Innocor, Innovision), impedance cardiography (ICG, CNSystems) and the aortic Doppler time velocity integral (TVI). Measurements were obtained at rest with the patient in supine and upright position and during limited bicycle exercise (20 W). RB was used as the reference method.
Results: CO estimates from the IHM correlated well with RB in all body positions and during limited exercise and was better correlated with RB compared with ICG and TVI (table). During exercise, ICG was not useful for CO estimation due to artifacts by body movement.

Correlation with RB (r)

	IHM	ICG	VTI
Supine	0.88**	0.64*	0.47
Upright	0.66*	0.49	0.54
Exercise	0.62	0.08	not performed

*p<0.05; **p<0.001

Conclusion: A right ventricular pressure contour algorithm derived from an implanted hemodynamic monitor provides a reasonable estimate of CO in patients with CHF. The CO estimate from the IHM was superior to ICG and TVI. The algorithm may increase the ability of continuous monitoring to assess acute and chronic hemodyanmic changes in patients with CHF.

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Predictive value of high voltage impedance on heart failure status evaluated by LVEF and NYHA classification

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Background: prior studies have proven decreasing pacing impedance (LVI) concurrent with HF exacerbation. This study evaluated the predictive value of high voltage impedance (HVI) on HF status and its relation to pacing impedance.
Method: the study included 571 ICD patients (66±11.8 years, 83.5% male) with updated LVEF and NYHA classification at implant. The high voltage (at 100V) impedance and pacing impedance (at 5V) were tested at implant. The Spearman coefficient was used to assess the correlation between impedances and LVEF/NYHA.
Results: the average high voltage impedance was 47.4±10.8ohm and pacing impedance was 562.0±130.9ohm in the study population. High voltage impedance was highly correlated to the pacing impedance tested in the same lead (p<0.0001). While pacing impedance consistently correlated with LVEF (p=0.02), there was no correlation between high voltage impedance and LVEF. Although the data indicates a trend (table), NYHA class has not shown a correlation to either impedance measurements.

Impedances and LVEF by NYHA Class

	Class I	Class II	Class III	Class IV
HVI	47.6 ohm	47.2 ohm	45.3 ohm	45.1 ohm
LVI	557.4 ohm	578.2 ohm	547.3 ohm	522.2 ohm
LVEF	39.4%	29.8%	23.9%	26.4%

High Voltage Impedance and PAcing Impedance, LVEF by NYHA Class.

Conclusion: despite high voltage impedance being highly correlated with pacing impedance, it appears that HVI is not a good indicator of HF status.

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A feasibility study of using an ICD function for warning pulmonary edema in a volume overload acute canine model

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Background: several studies have shown that device based impedance monitoring was able to predict CHF admission. St. Jude Medical (SJM) ICDs are equipped with enhanced High Voltage Lead Integrity Check (HVLIC) feature, which can be modified for the use of monitoring intrathoracic impedance (Z). In this study we investigated feasibility of using HVLIC feature for monitoring Z during pulmonary edema induction.
Methods: in four canines the ventricular rate was controlled at 90 bpm in VVI mode after AV node ablation. Z was measured using HVLIC and reference Z box between the ICD case and RV shocking coil. The measurement of HVLIC Z was synchronized at QRS and the mean HVLIC Z over a respiration cycle was used for each data point during the induction. First the canine was volume loaded until the LVEDP exceeded 25 mmHg and allowed to stabilize. Then loading continued until the LVEDP reached about 35 mmHg. Z as well as LV, AP and PA pressures were monitored closely during the induction. The pulmonary edema was determined by rales and pink watery fluid from the mouth or nose.
Results: during volume overloading both HVLIC Z and reference Z monotonically decreased. The time durations from the start of fluid loading to the pulmonary edema were 213 ± 23 minutes, while HVLIC Z decreased 10% from the baseline in 96 ± 42 minutes. A 10% drop in HVLIC Z corresponded to a 20 ± 6 mmHg increase in LVEDP. LVEDP was linearly related and correlated to HVLIC Z from the onset of overloading to a 10% Z drop (R=0.96 ± 0.03, Slope=-0.33 ± 0.07 ohm/mmHg; pooled data: R=0.89, slope =-0.3).
Conclusions: the average Z method using HVLIC function in ICDs can measure Z drop and predict fluid overload prior to pulmonary edema. RV volume overload through femoral vein access was successful in creating pulmonary edema acutely.

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Long-term device-based monitoring of physical activity in heart failure patients treated with cardiac resynchronization therapy

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Purpose: Cardiac resynchronization therapy (CRT) improves functional capacity in advanced heart failure (HF) patients (pts). Long-term exercise data are missing. Aim of this study was to report long-term device-based monitoring of physical activity in advanced HF pts implanted with a CRT device.
Methods: Activity Log Index (ALI) represents the percentage of time the acceleration exceeds a pre-set fixed threshold. It monitors daily physical activity and is automatically calculated by some of the newest CRT devices. Stored ALI data of 114 CRT pts (NYHA III 90%, LVEF 21±6%, LVEDD 68±9 mm, sinus rhythm 82%, QRS 157±26 ms) were retrieved.
Results: ALI increased from a baseline (2nd week) value of 7,0±3,6 to 9,4±4,4 units (p<0,0001) and to 11,2±4,6 (p<0,005), 4 and 16 weeks after CRT initiation (graph). Changes remained stable up to 2 years follow-up. The magnitude and time course of ALI change were similar regardless gender, etiology and underlying rhythm. Diabetic and non-diabetic pts showed similar increase in ALI. Despite similar values at baseline, elderly pts (>65 yrs) showed significantly lower ALI values compared to younger pts (9,5±4,2 vs 13,3±4,8, p<0,001) during follow-up. Furthermore pts who experienced hospitalisation for cardiovascular reasons during follow-up, had significantly lower baseline (5,1±2,2 vs 7,6±3,7, p<0,01) and plateau (9,2±2,4 vs 11,9±4,7, p<0,05) ALI values compared to pts who were not hospitalised.