 2 years, was referred to our institution for clinical examination. The patient was then implanted in July 2008 with Reveal DX (Medtronic) and both automatic and manually triggered event recordings were enabled. In 2 weeks the patient stored 14 manually triggered episodes related to symptoms like dizziness or palpitations. The analysis of the corresponding ECG traces stored by the device showed sinus tachycardia with frequent premature atrial contractions, without any relevant rhythm disturbances. During the same follow-up session we also analyzed 2 asymptomatic events automatically stored by the device: both events referred to the same clinical episodes and they were temporarily consecutive: as shown in the figure below the patient had a prolonged cardiac pause. During the episode the patient was resting at home and probably this may explain the absence of symptoms. The patient was then implanted with a dual-chamber PM.

Conclusion: Automatic detection of pauses by Reveal DX is reliable and useful to make a correct diagnosis of cardiac rhythm disturbances.



RELATIONSHIP BETWEEN AGE, GENDER AND PROTOCOL OF HEAD-UP TILT TEST AND THE TYPE OF VASOVAGAL REACTION IN PATIENTS WITH NEURALLY-MEDIATED SYNCOPES

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Aim: Evaluation of influence of age, gender and protocol of HUTT on type of VVS in pts with neurally-mediated syncope.

Methods: We observed 468 pts (200 men, 268 women) aged 18-61 yrs (mean 38.2 yrs) with syncope referred to HUTT. Other than neurally-mediated syncope were excluded in all pts based on previous examinations. In 385 pts standard HUTT (HUTT-STD) acc. to Westminster protocol was performed. Additional tilt tests with isoproterenol infusion (1-5ug/min i.v.) HUTT-ISO or sublingual nitroglycerine administration (0.4mg s.l.) HUTT-NTG were preformed in pts with negative HUTT-STD. Additionally 83 pts (50 women and 33 men) underwent HUTT acc. to Italian protocol (HUTT-ITL). HUTT was assessed as positive if reproduced syncope in pts with concomitant hypotension and/or bradycardia (asystole). Occurrence frequency of all VVS types was analyzed using chi2 test and influence of all parameters on occurrence frequency of each type of VVS using ANOVA test.

Results: Occurrence frequency of positive HUTT had two peaks: first in 20-30 yrs pts and second in 5-6 decade of life, independently of used protocol and type of vasovagal reaction. Multifactorial analysis showed significant influence of age and used protocol on HUTT result whereas influence of gender on HUTT result was not important. Frequency of occurrence of positive HUTT was dependent on used HUTT protocol (mean-63.0%; STD-31.4%; ISO-58.8%; NTG-72.0%; ITL-65.9%). It was no significant difference between men and women (mean-64.6 vs 60.8%) independently of used HUTT protocol. Percentage of cardioinhibitory reaction in relation to all positive HUTT was dependent on used protocol (mean-22.4%; STD-6.0%; ISO-7.4%; NTG-33.3%; ITL-24.1%), but it was independent of pts' gender.

Conclusions: Type of vasovagal reaction is related to patient's age and used protocol.

Cardioinhibitory vasovagal syncope was significantly more frequent after NTG administration in comparison to standard protocol.

There is no significant relationship between gender of patients and type of VVS.

USEFUL OF MRI IN THE DIAGNOSIS OF 2 CASES OF MIDVENTRICULAR OBSTRUCTIVE HYPERTROPHIC CARDIOMYOPATHY WITH VENTRICULAR TACHYCARDIA

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Case 1; 53-year-old male with palpitation was admitted to our institution. Upon arrival, He had ventricular tachycardia (VT) at a heart rate (HR) of 212 bpm and was given a rapid IV injection of amiodarone to restore sinus rhythm. In an MRI exam, the presence of myocardial hypertrophy and an apical ventricular aneurysm was markedly apparent. Delayed-enhancement MRI revealed hyperintense areas consistent with sites of thinning. Coronary angiography revealed no significant stenosis, but left ventriculography revealed midventricular hypertrophy, and a left intraventricular pressure gradient of 40 mmHg was noted. In electrophysiology, VT was induced reproducibly, and the patient was diagnosed with midventricular obstructive hypertrophic cardiomyopathy (MVO-HCM) with an apical ventricular aneurysm increasing the risk of VT. An implantable cardioverter-defibrillator (ICD) was inserted, and the patient continued to take amiodarone.

Case 2; 67-year-old female who was being treated for HCM admitted our institute because of palpitation and Holter monitoring revealed multifocal premature ventricular contractions (PVC). Apparent from the MRI were apical thinning that was not distinct in echocardiography and a distinct shadow thought to be a thrombus. Left ventriculography yielded the same findings, and the patient's condition was determined to be MVO-HCM with apical ventricular aneurysm. Amiodarone was introduced to counter the frequent PVC, after which electrophysiology revealed sustained VT causing hemodynamic collapse, so an ICD was implanted.

Ventricular aneurysmectomy is also considered to be a useful treatment to prevent arrhythmia, but in these 2 cases a decline in cardiac output was expected when the aneurysm was excised, so treatment in the form of amiodarone and ICD implantation was selected. Following treatment, no episodes of VT were noted in either case, and the course of both was satisfactory. MRI proved extremely useful in depicting apical ventricular aneurysms and identifying myocardial scars thought to be the focus of VT.

AN UNUSUAL CASE OF ARRHYTHMOGENIC RIGHT VENTRICULAR DYSPLASIA

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A 49 year-old woman was referred to our institution for a syncope during an episode of abdominal pain. In the past the patient experienced previous syncopal episodes considered secondary to chronic anaemia. The electrocardiogram (ECG) at rest revealed a normal sinus rhythm and ST elevation in lead V 1-2 (coved type). These alterations were presents in previous ECGs (2002). Cardiac echo performed in Emergency Room revealed a normal ejection fraction without contractility alterations; biochemical markers of myocardial necrosis were normal. ECG remained stable in the following days.

We performed an Ajmaline test: a ST elevation in V1-2 non diagnostic for Brugada Syndrome (BS) were recorded. A right ventricular dilation with apical trabecular hypertrophy, a latero-basal and apical systolic bulging were present at a control cardiac echo; left ventricle ejection fraction and contractility were normals. Ventriculography confirmed these alterations. A right ventricle dilation (telediastolic volume 206 ml) with a thin lateral trabeculated free wall and a systolic bulge in the apex and RVOT were detected (common findings in the ARVD) during NMR. Late potentials were present at signal averaged ECG.

Sometimes ARVD has ECG characteristic common to BS; in this unusual case the presence of three major criteria (severe dilated right ventricle with systolic impairment + right ventricle aneurisms and QRS > 110 msec) and a minor criterium (late potentials) with non diagnostic ECG abnormalities during ajmaline test, are suggestive of ARVD rather than BS.

In ARVD ST elevation in V1-2, a right ventricle enlargement with dysfunction tend to correlate with an enhanced risk of arrhythmias: therefore we decided to implant an AICD.

LEFT VENTRICULAR DIASTOLIC FUNCTION ASSESSMENT IN ATHLETES

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Introduction: Echocardiography is a noninvasive and very reliable method for the evaluation of significant morphology and left ventricular function indicators. Judo is a sport which can be characterised by intensive and shorttermed physical, isometric above all, effort, while football is predominantly characterised by longtermed physical isotonic effort. The dominant compensatory cardiologic mechanism in both groups of athletes is the left ventricular hypertrophy.

Aim of the study: The aim of this study is the evaluation of morphology and left ventricular function of a group of judo players and footballers in the period of competition time and their interactive comparison.

Material and method: Echocardiographic examination was done on all the patients by using transthoracic approach. 32 judo players, average age 24 ± 2.5 years, and the time of their active sports life 12 ± 1.6 years and 41 footballers average age 23 ± 2.9 years with 13 ± 1.4 years of active sports life were included in the study.

Results of the study: Mean values of interventricular septum and posterior wall thickness in both groups of athletes pointed at hypertrophy of the left ventricular myocardium. The enlargement of the enddiastolic volume index was present in footballers but not in judo players. The left ventricular mass index was statistically significantly enlarged in the group of judo players. Diastolic dysfunction was not registered in either group.

Conclusion: Concentric hypertrophy of the left ventricular myocardium is present in footballers, while eccentric hypertrophy of the left ventricular myocardium predominantly occurred in judo players. Diastolic dysfunction was not registered in either group of athletes eventhough hypertrophy of the left ventricular myocardium was registered.

VENTRICULAR ARRHYTHMIAS WITHOUT STRUCTURAL HEART DISEASE. EXPERIENCE FROM THE QUEBEC HEART INSTITUTE, 2000-2007

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Purpose: Ventricular arrhythmia (VA) without structural heart disease (WSHD) is infrequent and sometimes amenable to radiofrequency catheter ablation (RFCA). The aim of our study was to report the experience of a high volume electrophysiology (EP) laboratory.

Patients and method: From 2000 to 2007, consecutive pts referred for an EP study were included if: 1- they had a diagnosis of VAWSHD and 2- the VA was documented in 12-lead ECG.

Results: The study population consisted of 63 pts (33 men, 42 ± 15 years). Palpitations were reported in 51 pts (81%), syncope in 9 (14%), and cardiac arrest in 5 (8%). The VA was classified as sustained ventricular tachycardia (SVT) in 30 pts (48%), non sustained (NSVT) in 28 (44%), ventricular fibrillation in 5 (8%).

In 7 pts (11%), the VA was polymorphic: 6 received an implantable cardioverter-defibrillator (ICD). In 56 pts (89%), the VA was monomorphic (left bundle branch block morphology in 36 pts, right bundle branch block morphology in 20 pts). During EP study, VA was induced in 46 pts (SVT in 21 pts, NSVT in 14 pts, premature ventricular contractions in 11 pts), with isoproterenol in 26 pts. RFCA was performed in 38 pts (in the right ventricle-RV on 27 pts, in the left ventricle-LV on 11 pts). The procedural success rate was 76% (20/27 and 9/11) without any complications. In 13 pts, after a period of 1-40 months, a second RFCA was performed (10 RV, 3 LV). In 2 pts, after a period of 15-38 months, a third ablation was performed (1 RV, 1 LV).

Conclusion: Polymorphic VAWSHD is a potentially lethal arrhythmia and an ICD is generally implanted. RFCA for monomorphic VA is more difficult than commonly thought, even in experienced hands. Continuous efforts are needed to improve success rate.

ARE RIGHT VENTRICULAR PRESSURE CHANGES DURING INDUCED VENTRICULAR TACHYCARDIAS USEFUL IN PREDICT CLINICAL SYMPTOMS OF CEREBRAL HYPOPERFUSION?

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Background: ICD shocks occurring in conscious patients have a deleterious impact on the quality of life. We evaluated if a hemodynamic parameter, calculated from the right ventricular (RVP) or systemic arterial (AP) pressure signals, could predict early clinical symptoms of cerebral hypoperfusion during induced ventricular tachycardias (VTs).

Methods and results: We analyzed 42 tolerated (no symptoms) and 30 un-tolerated (syncope or severe symptoms within 30 sec from the onset) VTs, induced during electrophysiological study. The cycle

length (CL) and the hemodynamic data (mean AP and RVP, pulse AP and RVP and maximum AP and RVP dP/dT) were automatically sampled in 2 VT epochs: the “detection” window, from beat 24 to 32, and the “pre-intervention” window, immediately before the first therapeutic attempt. Although the CL and all the hemodynamic parameters (expressed as % change versus pre-VT values) were significantly lower in un-tolerated versus tolerated VTs both at detection and pre-intervention (with the exception of the mean RVP which progressively increased in both groups), ROC analysis demonstrated that only the pre-intervention pulse RVP showed no overlap between groups, providing 100% sensitivity and positive predictive value.

Conclusions: During induced VTs the reduction of pulse RVP is a better predictor of early cerebral symptoms than CL and other hemodynamic indexes. Since long-term RVP monitoring is feasible, this parameter could be incorporated into ICDs decisional path, in the perspective of reducing unnecessary, painful shocks.

A NOVEL MUTATION OF SCN5A LEADING TO BRUGADA SYNDROME, CONDUCTION DISORDERS, SUDDEN DEATH AND STRUCTURAL HEART ABNORMALITIES IN A VENETIAN FAMILY

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We described a family composed of 29 subjects with a novel SCN5A mutation leading to Brugada Syndrome (BS), conduction disorders (CCD), sudden death (SD) and structural heart abnormalities. Proband is a 60-year-old men presented for syncope after Propafenone intake for persistent AF. ECG showed transient “coved type” ST elevation V1-V3, RBBB and LAFB. Echocardiogram and coronary angiography were normal. PES induced VF and patient underwent ICD implantation. At follow-up he suffered from inappropriate ICD shocks occurred due to AF. Quinidine therapy was ineffective. Family members: 3 subjects died (brother’s proband died suddenly at 38 years) and 3 refused clinical evaluation. The others underwent clinical examination, ECG, echocardiogram and after written consensus Flecainide test, PES and genetic screening. Patients with type 1 ECG pattern and positive PES or syncope underwent ICD implantation

Results: ECG showed type 1 pattern in 3 subjects, type 2 in 1, LPFB in 2. Flecaïnide test was negative in 8 subjects with normal ECG. PES (in 9 patients): VF was inducible in 1 of 2 patients with type 1 ECG, that underwent ICD implantation; in all patients with type 1 ECG a prolonged HV interval was recorded. Mutation screening: sequence and splicing sites of genomic proband’s DNA of SCN5A gene were performed by DHPLC analysis and direct sequencing. A single substitution in heterozygosity of exon 9 (c.1140+2T>C) was identified in subjects with BS and CCD. This nucleotide change was absent in 100 control individuals. Follow-up: a 38-year-old man with LPFB at ECG died suddenly. Autopsy showed fibrosis at histological study. His mother and son had SCN5A mutation.

Conclusion: in this Venetian family, a novel mutation of SCN5A was found in subjects with BS, CCD, SD and structural heart abnormalities. Only patients with type 1 ECG were inducible at PES and patients with SCN5A mutation had prolonged HV interval.

HARLEQUIN SYNDROME: A CASE WITH CARDIAC INVOLVEMENT

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Introduction: Harlequin syndrome is characterized by unilateral absence of exercise induced facial sweating and flushing. This is the first reported case associated with cardiac symptoms.

Case report: A 34 year-old woman presents with a five-year history of frequent episodes of palpitations and chest pain associated with exercise. The patient noticed unilateral facial flushing after strenuous exercise, where her right face was dry and pale in comparison with the flushed, diaphoretic left side of her face. She had no significant past medical history. Physical examination was unremarkable. MRI and MRA did not identify a structural lesion. Pupillary testing with hydroxyamphetamine and phenylephrine suggested a third order sympathetic neuron disorder on the right. Tilt table test was positive for autonomic dysfunction. Loop recorder revealed several events of inappropriate sinus tachycardia, predominantly associated with chest pain but no dizziness or light-headedness. Exercise stress test done while patient was treated with atenolol was not completed secondary to pre-syncope symptoms and a hypotensive response to exercise. Repeat exercise stress test on midodrine demonstrated no symptoms with maximal stress, normal electrocardiographic responses with no signs of inducible ischemia and an appropriate blood pressure response to exercise.

Discussion: Unilateral facial flushing and sweating induced by heat is a normal response by an intact ipsilateral sympathetic pathway. However, anhidrosis and pallor of the contralateral side reflects an ipsilateral sympathetic deficit. The patient’s pupillary response suggests a superior cervical ganglion outflow defect on the right side. We believe this disorder is due to inadequate unilateral superior cervical ganglion outflow leading to contralateral compensatory stellate and cardiac ganglia overflow resulting in the cardiac symptoms and their response to alpha-blockade. Harlequin syndrome is a rare but physically striking syndrome that is typically benign and warrants no treatment. This is the first reported case involving cardiac symptoms and successful treatment with midodrine.

IMMUNOLOGICAL ASPECTS OF WOLFF-PARKINSON-WHITE SYNDROME

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Wolff-Parkinson-White (WPW) syndrome is argued to be genetic determined disease. Nowadays there appear molecular explanations of the WPW syndrome. We suppose that autoimmune inflammatory factors may influence the manifestation of this pathology. Cytokine disbalance and loss of selftolerance may be also genetically predisposed. In this study we estimated the level of proinflammatory cytokines and anti-heart autoantibodies in patients with WPW syndrome. In 29 patients with WPW syndrome the level of tumor necrosis factor α (TNF- α) and interleukin 1 β (IL-1 β) was measured by ELISA and antiheart autoantibodies were determined by indirect immunofluorescence. Control group consisted of 30 healthy volunteers. There was revealed significant elevation of the proinflammatory cytokines’

level in patients with WPW ($p=0.001$ for $\text{TNF-}\alpha$ and $p=0.005$ IL- 1β). The frequency of antifibrillar autoantibodies' determination was also elevated ($p=0.001$). Autoantibodies were determined in 10 % patients in titer 1:20, in 61% patients – in titer 1:40, in 19% patients – in titer 1:80, in 5% patients – in titer 1:160. The dilution of serum for detection of autoantibodies to structures of sarcolemma in patients with WPW was 1:20 in 29% cases, 1:40 in 32% cases, 1:80 in 10% cases, which was more frequent than in the control group ($p=0.007$). The frequency of antinuclear antibodies was higher in the group of patients either ($p=0.005$). These autoantibodies detected in titer 1:20 in 14% cases, in titer 1:40 – in 29% cases, in titer 1:80 – in 19% cases, in titer 1:160 – in 14% cases.

In view of our findings subclinical autoimmune inflammation may be regarded as one of reasons of the WPW syndrome. Further studying of the molecular mechanisms and genetics of WPW syndrome may shed some light on pathogenesis and ways of non-surgical treatment of this arrhythmia.

INTERATRIAL DELAY IN WOLF-PARKINSON-WHITE WPW SYNDROME

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Introduction: The aim of this study is studying relation between interatrial conduction delay time and atrial fibrillation (FA) events in Wolff-Parkinson -White (WPW) patients.

Material and methods: 44 patients with ECG preexcitation signs undergone through electrophysiologic transesophageal study were classified into two different groups: 18 patients in whom FA was induced and 26 not induced FA. Both groups were compared with each other and with 31 controls.

Results: Patients with preexcitation present a prolonged interatrial conduction time compared to control (73 ± 11.2 msec vs 44.5 ± 6.11 ; $p<0.002$). This delay in patients with FA induced is more than patients without it (81 ± 9.38 msec vs 44.5 ± 4.22 msec, $p<0.0001$). In conclusion comparison between patients without FA and controls has no significant difference.

Conclusions: WPW patients with interatrial conduction time longer than 80 msec should be submitted to transcatheter ablation instead of an expectation attitude.