determines the activation patterns during the arrhythmia. The purpose of this study is to analyze the activation frequencies during VF in isolated perfused healthy human hearts without the interference of extrinsic factors that could modulate the VF activation patterns.

**Methods:** Three explanted hearts not suitable for cardiac transplantation obtained from donors without structural cardiac disorders were used to obtain multiple transthoracic recordings with transmural needles (n=24), each equipped with four unipolar electrodes (interelectrode distance = 4 mm). Informed consent was obtained from the relatives of the deceased patients, and the study was approved by the Ethical Review Board. Hearts were perfused according to the Langendorff technique with whole blood, and the electrodes were inserted in the left, and right ventricular myocardium. Spectral techniques were applied to analyze the VF recordings obtained during the electrically induced arrhythmia. The dominant frequency of the spectrum was obtained in each channel.

**Results:** The highest mean dominant frequencies were obtained in the subendocardium of the posterior part of both the left ventricle (8.9±1.8 Hz vs 6.4±1.5 Hz in anterior wall, p<0.0001), and the right ventricle (7.1±1.1 Hz vs 6.3±1.0 Hz in anterior wall, p<0.05). The location of the maximum values varied in each of the three cases, corresponding to the posterior wall of the left ventricle in one case (11.3 Hz), the posterior wall of the right ventricle in another (7.8 Hz), and the posterior zone of the junction between septum and right ventricle in the third (8.6 Hz). In the left ventricle no clear endo- to epicardial gradients were observed, though the right ventricle tended towards slightly higher values in the subendocardial recordings.

**Conclusion:** The distribution of activation frequencies during VF shows heterogeneous patterns, with no clear endo- to epicardial gradients. The maximum dominant frequencies are obtained in the posterior zones of both ventricles.

1917 | BEDSIDE
Multi-directional ventricular conduction on magnetocardiography predicts poor prognosis after CRT implantation

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**Backgrounds:** Cardiac resynchronization therapy (CRT) is an established option for advanced heart failure (HF) with electro-mechanical dyssynchrony. However, it provides no benefit in an approximately one third of the patients, which is unpredictable by any clinical tool. We hypothesized that (1) magnetocardiography (MCG) capable of delineating ventricular conduction sequences with high spatio-temporal resolution identify heterogeneous (multi-directional) left ventricular (LV) intraventricular conduction (presumably indicative of local block) and that (2) it would hamper the CRT effect, thereby predicting poor prognosis after CRT implantation.

**Methods:** We analyzed 64-Ch MCGs (1kHz) in 52 patients with advanced HF (LVEF 25±9%) and QRS prolongation (147±31ms) on ECG before CRT implantation. According to the QRS current arrow mapping, they were divided into Group-A with uni-directional homogeneous ventricular conduction (n=33) and Group-B with multi-directional heterogeneous ventricular conduction patterns (n=19). CRT responder was defined when LVEF decreased >15% or LVEF increased >15%.

**Results:** Baseline LVEF, BNP, and NYHA class were comparable between the groups. After 6 months, responders were more frequently found in Group-A (27/33) than Group-B (4/19, p<0.01). More importantly, during the mean follow-up of 657±204 days, Kaplan-Meier analysis revealed a marked difference in mortality (death and IADV implant, 0/33 in Group-A, 8/19 in Group-B, p<0.001).

**Conclusions:** Our MCG analysis indicated that prolonged but homogeneous LV conduction may represent a characteristic of the candidate who benefits from CRT, while the presence of multi-directional heterogeneous conduction may negate the efficacy of CRT, thereby predicting poor prognosis after CRT implantation.

1918 | BENCH
Assessment of leadless pacemaker performance

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**Background:** Since their invention, cardiac pacemakers have provided significant lifesaving therapy for millions of people. However, a device small enough to be placed within the heart would eliminate the pocket and the lead and thereby many of the modern pacemaker complications. We have created a 7-year TVIR pacemaker with a volume less than 1 cc that can be placed directly within the heart. In this study, we assessed the performance of the device design by comparing the pacing thresholds, R-wave amplitudes, and impedances of leadless pacemaker prototypes using three separate methods of measurement.

**Methods:** One prototype was placed in the RV apex in each of 16 sheep via the jugular vein for a period of 6 weeks. The prototypes were constructed of a titanium main body, a distal titanium nitride coated pacing electrode with steroid, and a proximal titanium nitride ring. To allow direct measurement of the electrode potentials and currents, the electrodes were externalized through small wires that exited the prototype at the proximal end, passed through the jugular vein, and crossed the skin between the shoulder blades. The pacing thresholds, impedance and R-wave amplitudes were measured with both a breadboard of the pacemaker circuitry and a Medtronic 2290 pacing system analyzer at implant, and each week for 6 weeks.

**Results:** The pacing thresholds at 0.2 ms and the R-wave amplitudes measured no data in the analyzer and the breadboard can be seen in Figure 1. The measurements were similar between the two methods for both the threshold and R-wave measurements. In addition, both the thresholds and the R-wave amplitudes were stable over the 6 week study.

**Conclusion:** Leadless pacemaker accurately measures pacing thresholds and R-wave amplitudes.

PRACTICAL ASPECTS OF BIOMARKERS IN HEART FAILURE

1935 | BEDSIDE
Prognostic value of NT-pro-C type natriuretic peptide (NT-proCNP) in heart failure patients with preserved and reduced ejection fraction

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**Background:** BNP and NT-pro-BNP are established markers in chronic heart failure (HF). C-type Natriuretic Peptide (CNP) belongs to the same peptide family. However, data are available of CNP as marker in HF.

**Objective:** To assess the prognostic power of the N-terminal part of pro-CNP (NT-proCNP) in HF.

**Methods:** In 571 patients, NT-proCNP was measured at discharge. Primary end-point was a composite endpoint of all-cause mortality and HF hospitalization after 18 months. Secondary end-point was all-cause mortality after 3 years.

**Results:** Mean age was 71±11 years, 62% was male and left ventricular ejection fraction (LVEF) was 32±14%. In a multivariate linear regression model, NT-proCNP showed a positive correlation with NT-proBNP and a negative correlation with renal function and female sex. 240 Patients reached the composite end-point and 254 died. Interaction analysis revealed a strong interaction between NT-proCNP and LVEF for both endpoints (p-value for interaction: 0.003 respectively 0.008). Therefore further analysis was stratified into patients with a reduced (HFrEF) or preserved (HFpEF) LVEF. In multivariate analyses, each doubling of