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Congress report: "Integrative echo approach to cardiac resynchronization therapy"

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Heart failure patients with implanted Cardiac Resynchronization Therapy (CRT) devices are a frail group of patients requiring integrative approach and care from multiple cardiovascular subspecialties inclusive of the HF, electrophysiology (EP), and echocardiography (ECHO)/imaging services. From the echocardiographic point of view integrative approach consist of ECHO guided patient selection and LV & RV lead positioning during pre-implant care, as well as ECHO guided device optimization and follow-up during post- implantation period. Emphasis is on integration of the care delivered to the CRT patient with open cross talk within echocardiographers and different subspecialties.

In a first talk, the effect of LBBB on myocardial mechanics was reviewed by Piet Claus. Data from animal models and simulations of pure LBBB show that immediately the prolonged activation sequence from septal to lateral wall results in an early septal shortening and lateral stretching. by lateral shortening and fast septal lengthening at the time of lateral contraction force development. The very fast septal shortening can be explained as an unloaded contraction, whereby this septal wall segment does not perform any work, whereas the pre-stretched lateral wall will exhibit more force, due to Frank Starling, and will perform excessive work. In animal studies this has been shown to be concomitant with a reduced septal perfusion and increased lateral perfusion. Chronic LBBB, ventricular dilatation and overall reduced contractility, do not alter this pattern of septal and lateral deformation. Lateral hypertrophy, can be explained as a remodeling due to the excessive fiber stress in the lateral wall.

In her presentation, Dr. Cikes provided arguments that echocardiography can sill be used in the guidance of CRT – both patient selection and LV lead placement. Although multiple echo studies failed to find a specific parameter which would optimally guide CRT patient selection, most of these studies did not search for underlying pathophysiologic mechanisms. "Septal flash" was recognized as a marker of intraventricular dyssynchrony which was one of the underlying mechanisms aside from AV and VV dyssynchrony. Notably, all patients with a detectable underlying mechanism indeed responded to CRT. This septal flash was further used to optimize

LV lead placement during CRT implantation by mini-thoracotomy, providing better LV remodeling compared to the transvenously placed devices where the lead positioning was not echo-guided.

Dr. Lieven Herbots then present a variety of post-implant issues besides patient selection that can contribute to CRT patient response. During patient follow-up, echocardiography has been shown to be helpful to evaluate response to CRT, predict long-term patient outcome and guide management of non-responders. However, other clinical, pharmacological and pacing factors must also be taken into account. On this ground, the communication lines between the electrophysiologist, echocardiographer and HF specialist, need to be open and fluid. An integrated multidisciplinary model may make this process achievable, and could improve outcome of patients receiving CRT.

Beside the evolving device diagnostic and automated optimization algorithms, ECHO is still a cornerstone in CRT optimization, based on underlying physiological concept of synchronizing the LV, concluded prof. Separovic. In her presentation she focus on different aspects of potential suboptimal mechanical response due to variety of unpredictable reasons inherent in patient conduction system, myocardial structure, lead position and electromechanical coupling. Therefore, residual intraventricular dyssynchrony on a top of an atrioventricular dysynchrony due to unoptimal out of box settings, needs to be evaluated early after device implantation. Transmitral Doppler flow pattern is still a “gold” standard for AV optimization, although “whole picture” of diastolic dysfunction including myocardial relaxation, stiffness, exercise, as well as tricuspid flow, has to be taken in consideration. Post implantation intraventricular dyssynchrony could be measured with any available tool (M-mode, strain imaging, 3D) preferable one using higher temporal resolution. Best VV delay is the one with less/no dyssynchrony and consequently with the best parameters of LV mechanical synchrony that can be achieved at that time. Surrogates of cardiac output, parameters like LVOT and MR dp/dt, alone, should be used with caution due to high beat–to-beat variability. ECHO guided AV and VV optimization, through synchronization of a properly timed LV pacing impulse may provide a more physiological RV, and RV-LV contraction pattern.