p<0.05), chronic kidney disease (r=0.258, p<0.05) and left ventricular end systolic diameter (r=0.347, p<0.05). After a median follow-up of 163 days, the VD ratio had significantly decreased (0.83±0.09 vs 0.72±0.11, P<0.05) in patients receiving CRT-D. In addition, the VD ratio had significantly increased (0.77±0.07 vs 0.84±0.05, P<0.05) in patients receiving single-chamber or dual-chamber ICDs.
Conclusions: HF patients with lower ejection fraction had higher circulating, nonfunctional VD levels. CRT decreased the proportion of nonfunctional sodium channels, which might explain lower arrhythmic risk related to CRT therapy.

AB16-06

RELATION BETWEEN ECG PARAMETERS AND LV ELECTRICAL DELAY IN PATIENTS WITH LEFT VENTRICULAR DYSFUNCTION

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Introduction: The ability to derive left ventricle (LV) electrical delays (Q-LV) from the 12-lead ECG is a critical element to improving application of cardiac resynchronization therapy (CRT). The purpose of this study was to examine the ECG parameters correlated with longer Q-LV.
Methods: one hundred seventy-two patients (130 men, 73±8 y; LV ejection fraction 29 ± 6%) underwent CRT. In according to baseline ventricular conduction delay the patients were categorized in two groups: 1) left bundle branch block (BBB) pattern (QRS d ≥ 130 ms, monophasic QS or rS complex in lead V1/V2 and a RsR complex in lead V6; 2) right (RBBB) pattern (QRS d ≥ 130 ms, dominant terminal R wave in lead V1 with triphasic complex rSR, qR, or R). The following 12-lead baseline ECG parameters were evaluated in LBBB pattern: a) QRS d (> 150 ms), b) mid-QRS notch/slurring in ≥ contiguous lateral leads, c) r wave ≥1 mm in lead V1 and/or a q wave ≥1 mm in lateral lead, d) left QRS axis deviation, e) intrinsicoid deflection (QRS onset to R peak ≥ 60 ms in V6). In patients with RBBB pattern we evaluated: a') QRS d (>150 ms), b') S wave in leads I/aVL, c) left QRS axis deviation. The maximum Q-LV measured into lateral/postero-lateral tributary veins of the coronary sinus were correlated with the above ECG parameters and clinical variables. The frequency of patients with Q-LV>110 ms (cut-off value) was also evaluated in both BBB pattern groups in according to QRS parameters.
Results: In LBBB pattern QRS > 150 ms and mid-QRS notching independently correlated with Q-LV (B=15.3, p<0.0001; B=27.7, p<0.0001 respectively). A Q-LV > 110 ms was observed in all patients (75/75) when both of these ECG parameters were present. In RBBB pattern only S waves in DI/aVL predicted a longer Q-LV value (B= -36.5, p>0.0001). A QLV >110 ms was found in 7/10 patients with a QRS > 150 ms without S wave DI/aVL whereas none patients had QLV >110 ms with typical RBBB (S waves in DI/aVL) despite of QRS > 150 ms. LV end systolic volume correlated with Q-LV only in patients with LBBB pattern.
Conclusions: A longer QRS (>150ms) and mid-QRS notching are strong predictors of longer Q-LV in LBBB pattern patients. In RBBB pattern the absence of S wave in DI/aVL predicts longer Q-LV. These ECG parameter identify patients who may respond to CRT despite RBBB pattern.

ABSTRACT AB17: CRT: Emerging Methods and Technology

Thursday, May 5, 2016
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AB17-01

WIRELESS LV ENDOCARDIAL STIMULATION FOR CARDIAC RESYNCHRONIZATION: LONG-TERM (12 MONTH) EXPERIENCE OF CLINICAL EFFICACY AND CLINICAL EVENTS FROM TWO CENTERS

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Introduction: CRT does not always produce the desired clinical outcome due to problematic CS access, lead placement / dislodgement, phrenic nerve stimulation, chronic reliability lead issues, worsening heart failure or high risk ICD / pacemaker upgrades. Endocardial pacing for CRT is an alternative. The Wireless Stimulation of the Endocardium System (WiSE) is comprised of a battery-powered ultrasonic transmitter implanted in a left intercostal space and a leadless pacing electrode fixed directly onto the LV endocardium, replacing the CS lead. The WiSE System was evaluated in the multicenter SELECT-LV study.
Methods: At Homolce and Aalborg Univ. Hospitals, WiSE was implanted in 12 and 10 pts, respectively, who were indicated for CRT, but untreated due to various difficulties. Twenty pts were followed for 12m. Primary and secondary endpoints were evaluated at 1 and 6m.
Results: Baseline characteristics: 19 male; NYHA 2.4±0.7; age 67.3±6.4 yrs; BMI 29.5±4.5; intrinsic and RV paced QRSs were 174±31 ms and 193±23 ms respectively; EF 26.6±6.0%; etiology ICM-10 / NICM-10 / both-2. By 12m, there was 1 death, 1 acute MI, 2 HF admissions in1 pt, and a resolved CVA in 1 pt who had failed to follow the post-op anticoagulation regimen. There were no instances of cardiac perforation or LV electrode dislodgement. Mean implant duration was 534±210 days. Consistent CRT was achieved in 100%, 91% and 94% of pts at 1, 6 and 12m. BiV QRS durations were 133±25, 131±23 and 127±20 ms at 1, 6 and 12m respectively. Reductions in BiV QRS duration compared with the baseline QRS were 40±26, 41±30 and 48±33 ms at 1, 6 and 12m respectively. The 6m clinical composite scores were: 77% improved, 18.6% unchanged and 4.5% worsened.
Conclusions: Wireless endocardial LV pacing is an alternative approach to CRT. These 12m data demonstrate the clinical benefit to our pts, previously untreated by CRT. BiV pacing is maintained with reverse electrical remodeling evident 12m post implant.

AB17-02

LEADLESS LV ENDOCARDIAL STIMULATION FOR CRT: FINAL OUTCOMES OF THE SAFETY AND PERFORMANCE OF ELECTRODES IMPLANTED IN THE LEFT VENTRICLE (SELECT-LV) STUDY

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Introduction: Patients indicated for conventional CRT (CRT) do not always benefit due to CS lead issues both acute and chronic, inability to place the lead or not responding to CRT. LV endocardial pacing has been proposed as a potential solution. SELECT-LV assessed the safety and performance of a novel Wireless Stimulation of the Endocardium System, (WiSE), providing endocardial LV stimulation.
Methods: This non-randomized EU study of CRT included pts with either a failure of CRT, or requiring an upgrade and were unsuitable for CRT. WiSE includes a leadless pacing electrode implanted at the endocardial LV free wall. The electrode is activated by a submuscular ultrasonic transmitter, synchronized with RV pacing pulses from a co-implanted pacer/ICD. Primary end points of safety / performance and secondary endpoints for safety / performance / preliminary efficacy were at 1 and 6m.
Results: 39 were enrolled but 3 (8%) of pts did not have an adequate acoustic window, 1 withdrew pre-implant, and 1 had intra-operative VF precluding successful implantation; this pt died a few days later. There were successful implants in 34 of 35 pts (97%), and 34 (97%) pts completed 6m follow-up. Baseline data: age 65±8 yrs; 29 (85%) male; 44% ICM, 44% NICM and 12% both; EF 26.0±6.2; NYHA 2.6±0.6; and baseline intrinsic QRS 170±29 ms. There were 3 (8.5%) AEs peri-operatively and 8 AEs (22%) by 1 month. BiV pacing at 1 and 6m was demonstrated in 33 (97%) of 34 pts and in 31 (94%) of 33 pts respectively. Mean QRS reductions were 51 and 36 ms compared with baseline RV paced QRS and baseline intrinsic QRS respectively. At 6m, 63% of pts demonstrated ≥ 5% increase in EF at 6m; the mean increase was 7.1±8.0%. Compared with baseline, at 6m, 67% pts improved ≥1 NYHA class and 52% patients showed ≥15% improvement in LVESV. The clinical composite score at 6m showed that 28 (85%) improved, 3 (9%) unchanged, and 2 (6%) worsened.
Conclusions: This multicentre experience has demonstrated the feasibility of direct, wireless endocardial LV pacing to achieve CRT in patients with a previous CRT failure or previously unsuitable for CRT.

AB17-03

IN VIVO NON-INVASIVE ULTRASOUND-BASED CARDIAC PACING IN PIGS

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Introduction: Currently, no non-invasive cardiac pacing device acceptable for prolonged use in conscious patients exists. The main approach is invasive, employing intravascular catheters, which has associated risks. Focused ultrasound can be used to perform remote pacing using reversibility of electromechanical coupling of cardiomyocytes. This technique might be useful in the short term in the clinical settings in various conditions: temporary pacing for bradycardia or any clinical condition with risks of asystole; terminating or examining the inducibility of tachyarrhythmia; screening and optimization of cardiac resynchronization therapy. Here we described an extracorporeal cardiac stimulation device and study its efficiency and safety.
Methods: In vivo non-invasive stimulation was performed using 314 sonications in 4 anesthetized pigs using a focused ultrasound device (Image Guided Therapy, France, 256 elements, 13/13 cm aperture/focal, operating at 1 MHz) under MR-guidance (Siemens Avanto 1.5T, Germany). The animals were injected with ultrasound contrast agents using SonoVue (Bracco, Italy. Two consecutive 0.1 mL.kg-1 boli intravenous injections were performed in each animal. At the end of each in vivo experiment, a navigated delayed inversion-recovery 3D Flash sequence was performed. The animals were injected with 0.2 mmol.kg-1 gadoterate meglumine (Dotarem®, Guerbet, France) and scanned 15 minutes post injection. Masson's staining was performed to assess acute damages screening from acoustic stimulation.
Results: Using this setup, consistent cardiac stimulation was achievable for up to 1 hour sessions in 4 different animals. No damage was observed in inversion-recovery MR sequences performed in vivo in the 4 animals. No signal increase can be seen in the myocardium in the delayed-enhancement MR images that would indicate irreversible injury. Histological analysis revealed no differences between stimulated and control regions, for all in vivo cases.
Conclusions: To the best of our knowledge, this study is the first in vivo proof of feasibility of controlled non-invasive ultrasound-based cardiac stimulation in large animals. Preliminary safety results showed that this novel technology offers good prospects for clinical developments.

AB17-04

PERMANENT HIS BUNDLE PACING IS AN EXCELLENT ALTERNATIVE TO CARDIAC RESYNCHRONIZATION THERAPY

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Introduction: Cardiac resynchronization therapy (CRT) is effective in patients with cardiomyopathy, heart failure, LBBB and / or right ventricular pacing. Permanent His bundle pacing (HBP) has been reported to correct LBBB and normalize conduction in patients with AV block. The aim of the study is to assess the feasibility and outcomes of HBP in CRT eligible or failed pts.
Methods: HBP was attempted in patients with previously failed LV lead, non-responders or in pts with AV block as an alternative to CRT. HBP was performed using Medtronic 3830 pacing lead. Implant characteristics, NYHA functional class and LVEF were assessed in follow-up.
Results: HBP was successful in 23 of 25 pts (age 72±14 yrs, male 15, CAD 9, LBBB 13, AV block 12). Indications: failed LV lead 11, non-responder 2, primary HBP 8, combined LV and HBP 4. NYHA functional status improved from 2.9 to 1.6 (p=0.05); LVEF improved from 32±10 to 46±11% (p=0.001); QRS duration decreased from 169±24 ms to 113±17 ms with HBP (P<0.001).
Conclusions: NYHA functional class, LV systolic function and heart failure symptoms improved with HBP. Permanent HBP is an excellent alternative to CRT in patients with failed LV lead, non-responders or as primary option in pts with AV block and heart failure.